

DESCRIPTION

ELEVATOR DOOR OPENING AND CLOSING DEVICE

5 FIELD

[0001]

The present invention relates to an elevator door opening and closing device that opens and closes a car door of an elevator car.

10 BACKGROUND

[0002]

An elevator has a structure, as shown in FIG. 12, in which a shaft 1 is provided in a building, an entrance 2 is provided at a desired height position of the shaft 1, a platform 3 is provided facing the entrance 2, a platform door 4 is provided at the entrance 2, an elevator car 6 is provided in the shaft 1 so as to be vertically moved by a drive unit (not shown), an entrance 7 is provided in the elevator car 6, and a car door 8 is provided at the entrance 7. A common elevator has a structure in which an engaging portion 9 is provided at the car door 8 so as to project toward the platform door 4, an engagement receiving portion 5 is provided at the platform door 4 so as to project toward the car door 8. The engaging portion 9 and the engagement receiving portion 5 engage each other upon the arrival of the elevator car 6 at the position of the platform 3. Thus, when the car door 8 is opened and closed by a door opening and closing device provided on the elevator car 6 side, the platform door 4 is opened and closed accordingly.

[0003]

As shown in FIG. 13, such a door opening and closing device includes: a drive motor 30 that is attached onto the upper surface of an upper frame 10 extending along the front width direction (the left-right direction in FIG. 13) of the entrance 7 of the elevator car 6; a reduction pulley 32 that is attached on one end side of the front of the upper frame 10 and has a larger diameter than a

motor pulley 31 attached to a drive shaft of the drive motor 30; a drive pulley 33 provided coaxially and integrally with the reduction pulley 32; a driven pulley 34 attached on the other end side of the front of the upper frame 10; a reduction belt 35 that is composed of an endless belt and is wound and hung around the
5 motor pulley 31 and the reduction pulley 32; and a drive belt 36 that is composed of an endless belt and is wound and hung around the drive pulley 33 and the driven pulley 34.

[0004]

A door rail 11 is attached to the front of the upper frame 10. A pair of
10 rollers 13 attached to a door hanger 12 are placed on the door rail 11, and thereby the car door 8 is hung from the door rail 11 via the door hanger 12. In such a state, the car door 8 is coupled to the drive belt 36 of the door opening and closing device via the door hanger 12 and a coupling tool 37 attached to the door hanger 12.

15 [0005]

Accordingly, when the motor pulley 31 is rotated by the drive motor 30, the rotation is transmitted to the reduction pulley 32 via the reduction belt 35, and the drive pulley 33 is rotated together with the reduction pulley 32. This allows circulation of the drive belt 36, thus causing the car door 8 to reciprocate
20 along the door rail 11 via the coupling tool 37 and the door hanger 12, so that the car door 8 is opened and closed. The elevator shown in FIG. 13 has a configuration in which a pair of car doors 8 move respectively in opposite directions because one of the car doors 8 is coupled to one side of the drive belt 36, whereas the other of the car doors 8 is coupled to the other side of the drive
25 belt 36. That is, the elevator shown in FIG. 13 is a so-called center opening elevator in which the entrance 7 of the elevator car 6 is opened from its center.

CITATION LIST

Patent Literature

30 [0006]

Patent Literature 1: JP 2002-37574 A

SUMMARY

Technical Problem

[0007]

5 However, the above-mentioned conventional door opening and closing device has a problem that the total height of the elevator car 6 is large because the drive motor 30 is attached onto the upper surface of the upper frame 10. For solving such a problem, it is an extremely effective method to arrange the drive motor 30 so as not to project upward from the upper surface of the upper frame 10, specifically, to arrange the drive motor 30 on the front side of the upper frame 10 by attaching the drive motor 30 to the front of the upper frame 10, for example, via a bracket.

[0008]

 However, another problem is expected to occur in such a method. Such
15 problem occurs in attaching the drive motor to the upper frame.

[0009]

 Generally, the bracket extends from the upper frame toward the front side. The drive motor is attached to the extending bracket, thereby allowing the bracket to keep a distance between the drive pulley attached to the drive shaft of the drive motor and the front of the upper frame. The drive motor is
20 attached to one surface of the bracket formed into a flat plate using a bolt so as to be attached to the upper frame.

[0010]

 Here, the drive belt is wound and hung around the drive pulley and the driven pulley so as to rotate in a direction parallel to the front width direction
25 of the entrance. That is, the drive motor is provided at a position such that the distance from the front of the upper frame to the drive pulley and the distance from the front of the upper frame to the driven pulley are equal to each other. In such a state, the drive belt is wound and hung around the drive pulley and
30 the driven pulley. Therefore, if the position of the drive pulley deviates, the drive belt rotates while having unnecessary abrasion to a part of the drive

pulley or the driven pulley. Further, the positional deviation in the axis direction between the drive pulley and the driven pulley is one of the causes of malfunction of the door opening and closing device such as making an unusual noise.

5 [0011]

Accordingly, the drive motor should be attached at an exact position relative to the bracket. However, since the drive motor is attached to the bracket by means of a bolt, the attachment position of the drive motor deviates corresponding to the play within the bolt hole formed in the bracket.

10 Therefore, the position to which the drive motor is attached needs to be measured precisely in attaching the drive motor to the bracket. Thus, a configuration that allows the position of the drive motor to be suitably determined merely by attaching the drive motor to the bracket is desired.

[0012]

15 The present invention has been devised in view of such problems, and an object thereof is to provide an elevator door opening and closing device that allows the position of the drive motor to be suitably determined relative to the front of the upper frame.

20 Solution to Problem

[0013]

For solving the above-mentioned problems, the elevator door opening and closing device according to the present invention in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor
25 is coupled to the car door via a transmission mechanism is characterized in that: the drive motor is attached via a bracket to the front of an upper frame provided above the entrance of the elevator car; and the drive motor has a positioning portion that determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being in
30 abutting contact with the bracket.

[0014]

According to such a configuration, the positioning portion of the drive motor is in abutting contact with the bracket when the drive motor is attached to the bracket, thereby regulating the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front.

5 Accordingly, it is possible to suitably determine the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front.

[0015]

The elevator door opening and closing device according to the present
10 invention is preferably configured so that the positioning portion determines the position, in a direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor by being in abutting contact with the bracket.

[0016]

15 According to such a configuration, the positioning portion of the drive motor is in abutting contact with the bracket, thereby regulating the position, in a direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor. Accordingly, it is possible to suitably determine the position, in a direction along the front of the
20 upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor relative to the front of the upper frame.

[0017]

Further, the elevator door opening and closing device according to the present invention may have a configuration in which the positioning portion
25 determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being in abutting contact with the tip of the bracket extending from the front of the upper frame.

[0018]

According to such a configuration, the positioning portion of the drive
30 motor is in abutting contact with the tip of the bracket, thereby regulating the position, in the axis direction orthogonal to the front of the upper frame, of the

drive motor relative to the front. Accordingly, it is possible to suitably determine the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front.

[0019]

5 Further, the elevator door opening and closing device according to the present invention also may be configured so that the positioning portion determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being engaged with a through hole provided in the bracket extending from the front of the upper frame.

10 [0020]

According to such a configuration, the positioning portion of the drive motor is engaged with the through hole provided in the bracket, thereby regulating the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front. Accordingly, it is possible to
15 suitably determine the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front.

[0021]

Further, the elevator door opening and closing device according to the present invention also may be configured so that the positioning portion
20 determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being in abutting contact with one surface of the bracket extending from the front of the upper frame and bent in a direction along the front of the upper frame.

[0022]

25 According to such a configuration, the positioning portion of the drive motor is in abutting contact with one surface of the bracket bent in a direction along the front of the upper frame, thereby regulating the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front. Accordingly, it is possible to suitably determine the position, in
30 the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front.

[0023]

Further, the elevator door opening and closing device according to the present invention also may be configured so that the positioning portion determines the position, in a direction along the front of the upper frame and
5 orthogonal to a direction in which the car door opens and closes, of the drive motor by being in abutting contact with the lower surface of the bracket extending from the front of the upper frame.

[0024]

According to such a configuration, the positioning portion of the drive
10 motor is in abutting contact with the lower surface of the bracket extending from the front of the upper frame, thereby regulating the position, in a direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor relative to the front of the upper frame. Accordingly, it is possible to suitably determine the position, in a
15 direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor relative to the front of the upper frame.

[0025]

Further, the elevator door opening and closing device according to the
20 present invention also may be configured so that the positioning portion determines the position, in a direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor by being in abutting contact with the tip of the bracket extending from the front of the upper frame and bent in a direction along the front of the upper
25 frame.

[0026]

According to such a configuration, the positioning portion of the drive motor is in abutting contact with the tip of the bracket bent in a direction along the front of the upper frame, thereby regulating the position, in a direction
30 along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor relative to the front of the upper

frame. Accordingly, it is possible to suitably determine the position, in a direction along the front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor relative to the front of the upper frame.

5 [0027]

Further, the elevator door opening and closing device according to the present invention also may be configured so that the drive pulley in the transmission mechanism is directly coupled to the drive motor, and the drive motor is attached to the front of the upper frame with the drive pulley facing
10 the front of the upper frame.

[0028]

According to such a configuration, the drive pulley is provided close to the front of the upper frame, so that the space to install the elevator door opening and closing device can be saved in an upper part of the elevator car.

15 [0029]

Further, the elevator door opening and closing device according to the present invention also may be configured so that the bracket is attached to the front of the upper frame while being inclined about an axis orthogonal to the front of the upper frame, and the drive motor is attached to the lower surface of
20 the bracket.

[0030]

According to such a configuration, the bracket has an inclined portion that is inclined with respect to an axis direction orthogonal to the front of the upper frame, and the drive motor is located below the bracket, thereby allowing
25 the upper part of the drive motor-bracket structure, that is, the upper surface of the bracket to be inclined. Even in such a state where the upper surface of the bracket is inclined, the positioning portion of the drive motor can suitably determine the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor relative to the front by being in abutting contact with
30 the bracket.

Advantageous Effects of Invention

[0031]

As has been described above, the present invention makes it possible to suitably determine the position, in the axis direction orthogonal to the front
5 of the upper frame, of the drive motor relative to the front.

BRIEF DESCRIPTION OF DRAWINGS

[0032]

FIG. 1 is a front view of an elevator car according to a first embodiment
10 with car doors closed.

FIG. 2 is a side view on the front side of the elevator car.

FIG. 3 is a front view of the elevator car with the car doors open.

FIG. 4 is a view showing an attached state of a drive motor in the door opening and closing device provided at an upper part of the elevator car.

15 FIG. 5 is a front view of a main part of the door opening and closing device.

FIG. 6 is a view showing an attached state of a drive motor in a door opening and closing device according to a second embodiment.

FIG. 7 is a view showing an attached state of a drive motor in a door
20 opening and closing device according to a third embodiment.

FIG. 8 is a view showing an attached state of a drive motor in a door opening and closing device according to a fourth embodiment.

FIG. 9 concerns a drive motor in a door opening and closing device according to a fifth embodiment, where FIG. 9(A) is a view showing an attached
25 state of the drive motor, and FIG. 9(B) is a view showing the drive motor as seen from the arrow A.

FIG. 10 is a view showing an attached state of a drive motor according to another embodiment.

FIG. 11 is a view showing an attached state of a drive motor according
30 to another embodiment.

FIG. 12 is a sectional plan view of a conventional elevator.

FIG. 13 is a front view of a car of the elevator.

DESCRIPTION OF EMBODIMENTS

[0033]

5 Hereinafter, a first embodiment of the elevator door opening and closing device according to the present invention is described with reference to the drawings. It should be noted that, among the components described in this embodiment, components identical or corresponding to those in the conventional technique shown in FIG. 12 and FIG. 13 are denoted by the same
10 reference numerals.

[0034]

First, the elevator according to this embodiment is schematically described with reference to FIG. 1 to FIG. 3. The elevator according to this embodiment is a so-called side opening elevator in which the entrance 7 of the
15 elevator car 6 is opened from one end. That is, the elevator according to this embodiment has a structure in which a pair of car doors 8 move in the same direction, where one of the car doors 8 moves more than the other of the car doors 8. The one of the car doors 8 moves more, that is, moves at a higher speed, and therefore is commonly called a "fast door". The other of the car
20 doors 8 moves less, that is, moves at a lower speed, and therefore is commonly called a "slow door". Hereinafter, components of the fast door are denoted by the reference numerals followed by the letter "f", and components of the slow door are denoted by the reference numerals followed by the letter "s", for convenience of description.

25 [0035]

A car door 8f is hung from a door rail 11f via a door hanger 12f by mounting a pair of rollers 13f attached to the door hanger 12f on the door rail 11f. Further, a car door 8s is hung from a door rail 11s via a door hanger 12s by mounting a pair of rollers 13s attached to the door hanger 12s on the door
30 rail 11s. The door rail 11s is directly attached to the front of the upper frame 10. On the other hand, the door rail 11f is attached to the front of the upper

frame 10 via a bracket 14. Accordingly, the door rail 11s is first arranged and the door rail 11f is then arranged in front of the upper frame 10. Therefore, the car door 8f is arranged at a position offset toward the front side more than the car door 8s. Accordingly, when the car doors 8f and 8s are opened, they
 5 overlap each other so that the car door 8f covers the car door 8s.

[0036]

The car door 8f is coupled to the drive belt 36 of the door opening and closing device via the door hanger 12f and the coupling tool 37 attached to the door hanger 12f in the same manner as in the center opening type. On the
 10 other hand, the car door 8s is coupled to the car door 8f via a reduction mechanism.

[0037]

The reduction mechanism includes: an arm 15 that extends along the front width direction of the entrance 7 of the elevator car 6 and is attached to
 15 the door hanger 12s of the car door 8s; a pair of reduction pulleys 16 that are respectively attached on one end side and the other end side of the arm 15; a reduction wire 17 that is composed of an endless wire and is wound and hung around the pair of reduction pulleys 16; and a bracket 18 that is attached to the front of the upper frame 10 so as to fix a part of the reduction wire 17 to the
 20 upper frame 10. The car door 8f is coupled to the reduction wire 17 of the reduction mechanism via the door hanger 12f and a coupling tool 38 attached to the door hanger 12f.

[0038]

Accordingly, when the drive belt 36 is circulated by the drive motor 30,
 25 the car door 8f moves along the door rail 11f via the door hanger 12f.

Simultaneously, the reduction wire 17 is circulated, and following this, the car door 8s moves along the door rail 11s via the arm 15 and the door hanger 12s at the half speed of the car door 8f. Thus, the car doors 8f and 8s are opened and closed.

30 [0039]

A guide shoe 19 is provided at the lower end of each of the car doors 8f

and 8s. The guide shoe 19 is fitted into a groove formed on a car threshold (car floor) 20, and is configured to slide inside the groove with the opening and closing of the car doors 8f and 8s.

[0040]

5 Here, the door opening and closing device according to this embodiment includes: the drive motor 30 arranged on one end side of the front of the upper frame 10; the drive pulley 33 attached to the drive shaft of the drive motor 30; the driven pulley 34 attached on the other end side of the front of the upper frame 10; and the drive belt 36 that is composed of an endless belt and is wound
10 and hung around the drive pulley 33 and the driven pulley 34.

[0041]

The drive motor 30 is attached to the front of the upper frame 10 via a bracket 39, as shown in FIG. 4 and FIG. 5. Therefore, it is possible to reduce the total height of the elevator car 6 as compared to the above-mentioned
15 conventional door opening and closing device in which the drive motor 30 is attached onto the upper surface of the upper frame 10.

[0042]

Further, the drive motor 30 is a so-called direct drive motor, in which its housing is formed into a substantially circular shape and the drive pulley 33 is
20 directly coupled to its drive shaft. Accordingly, it is possible to eliminate the motor pulley 31, the reduction pulley 32, and the reduction belt 35 from the configuration of the above-mentioned conventional door opening and closing device, which makes it possible not only to improve maintenance performance, but also to reduce the man-hours or cost through the reduction in the number of
25 parts.

[0043]

The bracket 39 includes a base 39a and a first extending portion 39b connected to the base 39a and extending from the base 39a. The base 39a has a flat plate shape, and the first extending portion 39b also has a flat plate
30 shape. The first extending portion 39b has its base end connected to the tip of the base 39a (orthogonally). That is, the first extending portion 39b is formed

into an L shape in the cross section.

[0044]

The base 39a has a through hole formed at an appropriate point. The bracket 39 is attached to the front of the upper frame 10 using a fastener 40 by
5 passing a bolt through the above-mentioned through hole and another through hole formed in the upper frame 10 and fastening a nut. In this embodiment, a plurality of through holes are formed in a grid pattern at intervals.

[0045]

Also in the first extending portion 39b, a through hole is formed at an
10 appropriate point. In this embodiment, a plurality of through holes are formed at intervals in the direction of the drive shaft of the drive motor 30.

[0046]

For attaching the drive motor 30 to the bracket 39 using a bolt, the drive motor 30 is provided with a positioning portion 41 that determines the
15 attachment position of the drive motor 30 relative to the front of the upper frame 10. The positioning portion 41 is provided for the purpose of exactly determining the position of the drive motor 30 relative to the front of the upper frame 10. Here, the positioning portion 41 is formed integrally with the housing of the drive motor 30. The positioning portion 41 has: an axis
20 direction positioning portion 41a that determines the attachment position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 relative to the front; and an up-down direction positioning portion 41b that determines the attachment position, in a direction along the front of the upper frame 10, more specifically, in a direction along the front of the upper
25 frame 10 and orthogonal to a direction in which the car door 8 opens and closes, of the drive motor 30 relative to the front.

[0047]

The axis direction positioning portion 41a is provided, on the abutting surface of the drive motor 30 attached to the bracket 39, projecting in a
30 direction along the front of the upper frame 10 (that is, in a direction orthogonal to the drive shaft of the drive motor 30) by a specific length. The

axis direction positioning portion 41a has a surface that is in abutting contact with the tip of the first extending portion 39b of the bracket 39. In this embodiment, the axis direction positioning portion 41a is provided, corresponding to each of two corners on the abutting surface of the drive motor 5 30 attached to the bracket 39, projecting in a rectangular shape in a direction along the upper frame 10. In this embodiment, the two axis direction positioning portions 41a each have a surface facing the front of the upper frame 10, which surface is parallel to the front of the upper frame 10 and has the same distance from the front of the upper frame 10. This surface is in 10 abutting contact with the tip of the first extending portion 39b of the bracket 39 in a direction orthogonal to the front of the upper frame 10, thereby allowing the axis direction positioning portion 41a to regulate the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 relative to the front. In this way, the axis direction positioning portion 41a can 15 determine the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30, more specifically, the position of the drive pulley 33, relative to the front.

[0048]

The up-down direction positioning portion 41b is provided as the 20 abutting surface of the drive motor 30 attached to the bracket 39. That is, the up-down direction positioning portion 41b is provided as the abutting surface of the drive motor 30 attached to the lower surface of the first extending portion 39b of the bracket 39 in the form of a flat plate. The up-down direction positioning portion 41b is in abutting contact with the lower surface of the first 25 extending portion 39b, thereby allowing the up-down direction positioning portion 41b to regulate the position, in a direction along the front of the upper frame 10 and orthogonal to a direction in which the car door 8 opens and closes, of the drive motor 30 relative to the front. In this way, the up-down direction positioning portion 41b can determine the position, in a direction along the 30 front of the upper frame 10 and orthogonal to a direction in which the car door 8 opens and closes of the drive motor 30, more specifically, the position of the

drive pulley 33, relative to the front. As a result of this, it is made possible to adjust the drive pulley 33 and the driven pulley 34 to be parallel to the opening and closing direction of the car door 8, so as to adjust the drive belt 36 to be parallel thereto.

5 [0049]

Then, in the state where the axis direction positioning portions 41a and the up-down direction positioning portion 41b are each in abutting contact with the bracket 39, the drive motor 30 is attached to the lower surface of the bracket 39 using a fastener 42. Specifically, in the state where the axis
10 direction positioning portions 41a and the up-down direction positioning portion 41b are each in abutting contact with the bracket 39, a bolt is screwed into a through hole formed in the first extending portion 39b and an internal thread formed in the housing of the drive motor 30. In this way, the drive motor 30 is attached to the lower surface of the bracket 39 so as to be fixed
15 thereto. In this embodiment, the drive motor 30 is attached to the front of the upper frame 10, thereby allowing the drive pulley 33 to be positioned so as to face the front of the upper frame 10.

[0050]

As has been described above, the door opening and closing device
20 according to this embodiment allows the positioning portion 41 to regulate the position of the drive motor 30 merely by bringing the axis direction positioning portions 41a and the up-down direction positioning portion 41b into abutting contact with the first extending portion 39b of the bracket 39. That is, the positioning portion 41 can regulate the position, in the axis direction orthogonal
25 to the front of the upper frame 10 and also in a direction along the front of the upper frame 10 and orthogonal to a direction in which the car door 8 opens and closes, of the drive motor 30 relative to the front, merely by being in abutting contact with the first extending portion 39b of the bracket. Accordingly, the attachment position of the drive motor 30 to the bracket 39 is exactly
30 determined, so that the axis direction positioning portions 41a and the up-down direction positioning portion 41b can suitably determine the position of the

drive motor 30 relative to the front of the upper frame 10. This allows the drive pulley 33 to be exactly positioned corresponding to the position of the driven pulley 34.

[0051]

5 Next, a second embodiment of the elevator door opening and closing device according to the present invention is described with reference to FIG. 6. In the configuration of this embodiment, components identical or corresponding to those of the conventional technique shown in FIG. 12 and FIG. 13 are denoted by the same reference numerals. Further, the components other than
10 the positioning portion 41 of the drive motor 30 and the bracket 39 are the same as those in the first embodiment. Therefore, the description thereof is omitted in this embodiment.

[0052]

 The bracket 39 of this embodiment is different from the bracket 39 of
15 the first embodiment by further including a second extending portion 39c bent from the first extending portion 39b. The second extending portion 39c has a base end connected to the tip of the first extending portion 39b (orthogonally). Further, the second extending portion 39c has a tip extending toward the upper part of the car door 8 (in the upward direction on the paper of FIG. 6). Thus,
20 the bracket 39 is formed into an S shape in cross section.

[0053]

 The second extending portion 39c has a through hole formed at an appropriate point for the purpose of attaching the drive motor 30 to the bracket 39. In this embodiment, the first extending portion 39b and the second
25 extending portion 39c each may have a plurality of through holes formed at intervals in the opening and closing direction of the car door 8.

[0054]

 The drive motor 30 of this embodiment is different from the drive motor 30 of the first embodiment in the shape of the axis direction positioning portion
30 41a and the abutting portion of the positioning portion 41 with the bracket 39.

[0055]

The axis direction positioning portion 41a has a thickness in the axis direction orthogonal to the front of the upper frame 10 such that an internal thread can be formed therein. The axis direction positioning portion 41a has a width in a direction along the front of the upper frame 10 such that an internal
5 thread can be formed therein. The axis direction positioning portion 41a has an abutting surface in abutting contact with the second extending portion 39c that is parallel to the front of the upper frame 10. The abutting surface is in abutting contact with the front of the second extending portion 39c, thereby allowing the axis direction positioning portion 41a to regulate the position, in
10 the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 relative to the front. Accordingly, the axis direction positioning portion 41a can determine the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30, more specifically, the position of the drive pulley 33, relative to the front.

15 [0056]

Then, in the state where the axis direction positioning portion 41a and the up-down direction positioning portion 41b are each in abutting contact with the bracket 39, the drive motor 30 is attached to the lower surface of the first extending portion 39b and the front of the second extending portion 39c so as to
20 be fixed thereto. Specifically, in the state where the axis direction positioning portion 41a and the up-down direction positioning portion 41b are each in abutting contact with the bracket 39, a bolt is screwed into each through hole formed in the first extending portion 39b and the second extending portion 39c and each internal thread formed in the housing of the drive motor 30. In this
25 way, the drive motor 30 is attached to each of the lower surface of the first extending portion 39b and the front of the second extending portion 39c using the fastener 42 so as to be fixed thereto.

[0057]

As has been described above, the door opening and closing device
30 according to this embodiment can increase the working efficiency in the work to attach the drive motor 30 to the bracket 39, since it is easier to confirm that the

axis direction positioning portion 41a is in abutting contact with the second extending portion 39c, in addition to the effects obtained in the first embodiment. Further, the through hole formed in the first extending portion 39b and the through hole formed in the second extending portion 39c have
5 different opening directions from each other. Therefore, the drive motor 30 can be attached temporarily to the bracket 39 by using either one of the through holes depending on the working position. Accordingly, it is possible to attach the drive motor 30 easily and exactly to the bracket 39, regardless of the working position.

10 [0058]

Next, a third embodiment of the elevator door opening and closing device according to the present invention is described with reference to FIG. 7. In the configuration of this embodiment, components identical or corresponding to those of the conventional technique shown in FIG. 12 and FIG. 13 are
15 denoted by the same reference numerals. Further, the components other than the positioning portion 41 and the bracket 39 are the same as those in the second embodiment. Therefore, the description thereof is omitted in this embodiment.

[0059]

20 The bracket 39 of this embodiment is different from the bracket 39 of the second embodiment in that no through hole is formed in the first extending portion 39b. Other than that, the bracket 39 is the same as in the second embodiment. Thus, the description thereof is omitted.

[0060]

25 The drive motor 30 of this embodiment is different from the drive motor 30 of the second embodiment in that no internal thread is provided in the up-down direction positioning portion 41b. Other than that, the drive motor 30 is the same as in the second embodiment. Thus, the description thereof is omitted.

30 [0061]

As has been described above, according to the door opening and closing

device of this embodiment, it is easier to confirm that the up-down direction positioning portion 41b is in abutting contact with the second extending portion 39c, in addition to the effects obtained in the first embodiment. Further, it is possible to reduce the number of fasteners 42 as compared to the second
5 embodiment, thereby reducing the cost more and enhancing the working efficiency.

[0062]

Next, a fourth embodiment of the elevator door opening and closing device according to the present invention is described with reference to FIG. 8.
10 In the configuration of this embodiment, components identical or corresponding to those of the conventional technique shown in FIG. 12 and FIG. 13 are denoted by the same reference numerals. Further, the components other than the positioning portion 41 of the drive motor 30 and the bracket 39 are the same as those in the third embodiment. Therefore, the detailed description thereof
15 is omitted in this embodiment.

[0063]

The bracket 39 of this embodiment is different from the bracket 39 of the third embodiment in that the first extending portion 39b has a smaller length in the axis direction orthogonal to the front of the upper frame 10
20 relative to the front. Other than that, the bracket 39 is the same as in the third embodiment. Thus, the description thereof is omitted.

[0064]

The axis direction positioning portion 41a of this embodiment is different from the axis direction positioning portion 41a of the third
25 embodiment by having the same thickness as the thickness of the housing. Specifically, the axis direction positioning portion 41a is different therefrom by having the same thickness as the thickness, in the axis direction orthogonal to the front of the upper frame 10, of the housing relative to the front. Other than that, the axis direction positioning portion 41a is the same as in the third
30 embodiment. Thus, the description thereof is omitted.

[0065]

The up-down direction positioning portion 41b of this embodiment is provided projecting from the surface of the axis direction positioning portion 41a facing the front of the upper frame 10 by a specific length at a specific position in the axis direction orthogonal to the front of the upper frame 10
5 relative to the front. The up-down direction positioning portion 41b has an abutting surface that is in abutting contact with the tip, parallel to the opening and closing direction of the car door 8, of the second extending portion 39c of the bracket 39. In this embodiment, the up-down direction positioning portion 41b is provided rectangularly projecting from the surface of the axis direction
10 positioning portion 41a facing the front of the upper frame 10. The up-down direction positioning portion 41b is provided upwardly adjacent to the surface of the axis direction positioning portion 41a attached to the bracket 39 as seen from the car door 8. In this embodiment, the up-down direction positioning portion 41b is in abutting contact with the tip of the second extending portion
15 39c, thereby regulating the position, in a direction along the front of the upper frame 10 and orthogonal to a direction in which the car door 8 opens and closes, of the drive motor 30 relative to the front. In this way, the up-down direction positioning portion 41b can determine the position, in a direction along the front of the upper frame 10 and orthogonal to a direction in which the car door 8
20 opens and closes, of the drive motor 30, more specifically, the position of the drive pulley 33, relative to the front.

[0066]

As has been described above, according to the door opening and closing device of this embodiment, it is easier to confirm that the axis direction
25 positioning portion 41a and the up-down direction positioning portion 41b are each in abutting contact with the second extending portion 39c, in addition to the effects obtained in the first embodiment. Further, it is possible to reduce the number of fasteners 42 as compared to the second embodiment, thereby reducing the cost more. Furthermore, the attachment work can be performed
30 with the up-down direction positioning portion 41b brought into abutting contact with the tip of the second extending portion 39c by gravity. Therefore,

the working efficiency in such attachment work can be enhanced.

[0067]

Next, a fifth embodiment of the elevator door opening and closing device according to the present invention is described with reference to FIG. 9. In the configuration of this embodiment, components identical or corresponding to those of the conventional technique shown in FIG. 12 and FIG. 13 are denoted by the same reference numerals. Further, the components other than the axis direction positioning portion 41a of the drive motor 30 and the bracket 39 are the same as those in the first embodiment. Therefore, the detailed description thereof is omitted in this embodiment.

[0068]

The bracket 39 of this embodiment is different from the bracket 39 of the first embodiment in that the first extending portion 39b has a through hole 39d that is engaged with the positioning portion 41. The through hole 39d is provided corresponding to the position of the axis direction positioning portion 41a on the upper surface of the drive motor 30. In this embodiment, two through holes 39d are provided respectively corresponding to the positions of two axis direction positioning portions 41a on the upper surface of the drive motor 30. The through holes 39d are each provided as a hole in a rectangular shape. Other than that, the first extending portion 39b is the same as in the first embodiment. Thus, the description thereof is omitted.

[0069]

The axis direction positioning portions 41a of this embodiment are different from the axis direction positioning portion 41a of the first embodiment by being provided corresponding to the positions of the through holes 39d provided in the first extending portion 39b. In this embodiment, the axis direction positioning portions 41a are provided respectively at two corners adjacent to the surface of the drive motor 30 facing the front of the upper frame 10 on the surface of the drive motor 30 attached to the bracket 39. The two axis direction positioning portions 41a each rectangularly project from the upper surface of the drive motor 30 that is in abutting contact with the bracket

39. Further, the two axis direction positioning portions 41a each have a cross-sectional area equal to or smaller than the cross-sectional area of the corresponding through hole 39d of the first extending portion 39b. This allows the two axis direction positioning portions 41a to be inserted respectively
5 through the through holes 39d of the first extending portion 39b when the upper surface of the drive motor 30 is brought into abutting contact with the bracket 39, so as to project further through the upper openings in the first extending portion 39b.

[0070]

10 The two axis direction positioning portions 41a are respectively brought into abutting contact with either internal surface, in the axis direction orthogonal to the front of the upper frame 10, of the through holes 39d relative to the front. This allows the two axis direction positioning portions 41a to regulate the position, in the axis direction orthogonal to the front of the upper
15 frame 10, of the drive motor 30 relative to the front. Accordingly, the axis direction positioning portions 41a determine the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30, more specifically, the position of the drive pulley 33, relative to the front.

[0071]

20 As has been described above, according to the door opening and closing device of this embodiment, it is easy to confirm that the axis direction positioning portions 41a are respectively in abutting contact with the internal surface of the through holes 39d in the axis direction orthogonal to the front of the upper frame 10 relative to the front, in addition to the effects obtained in
25 the first embodiment. Accordingly, it is possible to attach the drive motor 30 to the bracket 39 while checking the exact position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 relative to the front.

[0072]

30 It should be noted that the elevator door opening and closing device according to the present invention is not limited to the above-mentioned

embodiments, and various modifications can be made without departing from the scope of the invention.

[0073]

For example, as shown in FIG. 10, the bracket 39 may be attached to
5 the front of the upper frame 10 while being inclined about an axis orthogonal to the front of the upper frame 10 in the embodiments of the present invention. In detail, the bracket 39 may be attached to the front of the upper frame 10 so that the attached portions to the front of the upper frame 10 are arranged inwardly of an opening line L (more on the entrance 7 side) that defines the
10 front width of the entrance 7 of the elevator car 6. Specifically, the bracket 39 may be attached to the front of the upper frame 10 so that a plurality of fasteners 40 for fixing the bracket 39 to the front of the upper frame 10 are all arranged inwardly of the opening line L (more on the entrance 7 side).

[0074]

15 Further, as a result of the bracket 39 being attached in such an inclined state, the attached portions of the drive motor 30 also may be arranged inwardly of the opening line L (more on the entrance 7 side). Specifically, a plurality of fasteners 42 for fixing the drive motor 30 to the bracket 39 may be all arranged inwardly of the opening line L (more on the entrance 7 side).

20 [0075]

According to such a configuration, the bracket 39 is attached to the front of the upper frame 10 so that the attached portions to the front of the upper frame 10 (portions attached using the fasteners 40) and the attached portions of the drive motor 30 (portions attached using the fasteners 42) are
25 arranged inwardly of the opening line L, thereby allowing the work to detach the drive motor 30 from the bracket 39, or subsequent work to detach, from the front of the upper frame 10, the bracket 39 from which the drive motor 30 has been detached to be performed from the position of the platform 3, with the platform door 4 open. Therefore, the working efficiency in such work can be
30 enhanced.

[0076]

Moreover, when the maintenance staff steps on the elevator car 6 in maintenance checks for the elevator, the maintenance staff cannot put a foot on the upper surface of the bracket 39 well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to suitably prevent
5 the bracket 39 from being used as a foothold.
[0077]

Further, as shown in FIG. 11, the drive motor 30 may be attached onto the upper surface of the first extending portion 39b of the bracket 39 in the above-mentioned embodiments.
10 [0078]

Such a configuration also allows the attachment positions of the drive motor 30 to the bracket 39 to be exactly determined merely by bringing the axis direction positioning portion 41a and the up-down direction positioning portion 41b into abutting contact with the bracket 39, in the same manner as in the
15 first embodiment. Further, the attachment work of the drive motor 30 to the bracket 39 can be performed with the drive motor 30 being placed on the upper surface of the first extending portion 39b, and the position of the drive motor 30 being determined. Therefore, the working efficiency in such attachment work can be enhanced. Moreover, since the contour of the drive motor 30 (contour of
20 the housing) is circular, when the maintenance staff steps on the elevator car 6 in maintenance checks for the elevator, the maintenance staff cannot put a foot on the upper surface of the bracket 39 well, despite attempts. Since the maintenance staff would avoid such attempts, it is possible to suitably prevent the bracket 39 from being used as a foothold.
25 [0079]

Further, in the above-mentioned embodiments, the drive motor 30 may have a slit capable of accommodating the tip of the first extending portion 39b or the second extending portion 39c so that the slit functions as the positioning portion 41. For example, in the drive motor 30 of FIG. 4, the positioning
30 portion 41 may have a slit capable of accommodating the tip of the first extending portion 39b in the extending direction of the first extending portion

39b. The positioning portion 41 can exactly determine the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 relative to the front by accommodating the tip of the first extending portion 39b in the slit, with the bottom of the slit being in abutting contact with the tip of the first extending portion 39b. Further, the drive motor 30 is maintained at a position determined by the upper surface of the first extending portion 39b accommodated in the slit and the inner surface of the slit. Therefore, the working efficiency in the attachment work of the drive motor 30 to the bracket 39 can be enhanced. Likewise, in the drive motor 30 of FIG. 8, the working efficiency in the attachment work of the drive motor 30 to the bracket 39 can be enhanced by the positioning portion 41 having a slit capable of accommodating the tip of the second extending portion 39c in the extending direction of the second extending portion 39c.

[0080]

Further, in the above-mentioned embodiments, the base end of the second extending portion 39c may be formed into a substantially U-shape in cross section by being connected from the tip of the first extending portion 39b toward the car door 8 (so as to be orthogonal thereto). The drive motor 30 may have a slit for accommodating the tip of the second extending portion 39c on its upper surface, so that the slit serves as the axis direction positioning portion 41a. The slit may be provided from the upper surface of the drive motor 30 in a direction along the front of the upper frame 10. Such a configuration allows the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 to be exactly determined relative to the front merely by the slit accommodating the tip of the second extending portion 39c.

[0081]

Instead of providing such a slit on the upper surface of the drive motor 30, the front of the drive motor 30 may be in abutting contact with the surface, facing the front of the upper frame 10, of the second extending portion 39c. Such a configuration also allows the position, in the axis direction orthogonal to the front of the upper frame 10, of the drive motor 30 to be exactly determined

relative to the front.

[0082]

Further, although the side opening type is employed in the above-mentioned embodiments, the center opening type may be employed as in the above-mentioned conventional elevator. Furthermore, the side opening elevator provided with three or more car doors 8, instead of two car doors 8, may be employed. Also, the center opening elevator provided with two car doors 8 on each side may be employed.

[0083]

Further, the drive shaft of the drive motor 30 is directly coupled to the drive pulley 33 that rotates the drive belt 36 in the above-mentioned embodiments. However, instead of such a direct drive system, it is also possible to employ a mechanism as in the conventional door opening and closing device in which the drive motor 30 is arranged at a distance from the drive pulley 33, the motor pulley is attached to the drive shaft of the drive motor 30, the reduction pulley is attached to the drive pulley 33 coaxially and integrally, and the reduction belt is wound and hung around the motor pulley and the reduction pulley.

[0084]

Further, in the above-mentioned embodiments, the drive pulley 33, the driven pulley 34, the drive belt 36, and the coupling tool 37 are combined as a transmission mechanism for transmitting the driving force of the drive motor 30 to the car door 8. Besides that, publicly known transmission mechanisms such as a link mechanism can be employed.

[0085]

Further, although the housing of the drive motor 30 is formed into a circular shape in the above-mentioned embodiments, its shape may not be strictly circular, and includes elliptical shapes and polygon shapes such as a hexagonal shape and an octagonal shape.

[0086]

Further, although the upper frame 10 is composed of a perpendicular

portion 10a and a horizontal portion 10b extending backward from the upper end of the perpendicular portion 10a in the above-mentioned embodiments, the horizontal portion 10b may be eliminated.

[0087]

- 5 In the above-mentioned embodiments, the direction in which the first extending portion 39b extends from the upper frame 10 is not limited to the direction orthogonal to the front of the upper frame 10, and may be any direction as long as being in the direction of the car door 8.

10 REFERENCE SIGNS LIST

[0088]

- | | |
|-------|---------------------------|
| 1 | Shaft |
| 2 | Entrance |
| 3 | Platform |
| 15 4 | Platform Door |
| 5 | Engagement Receiving Part |
| 6 | Elevator Car |
| 7 | Entrance |
| 8 | Car Door |
| 20 9 | Engaging Part |
| 10 | Upper Frame |
| 10a | Perpendicular Portion |
| 10b | Horizontal Portion |
| 11 | Door Rail |
| 25 12 | Door Hanger |
| 13 | Roller |
| 14 | Bracket |
| 15 | Arm |
| 16 | Reduction Pulley |
| 30 17 | Reduction Belt |
| 18 | Bracket |

	19	Guide Shoe
	20	Car Threshold
	30	Drive Motor
	33	Drive Pulley
5	34	Driven Pulley
	36	Drive Belt
	37, 38	Coupling Tool
	39	Bracket
	39a	Base
10	39b	First Extending Portion
	39c	Second Extending Portion
	39d	Through Hole
	40	Fastener
	41	Positioning Portion
15	41a	Axis Direction Positioning Portion
	41b	Up-Down Direction Positioning Portion
	42	Fastener
	L	Opening Line

CLAIMS

1. An elevator door opening and closing device in which an openable and closable car door is provided at an entrance of an elevator car, and a drive motor
5 is coupled to the car door via a transmission mechanism, characterized in that:
the drive motor is attached via a bracket to a front of an upper frame that is provided above the entrance of the elevator car; and
the drive motor has a positioning portion that determines a position, in an axis direction orthogonal to the front of the upper frame, of the drive motor
10 by being in abutting contact with the bracket.
2. The elevator door opening and closing device according to claim 1, wherein
the positioning portion determines the position, in a direction along the
15 front of the upper frame and orthogonal to a direction in which the car door opens and closes, of the drive motor by being in abutting contact with the bracket.
3. The elevator door opening and closing device according to claim 1,
20 wherein
the positioning portion determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being in abutting contact with a tip of the bracket extending from the front of the upper frame.
25
4. The elevator door opening and closing device according to claim 1, wherein
the positioning portion determines the position, in the axis direction orthogonal to the front of the upper frame, of the drive motor by being engaged
30 with a through hole provided in the bracket extending from the front of the upper frame.

5. The elevator door opening and closing device according to claim 1,
wherein

the positioning portion determines the position, in the axis direction
5 orthogonal to the front of the upper frame, of the drive motor by being in
abutting contact with one surface of the bracket extending from the front of the
upper frame and bent in a direction along the front of the upper frame.

6. The elevator door opening and closing device according to any one of
10 claims 2 to 5, wherein

the positioning portion determines the position, in a direction along the
front of the upper frame and orthogonal to a direction in which the car door
opens and closes, of the drive motor by being in abutting contact with a lower
surface of the bracket extending from the front of the upper frame.

15

7. The elevator door opening and closing device according to claim 2 or 5,
wherein

the positioning portion determines the position, in a direction along the
front of the upper frame and orthogonal to a direction in which the car door
20 opens and closes, of the drive motor by being in abutting contact with a tip of
the bracket extending from the front of the upper frame and bent in a direction
along the front of the upper frame.

8. The elevator door opening and closing device according to claim 1,
25 wherein

the drive pulley in the transmission mechanism is directly coupled to
the drive motor, and

the drive motor is attached to the front of the upper frame with the
drive pulley facing the front of the upper frame.

30

9. The elevator door opening and closing device according to claim 1,
wherein

the bracket is attached to the front of the upper frame while being
inclined about an axis orthogonal to the front of the upper frame, and

5 the drive motor is attached to a lower surface of the bracket.