



(11)

EP 2 157 040 A1

(12)

EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
24.02.2010 Bulletin 2010/08

(51) Int Cl.:
B66B 13/12 (2006.01)

(21) Application number: **07744938.7**

(86) International application number:
PCT/JP2007/061618

(22) Date of filing: **08.06.2007**

(87) International publication number:
WO 2008/149456 (11.12.2008 Gazette 2008/50)

(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

(72) Inventors:

- **KIGAWA, Hiroshi**
Tokyo 100-8310 (JP)
- **ITO, Naotoshi**
Tokyo 102-0073 (JP)
- **KOIZUMI, Yoshihiko**
Tokyo 100-8310 (JP)

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

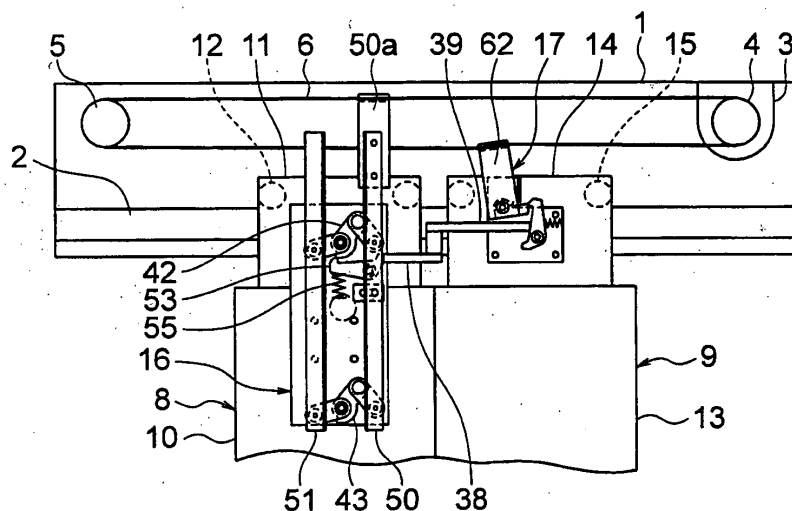
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) **ELEVATOR DOOR DEVICE**

(57) In an elevator door apparatus, an engaging apparatus that engages with a first landing door is disposed on a first car door. The engaging apparatus completes engagement with the first landing door and starts a door opening action of the first car door and the first landing door when a power transmitting body moves by a predetermined amount during door opening commencement.

A car door coupling mechanism that is connected to the power transmitting body is disposed on a second car door. The car door coupling mechanism transmits movement of the power transmitting body to the second car door and starts a door opening action of the second car door when the power transmitting body moves by the predetermined amount during door opening commencement.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator door apparatus in which an engaging apparatus that couples a landing door to opening and closing actions of a car door is disposed on a car door.

BACKGROUND ART

[0002] In conventional elevator doorway apparatuses, driving force from a driving motor is transmitted to a first car door by means of a ball screw, and action of the first car door is transmitted to a second car door using a ring-shaped driving chain (see Patent Literature 1, for example).

[0003] In conventional elevator door driving apparatuses, two car doors are opened and closed symmetrically by disposing engaging devices that have identical constructions on the two car doors so as to have bilateral symmetry (see Patent Literature 2, for example).

[0004]

[Patent Literature 1]

Japanese Patent Laid-Open No. 2005-41620 (Gazette)

[Patent Literature 2]

Japanese Patent Laid-Open No. HEI 1-294190 (Gazette)

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] In conventional doorway apparatuses such as that described above, because action of the first car door is transmitted to a second car door using a ring-shaped driving chain, the apparatuses are increased in size, require large installation spaces. In conventional door driving apparatuses, because two engaging apparatuses are used, the number of parts is increased, making costs high.

[0006] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator door apparatus that can synchronize actions of first and second car doors using a low-cost, space-saving construction.

MEANS FOR SOLVING THE PROBLEM

[0007] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator door apparatus including: first and second car doors that are disposed on a car; a door motor that is disposed on the car; a power transmitting body that is moved by the door motor, and that transmits a driving force from the door motor to the first and second car

doors; first and second landing doors that are disposed on a landing; a landing door coupling mechanism that couples the second landing door to opening and closing actions of the first landing door; and an engaging apparatus that is disposed on the first car door, and that is connected to the power transmitting body, and that engages with the first landing door, and the engaging apparatus completes engagement with the first landing door and starts a door opening action of the first car door and the first landing door when the power transmitting body moves by a predetermined amount during door opening commencement, a car door coupling mechanism that is connected to the power transmitting body is disposed on the second car door, and the car door coupling mechanism transmits movement of the power transmitting body to the second car door and starts a door opening action of the second car door when the power transmitting body moves by the predetermined amount during door opening commencement.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Figure 1 is a front elevation of an elevator car door apparatus according to Embodiment 1 of the present invention viewed from a landing side;

Figure 2 is a front elevation of an elevator landing door apparatus from Figure 1 viewed from a hoistway side;

Figure 3 is a plan that shows the car door apparatus from Figure 1 and the landing door apparatus from Figure 2;

Figure 4 is a front elevation that shows an engaging apparatus from Figure 1 enlarged;

Figure 5 is a front elevation that shows a car door coupling mechanism from Figure 1 enlarged;

Figure 6 is a front elevation that shows a state of the car door coupling mechanism from Figure 5 during door opening; and

Figure 7 is a front elevation that shows a car door coupling mechanism according to Embodiment 2 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0009] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0010] Figure 1 is a front elevation of an elevator car door apparatus according to Embodiment 1 of the present invention viewed from a landing side, and shows a two-door centrally-opening car door apparatus. In the figure, a car door frame 1 is fixed to an upper portion of a car doorway. A car door rail 2 that is parallel to a width direction of the car doorway is disposed on the car door

frame 1. A door motor 3 is fixed to a first longitudinal end portion of the car door frame 1.

[0011] A first car door pulley 4 is disposed on the door motor 3. A second car door pulley 5 is disposed on a second longitudinal end portion of the car door frame 1. An endless car door driving belt 6 that constitutes a power transmitting body is wound around the first and second car door pulleys 4 and 5. The first car door pulley 4 is rotated by a driving force from the door motor 3. When the first car door pulley 4 is rotated, the car door driving belt 6 is cycled, and the second car door pulley 5 is rotated.

[0012] A first car door (a driven door) 8 and a second car door (a slave door) 9 that open and close the car doorway are suspended on the car door rail 2. The first and second car doors 8 and 9 are driven by the door motor 3 during opening and closing of the car doorway so as to be moved in opposite directions from each other.

[0013] The first car door 8 has: a first car door main body 10; and a first car door hanger 11 that is fixed to an upper portion of the first car door main body 10. A plurality of first car door rollers 12 that are rolled along the car door rail 2 are disposed on the first car door hanger 11.

[0014] The second car door 9 has: a second car door main body 13; and a second car door hanger 14 that is fixed to an upper portion of the second car door main body 13. A plurality of second car door rollers 15 that are rolled along the car door rail 2 are disposed on the second car door hanger 14.

[0015] An engaging apparatus 16 that engages with landing door apparatuses is mounted to the first car door 8. A car door coupling mechanism 17 that couples action of the second car door 9 to action of the first car door 8 is mounted to the second car door 9. A first lock releasing rod 38 that functions as a first lock releasing member that engages with the engaging apparatus 16 when all doors are fully closed, and a second lock releasing rod 39 that functions as a second lock releasing member that engages with the car door coupling mechanism 17 when all doors are fully closed are fixed to the car door frame 1.

[0016] Figure 2 is a front elevation of an elevator landing door apparatus from Figure 1 viewed from a hoistway side. A landing door frame 18 is fixed to an upper portion of a landing doorway. A landing door rail 19 that is parallel to a width direction of the landing doorway is disposed on the landing door frame 18.

[0017] A first landing door pulley 20 is disposed on a first longitudinal end portion of the landing door frame 18. A second landing door pulley 21 is disposed on a second longitudinal end portion of the landing door frame 18. An endless coupling rope 22 is wound around the first and second landing door pulleys 20 and 21.

[0018] First and second landing doors 23 and 24 that open and close the landing doorway are suspended on the landing door rail 19. The first landing door 23 is engaged with the first car door 8 when the car arrives at a floor, and is moved together with the first car door 8.

[0019] The first landing door 23 is connected to the

coupling rope 22 by means of a first landing door linking fitting 25. The second landing door 24 is connected to the coupling rope 22 by means of a second landing door linking fitting 26. When the coupling rope 22 is cycled by opening and closing actions of the first landing door 23, the second landing door 24 is moved in an opposite direction to the first landing door 23. A landing door coupling mechanism 40 includes the landing door pulleys 20 and 21, the coupling rope 22, and the landing door linking fittings 25 and 26, and couples the second landing door 24 to the opening and closing actions of the first landing door 23.

[0020] The first landing door 23 has: a first landing door main body 27; and a first landing door hanger 28 that is fixed to an upper portion of the first landing door main body 27. A plurality of first landing door rollers 29 that are rolled along the landing door rail 19 are disposed on the first landing door hanger 28.

[0021] The second landing door 24 has: a second landing door main body 30; and a second landing door hanger 31 that is fixed to an upper portion of the second landing door main body 30. A plurality of second landing door rollers 32 that are rolled along the landing door rail 19 are disposed on the second landing door hanger 31.

[0022] An interlocking apparatus 33 for preventing the first and second landing doors 23 and 24 from being opened from the landing when the car is not at that floor is disposed on the landing door frame 18 and the first landing door hanger 28. The interlocking apparatus 33 has a catch 34, an interlocking clutch 35, a fixed interlocking roller 36, and a movable interlocking roller 37.

[0023] The catch 34 is fixed to the landing door frame 18. The interlocking clutch 35 is pivotably mounted to the first landing door hanger 28. The first and second landing doors 23 and 24 are prevented from moving in a door opening direction by a tip end portion of the interlocking clutch 35 engaging with the catch 34 when the first and second landing doors 23 and 24 are in a fully closed state.

[0024] The fixed interlocking roller 36 is disposed coaxially with a pivoting shaft of the interlocking clutch 35. The movable interlocking roller 37 is mounted to the interlocking clutch 35 so as to be pivotable together with the interlocking clutch 35.

[0025] Figure 3 is a plan that shows the car door apparatus from Figure 1 and the landing door apparatus from Figure 2. When the car arrives at a floor, the movable interlocking roller 37 of the interlocking apparatus 33 engages with the engaging apparatus 16.

[0026] Figure 4 is a front elevation that shows the engaging apparatus 16 from Figure 1 enlarged. An engaging apparatus supporting plate 41 is fixed to the first car door hanger 11. First and second supporting fittings 42 and 43 are mounted to the engaging apparatus supporting plate 41 so as to be spaced apart vertically. The first supporting fitting 42 is pivotable around a first fixed supporting shaft 44 that is fixed to the engaging apparatus supporting plate 41. The second supporting fitting 43 is pivotable around a second fixed supporting shaft 45 that

is fixed to the engaging apparatus supporting plate 41.

[0027] A cam portion 42a is disposed on an intermediate portion of the first supporting fitting 42. A locking portion 42b is disposed on the cam portion 42a. A base end portion of a first linking fitting 47 is linked pivotably to a first end portion of the first supporting fitting 42 by means of a first floating supporting shaft 46. A base end portion of a second linking fitting 49 is linked pivotably to a first end portion of the second supporting fitting 42 by means of a second floating supporting shaft 48.

[0028] A doorstop vane 50 that is parallel to a vertical direction is linked to and supported by tip end portions of the first and second linking fittings 47 and 49. A door pocket vane 51 that is parallel to the doorstop vane 50 is linked to and supported by second end portions of the first and second supporting fittings 42 and 43.

[0029] An upper end portion of the doorstop vane 50 is connected to the car door driving belt 6 by means of a vane linking fitting 50a. When the car door driving belt 6 is moved toward the door opening direction from the state in Figure 4, the doorstop vane 50 is also displaced in a similar direction, the floating supporting shafts 46 and 48 are displaced upward, and the supporting fittings 42 and 43 are pivoted counterclockwise in the figure. The door pocket vane 51 is thereby displaced in a door closing direction, reducing spacing between the doorstop vane 50 and the door pocket vane 51.

[0030] A vane guiding portion 52 that guides movement of the doorstop vane 50 in the door opening and closing directions is disposed between the engaging apparatus supporting plate 41 and the doorstop vane 50.

[0031] An engaging apparatus latch 53 that engages with the cam portion 42a is disposed on the engaging apparatus supporting plate 41. The engaging apparatus latch 53 can pivot around a pivoting shaft 54. A pushing spring 55 that pushes the engaging apparatus latch 53 against the cam portion 42a is disposed between the engaging apparatus supporting plate 41 and the engaging apparatus latch 53.

[0032] When the first supporting fitting 42 is pivoted by a predetermined amount by the displacement of the doorstop vane 50 in the door opening direction, the engaging apparatus latch 53 is pivoted clockwise in the figure by the spring force from the pushing spring 55 and engages with the locking portion 42b. The pivoting of the first supporting fitting 42 clockwise in the figure is thereby restricted, and the vanes 50 and 51 are locked in the position where the spacing therebetween is reduced.

[0033] When the first car door 8 is moved to a vicinity of a fully closed position, a tip end portion of the first lock releasing rod 38 is placed in contact with a second end portion of the engaging apparatus latch 53, and the engaging apparatus latch 53 is pivoted counterclockwise in the figure against the spring force from the pushing spring 55. Engagement of the engaging apparatus latch 53 with the locking portion 42b is thereby released.

[0034] Figure 5 is a front elevation that shows the car door coupling mechanism 17 from Figure 1 enlarged, and

shows a state when all doors are fully closed. A coupling mechanism supporting plate 61 is fixed to the second car door hanger 14. A stopper portion 61a is disposed on the coupling mechanism supporting plate 61. A coupling mechanism linking fitting 62 is disposed on the coupling mechanism supporting plate 61. The coupling mechanism linking fitting 62 is pivotable around a pivoting shaft 63. Pivoting of the coupling mechanism linking fitting 62 clockwise in the figure is restricted by the stopper portion 61 a.

[0035] An upper end portion of the coupling mechanism linking fitting 62 is connected to the car door driving belt 6. A cam portion 62a is disposed on the coupling mechanism linking fitting 62. A locking portion 62b is disposed on the cam portion 62a.

[0036] A coupling mechanism latch 64 that engages with the cam portion 62a is disposed on the coupling mechanism supporting plate 61. The coupling mechanism latch 64 can pivot around a pivoting shaft 65. A pushing spring 66 that pushes the coupling mechanism latch 64 against the cam portion 62a is disposed between the coupling mechanism supporting plate 61 and the coupling mechanism latch 64.

[0037] When the coupling mechanism linking fitting 62 is pivoted clockwise in the figure and comes into contact with the stopper portion 61 a due to movement of the car door driving belt 6 in the door opening direction, as shown in Figure 6, movement of the car door driving belt 6 is transmitted to the second car door 9 by means of the coupling mechanism linking fitting 62 and the coupling mechanism supporting plate 61, and the second car door 9 is moved in the door opening direction.

[0038] At this point, the coupling mechanism latch 64 is pivoted counterclockwise in the figure by the spring force from the pushing spring 66 and engages with the locking portion 62b. The pivoting of the coupling mechanism linking fitting 62 counterclockwise in the figure is thereby restricted.

[0039] When the second car door 9 is moved to a vicinity of a fully closed position during a door closing action, a tip end portion of the second lock releasing rod 39 is placed in contact with the coupling mechanism latch 64, and the coupling mechanism latch 64 is pivoted clockwise in the figure against the spring force from the pushing spring 66. Engagement of the coupling mechanism latch 64 with the locking portion 62b is thereby released.

[0040] Next, operation will be explained. First, during door opening, the first car door pulley 4 is rotated counterclockwise in Figure 1 by the door motor 3. The doorstop vane 50 and the door pocket vane 51 are thereby displaced in directions in which spacing between them is reduced. At this point, since the movable interlocking roller 37 is positioned between the doorstop vane 50 and the door pocket vane 51, the interlocking clutch 35 is pivoted clockwise in Figure 2 by the displacement of the doorstop vane 50 and the door pocket vane 51, and engagement of the interlocking clutch 35 with the catch 34 is released.

[0041] When the door motor 3 is subsequently driven further in the door opening direction, the first car door 8 and the first landing door 23 are moved together in the door opening direction with the interlocking rollers 36 and 37 held between the doorstop vane 50 and the door pocket vane 51. In other words, the first car door 8 and the first landing door 23 commence door opening actions after the car door driving belt 6 has moved by a predetermined amount from a fully closed state. Since the second landing door 24 is connected to the first landing door 23 by means of the landing door coupling mechanism 40, it performs a door opening action synchronously with the door opening actions of the first car door 8 and the first landing door 23.

[0042] On the other hand, the second car door 9 commences a door opening action after the car door driving belt 6 has been moved by the predetermined amount from the fully closed state, and the coupling mechanism linking fitting 62 is placed in contact with the stopper portion 61a. Consequently, timing of the door opening action of the second car door 9 can be synchronized with timing of the door opening action of the first car door 8 by pre-adjusting spacing between the coupling mechanism linking fitting 62 and the stopper portion 61a in the fully closed state.

[0043] During door closing, the first car door pulley 4 is rotated clockwise in Figure 1 by the door motor 3. At that point, because the engaging apparatus latch 53 is engaged with the locking portion 42b, pivoting of the first supporting fitting 42 in a clockwise direction in Figure 4 is restricted, and spacing between the doorstop vane 50 and the door pocket vane 51 remains reduced. Consequently, the first car door 8 and the first landing door 23 are moved together in the door closing direction together with the movement of the car door driving belt 6 in the door closing direction.

[0044] Then, immediately before the fully closed state is reached, the engaging apparatus latch 53 comes into contact with the first lock releasing rod 38, releasing engagement of the engaging apparatus latch 53 with the locking portion 42b. Since the second landing door 24 is connected to the first landing door 23 by means of the landing door coupling mechanism 40, the second landing door 24 performs a door closing action synchronously with the door closing action of the first car door 8 and the first landing door 23.

[0045] Since the coupling mechanism latch 64 is engaged with the locking portion 62b, pivoting of the coupling mechanism linking fitting 62 counterclockwise in Figure 6 is restricted during door closing. Consequently, the second car door 9 is also moved in a door closing direction together with the movement of the car door driving belt 6 in the door closing direction.

[0046] Thus, immediately before the fully closed state is reached, the coupling mechanism latch 64 comes into contact with the second lock releasing rod 39, releasing engagement of the coupling mechanism latch 64 with the locking portion 62b. After the engagement of the engag-

ing apparatus latch 53 with the locking portion 42b and the engagement of the coupling mechanism latch 64 with the locking portion 62b are released, the car doors 8 and 9 and the landing doors 23 and 24 are closed completely by the actions of door closers (not shown). The door closers constantly apply a force in the door closing direction to the car doors 8 and 9 and the landing doors 23 and 24. The door motor 3 drives the car door driving belt 6 until the doorstop vane 50 and the door pocket vane 51 return to their initial positions (a fully closed position) and is then stopped.

[0047] In an elevator door apparatus of this kind, the engaging apparatus 16 completes engagement with the first landing door 23, specifically, engagement with the interlocking apparatus 33 to start the door opening actions of the first car door 8 and the first landing door 23 when the car door driving belt 6 moves by a predetermined amount during door opening commencement. Similarly, the car door coupling mechanism 17 also transmits the movement of the car door driving belt 6 to the second car door 9 to start the door opening action of the second car door 9 when the car door driving belt 6 moves by the predetermined amount during door opening commencement. Consequently, the actions of the first and second car doors 8 and 9 can be synchronized using a low-cost, space-saving construction.

[0048] Because the engaging apparatus 16 releases the locked state of the interlocking apparatus 33 and completes engagement with the interlocking apparatus 33 when the car door driving belt 6 moves by the predetermined amount during door opening commencement, the locked state of the interlocking apparatus 33 can be released more reliably while synchronizing door opening commencement actions of the first and second car doors 8 and 9.

[0049] In addition, because a car door coupling mechanism 17 that has a coupling mechanism linking fitting 62 and a stopper portion 61a is used, the construction can be further simplified, and cost reductions and space saving can also be achieved.

[0050] Because an engaging apparatus latch 53 that locks the state of engagement with the first landing door 23 is disposed on the engaging apparatus 16 and a coupling mechanism latch 64 that locks the coupling mechanism linking fitting 62 in a position of contact with the stopper portion 61a are disposed on the car door coupling mechanism 17, the actions of the first and second car doors 8 and 9 can also be synchronized during a door closing action.

[0051] Because the first and second lock releasing rods 38 and 39 are placed in contact with the latches 53 and 64 when all doors are fully closed and the locked states due to the latches 53 and 64 are released, the engaging apparatus 16 and the car door coupling mechanism 17 can be returned to initial positions using a simple construction.

Embodiment 2

[0052] Next, Figure 7 is a front elevation that shows a car door coupling mechanism according to Embodiment 2 of the present invention, and shows a state when all doors are fully closed. A coupling mechanism supporting plate 71 is fixed to a second car door hanger 14. A stopper portion 71 a is disposed on the coupling mechanism supporting plate 71. A coupling mechanism linking fitting 72 is disposed on the coupling mechanism supporting plate 71. The coupling mechanism linking fitting 72 is slidable parallel to opening and closing directions of a second car door 9. Displacement of the coupling mechanism linking fitting 72 in the door opening direction is restricted by the stopper portion 71 a.

[0053] A pair of guiding pins 73a and 73b that guide sliding of the coupling mechanism linking fitting 72 are disposed on the coupling mechanism supporting plate 71. Guiding apertures 72a and 72b through which the guiding pins 73a and 73b are inserted are disposed on the coupling mechanism linking fitting 72.

[0054] An upper end portion of the coupling mechanism linking fitting 72 is connected to a car door driving belt 6. A cam portion 72c is disposed on the coupling mechanism linking fitting 72. A locking portion 72d is disposed on the cam portion 72c.

[0055] A coupling mechanism latch 74 that engages with the cam portion 72c is disposed on the coupling mechanism supporting plate 71. The coupling mechanism latch 74 can pivot around a pivoting shaft 75. A pushing spring 76 that pushes the coupling mechanism latch 74 against the cam portion 72c is disposed between the coupling mechanism supporting plate 71 and the coupling mechanism latch 74.

[0056] When the coupling mechanism linking fitting 72 is slid in the door opening direction and comes into contact with the stopper portion 71 a due to movement of the car door driving belt 6 in the door opening direction, movement of the car door driving belt 6 is transmitted to the second car door 9 by means of the coupling mechanism linking fitting 72 and the coupling mechanism supporting plate 71, and the second car door 9 is moved in the door opening direction.

[0057] At this point, the coupling mechanism latch 74 is pivoted clockwise in the figure by the spring force from the pushing spring 76 and engages with the locking portion 72d. The sliding of the coupling mechanism linking fitting 72 in the door closing direction is thereby restricted.

[0058] When the second car door 9 is moved to a vicinity of a fully closed position during a door closing action, a tip end portion of the second lock releasing rod 39 is placed in contact with the coupling mechanism latch 74, and the coupling mechanism latch 74 is pivoted counterclockwise in the figure against the spring force from the pushing spring 76. Engagement of the coupling mechanism latch 74 with the locking portion 72d is thereby released. The rest of the configuration is similar to that of Embodiment 1.

[0059] In a car door coupling mechanism of this kind, since the coupling mechanism linking fitting 72 is slidable parallel to the closing and opening directions of the second car door 9, the car door driving belt 6 can be moved along an ideal trajectory from a design perspective without a connecting portion between the car door driving belt 6 and the coupling mechanism linking fitting 72 being displaced vertically.

[0060] Moreover, the power transmitting body is not limited to a car door driving belt 6, and may also be a driving rope or a driving chain, etc., for example.

Claims

1. An elevator door apparatus comprising:

first and second car doors that are disposed on a car;
a door motor that is disposed on the car;
a power transmitting body that is moved by the door motor, and that transmits a driving force from the door motor to the first and second car doors;
first and second landing doors that are disposed on a landing;
a landing door coupling mechanism that couples the second landing door to opening and closing actions of the first landing door; and
an engaging apparatus that is disposed on the first car door, and that is connected to the power transmitting body, and that engages with the first landing door,

wherein:

the engaging apparatus completes engagement with the first landing door and starts a door opening action of the first car door and the first landing door when the power transmitting body moves by a predetermined amount during door opening commencement;
a car door coupling mechanism that is connected to the power transmitting body is disposed on the second car door; and
the car door coupling mechanism transmits movement of the power transmitting body to the second car door and starts a door opening action of the second car door when the power transmitting body moves by the predetermined amount during door opening commencement.

2. An elevator door apparatus according to Claim 1, wherein:

an interlocking apparatus that stops movement of the first and second landing doors in a door opening direction when all doors are fully closed

is disposed on the first landing door; and the engaging apparatus releases a locked state of the interlocking apparatus and completes engagement with the interlocking apparatus when the power transmitting body moves by the predetermined amount during door opening commencement.

3. An elevator door apparatus according to Claim 1, wherein:

the car door coupling mechanism comprises: a coupling mechanism linking fitting that is disposed displaceably on the second car door, and that is connected to the power transmitting body; and a stopper portion that restricts displacement of the coupling mechanism linking fitting that accompanies movement of the power transmitting body in a door opening direction; and the coupling mechanism linking fitting comes into contact with the stopper portion and movement of the power transmitting body is transmitted to the second car door by means of the coupling mechanism linking fitting and the stopper portion when the power transmitting body moves by the predetermined amount during door opening commencement.

4. An elevator door apparatus according to Claim 3, wherein:

the engaging apparatus further comprises an engaging apparatus latch that locks a state of engagement with the first landing door; and the car door coupling mechanism further comprises a coupling mechanism latch that locks the coupling mechanism linking fitting in a position of contact with the stopper portion.

5. An elevator door apparatus according to Claim 4, further comprising:

a first lock releasing member that releases a locked state of the engaging apparatus by the engaging apparatus latch by coming into contact with the engaging apparatus latch when all doors are fully closed; and a second lock releasing member that releases a locked state of the coupling mechanism linking fitting by the coupling mechanism latch by coming into contact with the coupling mechanism latch when all doors are fully closed.

Amended claims under Art. 19.1 PCT

1. (Amended) An elevator door apparatus comprising:

first and second car doors that are disposed on a car;
a door motor that is disposed on the car;
a power transmitting body that is moved by the door motor, and that transmits a driving force from the door motor to the first and second car doors;
first and second landing doors that are disposed on a landing;
a landing door coupling mechanism that couples the second landing door to opening and closing actions of the first landing door; and
an engaging apparatus that is disposed on the first car door, and that is connected to the power transmitting body, and that engages with the first landing door,

wherein:

the engaging apparatus completes engagement with the first landing door and starts a door opening action of the first car door and the first landing door when the power transmitting body moves by a predetermined amount during door opening commencement;
a car door coupling mechanism that is connected to the power transmitting body is disposed on the second car door; and
the car door coupling mechanism transmits movement of the power transmitting body to the second car door and starts a door opening action of the second car door when the power transmitting body moves by the same amount with the predetermined amount during door opening commencement.

2. An elevator door apparatus according to Claim 1, wherein:

an interlocking apparatus that stops movement of the first and second landing doors in a door opening direction when all doors are fully closed is disposed on the first landing door; and
the engaging apparatus releases a locked state of the interlocking apparatus and completes engagement with the interlocking apparatus when the power transmitting body moves by the predetermined amount during door opening commencement.

3. An elevator door apparatus according to Claim 1, wherein:

the car door coupling mechanism comprises: a coupling mechanism linking fitting that is disposed displaceably on the second car door, and that is connected to the power transmitting body; and a stopper portion that restricts displacement

of the coupling mechanism linking fitting that accompanies movement of the power transmitting body in a door opening direction; and the coupling mechanism linking fitting comes into contact with the stopper portion and movement of the power transmitting body is transmitted to the second car door by means of the coupling mechanism linking fitting and the stopper portion when the power transmitting body moves by the predetermined amount during door opening commencement.

4. An elevator door apparatus according to Claim 3, wherein:

the engaging apparatus further comprises an engaging apparatus latch that locks a state of engagement with the first landing door; and the car door coupling mechanism further comprises a coupling mechanism latch that locks the coupling mechanism linking fitting in a position of contact with the stopper portion.

5. An elevator door apparatus according to Claim 4, further comprising:

a first lock releasing member that releases a locked state of the engaging apparatus by the engaging apparatus latch by coming into contact with the engaging apparatus latch when all doors are fully closed; and a second lock releasing member that releases a locked state of the coupling mechanism linking fitting by the coupling mechanism latch by coming into contact with the coupling mechanism latch when all doors are fully closed.

6. (Added) A method for driving an elevator door apparatus comprising:

first and second car doors that are disposed on a car;
a door motor that is disposed on the car;
a power transmitting body that is moved by the door motor, and that transmits a driving force from the door motor to the first and second car doors;
first and second landing doors that are disposed on a landing;
a landing door coupling mechanism that couples the second landing door to opening and closing actions of the first landing door; and
an engaging apparatus that is disposed on the first car door, and that is connected to the power transmitting body, and that engages with the first landing door,

wherein the method for driving the elevator door ap-

paratus completes engagement of the engaging apparatus with the first landing door and starts a door opening action of the first car door and the first landing door after the power transmitting body has moved by a predetermined amount during door opening commencement, and simultaneously transmits movement of the power transmitting body to the second car door and starts a door opening action of the second car door by means of a car door coupling mechanism that is disposed on the second car door and that is connected to the power transmitting body.

FIG. 1

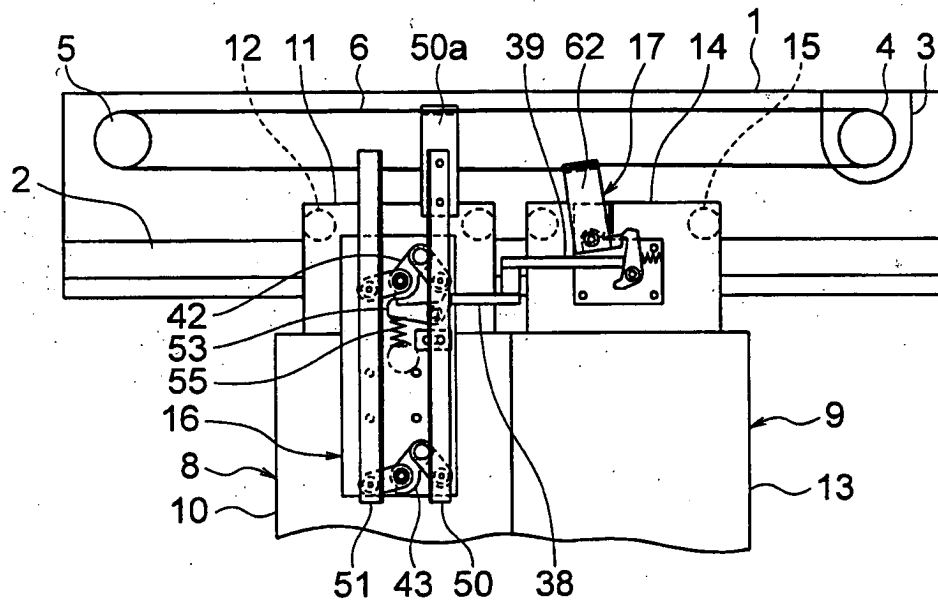


FIG. 2

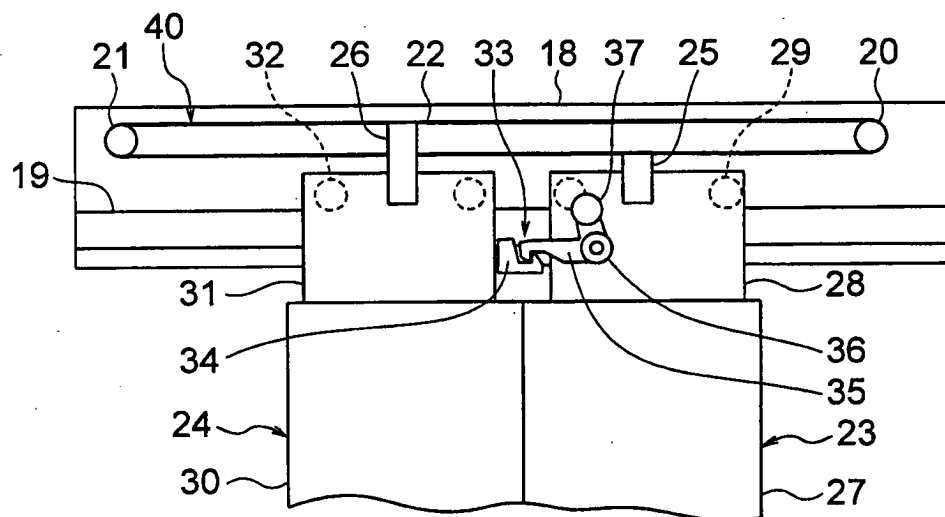


FIG. 3

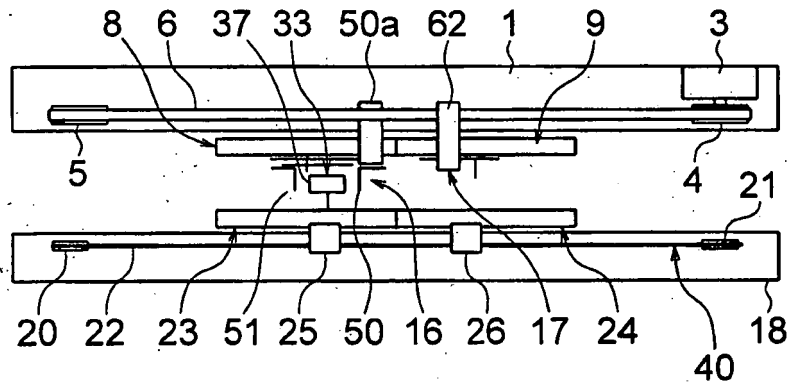


FIG. 4

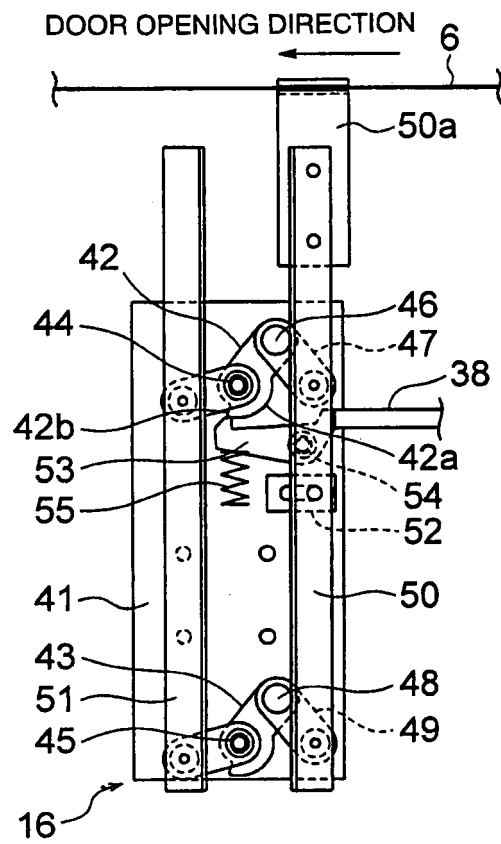


FIG. 5

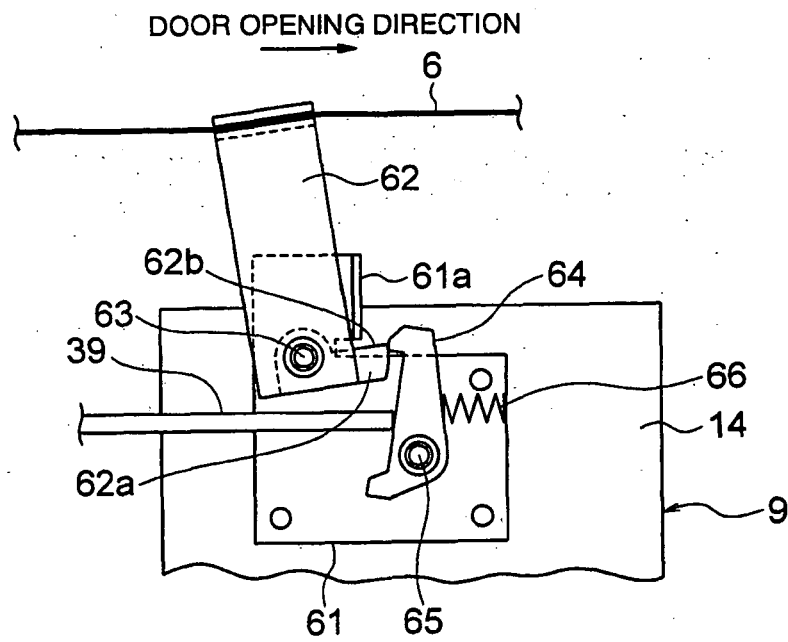


FIG. 6

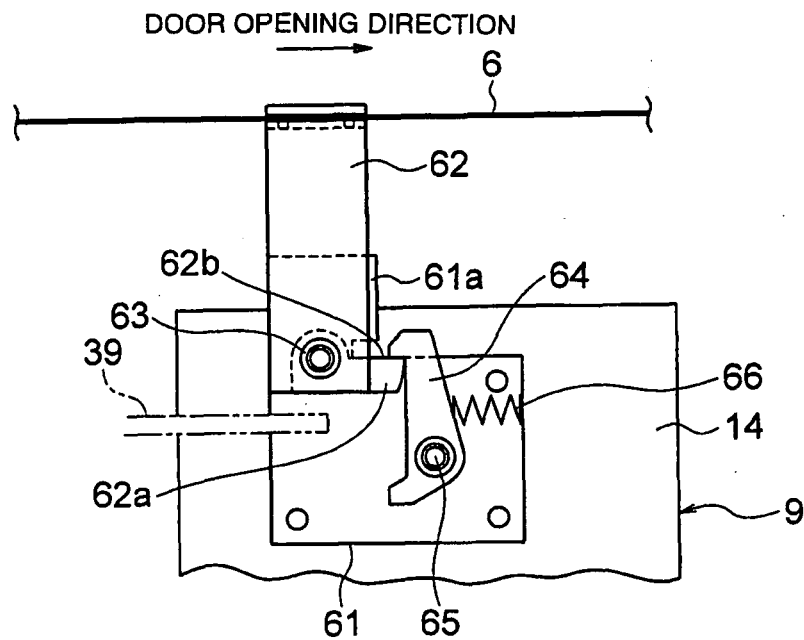
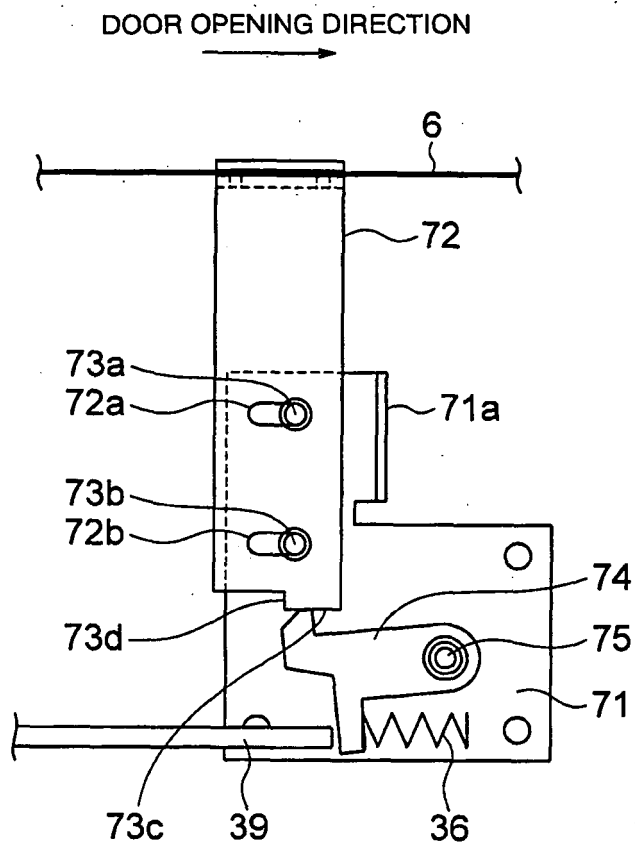


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/061618

A. CLASSIFICATION OF SUBJECT MATTER

B66B13/12 (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)

B66B13/12

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	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

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	JP 2005-170681 A (Inventio AG.), 30 June, 2005 (30.06.05), & US 2005/0126861 A1 & EP 1541518 A1 & BR 0405432 A & CA 2489497 A1	1-5
A	JP 2001-253671 A (Toshiba Corp.), 18 September, 2001 (18.09.01), (Family: none)	1-5

☐ 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
19 February, 2008 (19.02.08)Date of mailing of the international search report
26 February, 2008 (26.02.08)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 2005041620 A [0004]
- JP HE1294190 B [0004]