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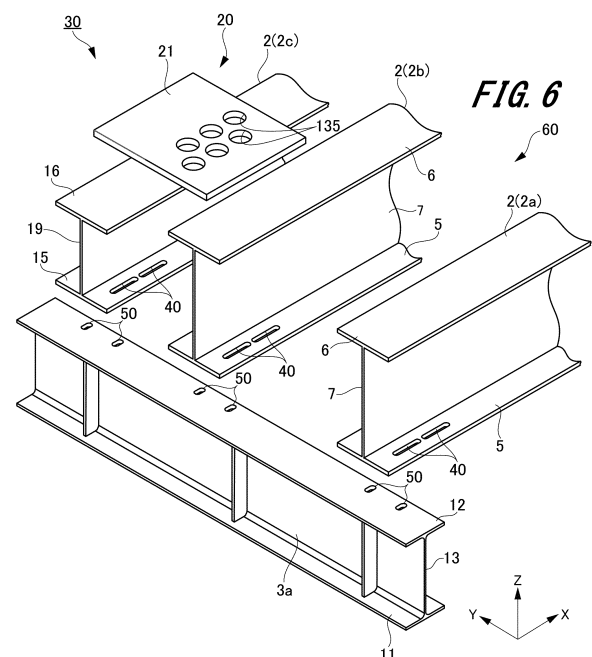
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(54) **HOISTWAY TOP STRUCTURE, METHOD FOR INSTALLING HOISTWAY TOP STRUCTURE, AND ELEVATOR**

(57) An elliptical spacer hole, which is longer in a direction along the longitudinal direction of a supporting beam, is provided on an upper surface of at least one spacer of a pair of spacers at the supporting beam side. In the longitudinal direction of the supporting beam, a plurality of beam holes are provided along the longitudinal direction at an end part on the side disposed on the top of the at least one spacer. The spacer is fixed to the supporting beam with a bolt that passes through the elliptical spacer hole and a beam hole which is provided at an upper position overlapping the elliptical spacer hole.



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Description

Technical Field

[0001] The present invention relates to a hoistway top structure installed at a hoistway top of an elevator, a method for installing the hoistway top structure, and the elevator.

Background Art

[0002] Conventionally, for installation of an elevator hoist, a support base for fixing the hoist and a steel material used when the support base is installed in a building are used. Welding or fastening with a bolt is used to fix the support base and the steel material. When there is a demand for no welding work at the time of installing the hoist, fastening with the bolt is used. Patent Literature 1 discloses a hoist installing device in which a hoist support base and a steel material are fixed by a through bolt.

Citation List

Patent Literature

[0003] Patent Literature 1: WO/2016/030943

Summary of Invention

Technical Problem

[0004] Incidentally, when the hoist support base and the steel material are fastened with the bolt, it is necessary to adjust a fixing position between the hoist support base and the steel material, then adjust a length of the support base, drill the hoist support base and the steel material on site, and fix the support base and the steel material with the bolt. In addition to the hoist support base, there is also a case where a rope end beam for holding an end part of a main rope is installed at a hoistway top. Even in the case of the rope end beam, it may be necessary to finely adjust a length in accordance with dimensions of a building when the rope end beam is installed on the steel material. Also in this case, after adjusting the length of the rope end beam, drilling work for the rope end beam is required on site in accordance with the steel material to fix the rope end beam.

[0005] However, the drilling work on site requires a lot of time and cost. Therefore, in the hoistway top structure including the hoist support base, the rope end beam, and the like provided at the hoistway top, a configuration that can be installed in the building without performing drilling is desired even when the length is adjusted in accordance with the building dimensions.

[0006] Therefore, an object of the present invention is to provide a hoistway top structure capable of coping with a dimensional error of a building without performing drilling, a method for installing the hoistway top structure,

and an elevator.

Solution to Problem

[0007] In order to solve the above problem and achieve the object of the present invention, a hoistway top structure of the present invention includes at least a pair of spacers disposed on a floor surface of a machine room at a hoistway top. Further, a supporting beam disposed such that both end parts in a longitudinal direction are fixed to respective tops of the pair of spacers is included. An elliptical spacer hole, which is longer in a direction along the longitudinal direction of the supporting beam, is provided on an upper surface of at least one spacer of the pair of spacers at the supporting beam side. Further, in the supporting beam, a plurality of beam holes is provided along the longitudinal direction at an end part on a side disposed on the top of the at least one spacer. The one spacer and the end part in the longitudinal direction of the supporting beam arranged at the top of the one spacer are fixed with a bolt that passes through the elliptical spacer hole and the beam hole provided at an upper position overlapping the elliptical spacer hole.

[0008] In a method for installing a hoistway top structure of the present invention, first, a supporting beam is prepared in which a plurality of beam holes is provided along a longitudinal direction at an end part on at least one side in the longitudinal direction. Furthermore, a pair of spacers is prepared in which an elliptical spacer hole, which is longer in a direction along the longitudinal direction of the supporting beam, is provided on an upper surface at the supporting beam side of at least one spacer of the pair of spacers. Then, the pair of spacers is arranged at predetermined positions on a floor surface at a hoistway top, an arrangement position of the supporting beam is adjusted according to an interval between the pair of spacers, an end part on one side where the beam holes of the supporting beam are provided is arranged at the top of the one spacer where the elliptical spacer hole is provided, and an end part on another side of the supporting beam is arranged at the top of another spacer. Then, a bolt is inserted into the elliptical spacer hole and the beam hole and fixed with a nut.

[0009] An elevator of the present invention includes the above-described hoistway top structure.

Advantageous Effects of Invention

[0010] According to the present invention, it is possible to install a hoistway top structure capable of coping with a dimensional error of a building without performing drilling.

Brief Description of Drawings

[0011]

Fig. 1 is an overall configuration diagram of an ele-

vator according to a first embodiment of the present invention.

Fig. 2 is a schematic configuration diagram of the elevator according to the first embodiment of the present invention, and is a diagram viewed from a direction different from that in Fig. 1.

Fig. 3 is a front view of a state around a hoist 100 including a hoistway top structure 30 as viewed from a direction (X direction) orthogonal to a rotation axis of the hoist 100.

Fig. 4 is a diagram of the state around the hoist 100 including the hoistway top structure 30 as viewed from an upper surface (Z direction).

Fig. 5 is a front view of the state around the hoist 100 including the hoistway top structure 30 as viewed from a direction (Y direction) along the rotation axis of the hoist 100.

Fig. 6 is an exploded perspective view of a main part of the hoistway top structure 30.

Fig. 7 is a diagram of a first machine beam 2a as viewed from a lower part in a lateral direction.

Fig. 8 is a diagram of a first spacer 3a as viewed from an upper part in the lateral direction.

Fig. 9 is a perspective view of a main part when the first machine beam 2a is fixed to the first spacer 3a after an end part of the first machine beam 2a is cut.

Fig. 10 is a schematic configuration diagram of a hoistway top structure 200 according to a second embodiment of the present invention.

Description of Embodiments

[0012] Hereinafter, an example of a hoistway top structure of an elevator and a method for installing the hoistway top structure according to embodiments of the present invention will be described with reference to the drawings. Note that the present invention is not limited to the following examples. In the drawings described below, common members are denoted by the same reference numerals.

1. First Embodiment: Configuration of Elevator

[0013] First, an overall configuration of an elevator to which a hoistway top structure of the elevator according to a first embodiment of the present invention (hereinafter referred to as "the present embodiment") is applied will be described with reference to Figs. 1 and 2. Fig. 1 is an overall configuration diagram of an elevator according to the present embodiment, and Fig. 2 is a schematic configuration diagram when the elevator according to the present embodiment is viewed from a direction different from that in Fig. 1.

[0014] As illustrated in Fig. 1, an elevator 1 of the present embodiment is provided in a hoistway 110 formed in a building structure. The elevator 1 moves up and down in the hoistway 110 and includes a car 120 on which a person and luggage are loaded, a main rope

130, a counterweight 170, and a hoist 100. Hereinafter, a direction in which the car 120 moves up and down will be described as a vertical direction.

5 [Hoistway]

[0015] The hoistway 110 is a space for the car 120 to ascend and descend, and is provided penetrating each floor in a building in the vertical direction. A guide rail (not illustrated) that guides the ascent and descent of the car 120 is attached to an inner wall surface 180 of the hoistway 110. Further, a landing door (not illustrated) leading to each floor is provided at a height position corresponding to each floor on the wall surface 180 of the hoistway 110.

[0016] Further, a machine room 190 is provided at the top of the hoistway 110. The machine room 190 is provided with a hoistway top structure 30 including a hoist support base 60 (see Fig. 2) to which the hoist 100 is fixed and a rope support mechanism 20 (see Fig. 2) that holds a tip of the main rope 130. The hoistway top structure 30 will be described in detail later.

[Car]

[0017] The car 120 is formed in a hollow substantially rectangular parallelepiped shape and is disposed in the hoistway 110. An on-car pulley 121 is provided at an upper end part of the car 120, and the main rope 130 is wound around the on-car pulley 121. The car 120 is connected with the counterweight 170 via the main rope 130 and moves up and down in the hoistway 110. This car 120 is guided by a guide rail provided on the wall surface 180 in the hoistway 110, and moves up and down in the vertical direction in the hoistway 110. On a side surface of the car 120, a car door (not illustrated) is provided at a position corresponding to the landing door of each floor, and when the car 120 stops on each floor, the car door and the landing door are opened, so that a person and luggage are loaded onto and unloaded from the car 120.

[Counterweight]

[0018] The counterweight 170 is disposed in the hoistway 110, and a weight-side pulley 141 is provided at an upper end part. The main rope 130 is wound around the weight-side pulley 141, and moves up and down in the hoistway 110 along a weight-side guide rail (not illustrated). Here, the on-car pulley 121 and the weight-side pulley 141 are arranged such that an axial direction thereof is orthogonal to a sheave 101 and a deflector wheel 150 of the hoist 100.

[Hoist]

[0019] It is fixed to the hoist support base 60 provided in the machine room 190. As illustrated in Fig. 2, the hoist 100 includes the sheave 101 around which the main rope

130 is wound, a drive unit 102 that rotationally drives the sheave 101, and a base part 103 that supports the sheave 101 and the drive unit 102. In addition, the deflector wheel 150 on which the main rope 130 is mounted is provided in the vicinity of the hoist 100. The hoist 100 raises and lowers the car 120 by winding up the wound main rope 130. The hoist 100 is installed such that a rotation axis of the sheave 101 is orthogonal to an axial direction of rotation axes of the on-car pulley 121 and the weight-side pulley 141.

[Main Rope]

[0020] Both axial end parts of the main rope 130 are fixed to the rope support mechanism 20 provided in the machine room 190 at the top of the hoistway 110 via a rope adjustment unit 131. The rope adjustment unit 131 is a member that adjusts tension of the main rope 130. The rope adjustment unit 131 will be described later in detail. After one end part of the main rope 130 is supported by the rope support mechanism in the machine room 190, in the hoistway 110, the main rope is wound around the on-car pulley 121, and then wound around the sheave 101 of the hoist 100 and the deflector wheel 150.

[0021] Furthermore, after the main rope 130 is wound around the sheave 101 of the hoist 100 and the deflector wheel 150, the main rope is wound around the weight-side pulley 141. Then, another end part of the main rope 130 is fixed to the rope support mechanism 20 provided in the machine room 190 at the top of the hoistway 110 via the rope adjustment unit 131. When the hoist 100 is driven, the car 120 and the counterweight 170 move up and down in the hoistway 110 via the main rope 130.

2. Configuration of Hoistway Top Structure

[0022] Next, the hoistway top structure 30 used in the elevator 1 of the present embodiment will be described. Fig. 3 is a front view of a state around the hoist 100 including the hoistway top structure 30 as viewed from a direction (X direction) orthogonal to a rotation axis of the hoist 100. Further, Fig. 4 is a diagram of the state around the hoist 100 including the hoistway top structure 30 as viewed from an upper surface (Z direction). Further, Fig. 5 is a front view of the state around the hoist 100 including the hoistway top structure 30 as viewed from a direction (Y direction) along the rotation axis of the hoist 100.

[0023] As illustrated in Figs. 3 and 4, the hoistway top structure 30 includes a first spacer 3a, a second spacer 3b, a first machine beam 2a, a second machine beam 2b, a rope end beam 2c, and a pair of support plates 21 and 21 which are placed on a floor surface 161 in the machine room 190. In the present embodiment, an example in which the first spacer 3a, the second spacer 3b, the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c are formed of a so-called H-shaped steel having an H-shaped cross-sectional

shape will be described. The H-shaped steel includes a pair of rectangular flange parts extending in one direction and a connection part connecting the pair of flange parts.

[0024] In the following description, in the H-shaped steel, an extending direction thereof will be described as a longitudinal direction, and a direction orthogonal to the longitudinal direction and perpendicular to a pair of flange parts extending in the longitudinal direction will be described as a lateral direction. In addition, a direction orthogonal to the longitudinal direction and the lateral direction will be described as a width direction. In addition, when the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c are not particularly distinguished, they are simply described as a supporting beam 2.

[0025] The first spacer 3a and the second spacer 3b are made of H-shaped steel having the same length in the lateral direction and the same length in the longitudinal direction. Further, the first machine beam 2a and the second machine beam 2b are also made of H-shaped steel having the same length in the lateral direction and the same length in the longitudinal direction. The rope end beam 2c is made of H-shaped steel having a length in the lateral direction shorter than those of the first machine beam 2a and the second machine beam 2b and a length in the longitudinal direction equal to those of the first machine beam 2a and the second machine beam 2b.

[0026] The first spacer 3a and the second spacer 3b are arranged such that the longitudinal directions thereof are parallel to each other, and are arranged on the floor surface 161 of the machine room 190 such that the longitudinal directions thereof are substantially parallel to an axial direction of the sheave 101 of the hoist 100. Further, the first spacer 3a and the second spacer 3b are placed at the top of a beam 112 of a building in the machine room 190 (see Fig. 5).

[0027] The first spacer 3a and the second spacer 3b include a lower flange part 11, an upper flange part 12 facing the lower flange part 11, and a connection part 13 (see Fig. 6) connecting the lower flange part 11 and the upper flange part 12. As illustrated in Fig. 3, the lower flange part 11 is fixed to the floor surface 161 in the machine room 190 by bolts 45.

[0028] Further, as shown in Fig. 6, the upper flange part 12 is provided with elliptical spacer holes 50. The elliptical spacer hole 50 is an elliptical hole elongated in the width direction. Then, bolts 17 for fixing the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c pass through the elliptical spacer holes 50 of the first spacer 3a and the second spacer 3b. Details of the elliptical spacer hole 50 will be described later. A height of the hoist 100 in the vertical direction from the floor surface 161 of the machine room 190 is adjusted by the first spacer 3a and the second spacer 3b.

[0029] The first machine beam 2a and the second machine beam 2b are arranged at the top of the first spacer 3a and the second spacer 3b such that longitudinal directions thereof are parallel to each other and orthogonal

to the longitudinal directions of the first spacer 3a and the second spacer 3b. The first machine beam 2a and the second machine beam 2b are arranged at a predetermined interval (an interval at which a base part 103 of the hoist 100 can be placed) in the longitudinal directions of the first spacer 3a and the second spacer 3b.

[0030] The first machine beam 2a and the second machine beam 2b each include a lower flange part 5, an upper flange part 6 facing the lower flange part 5, and a connection part 7 connecting the lower flange part 5 and the upper flange part 6. The lower flange part 5 is provided with a plurality of bolt holes used when fixing to the first spacer 3a and the second spacer 3b. Here, among the plurality of bolt holes provided in the first machine beam 2a and the second machine beam 2b, the bolt hole provided on one side in the longitudinal direction (in the present embodiment, a side fixed to the first spacer 3a) is an elliptical beam hole 40 (see Fig. 6). The elliptical beam hole 40 corresponds to a beam hole of the present invention, and a configuration thereof will be described in detail later.

[0031] In the present embodiment, the first machine beam 2a and the second machine beam 2b constitute the hoist support base 60 that supports the hoist 100. The hoist 100 is installed at the top of the upper flange parts 6 of the first machine beam 2a and the second machine beam 2b via vibration-proof members 41. Then, the hoist 100 is fixed to the first machine beam 2a and the second machine beam 2b by bolts.

[0032] Similarly to the first machine beam 2a and the second machine beam 2b, the rope end beam 2c is disposed at the top of the first spacer 3a and the second spacer 3b. The rope end beam 2c is disposed on a side opposite to the first machine beam 2a side with respect to the second machine beam 2b, and is disposed such that a longitudinal direction thereof is parallel to the longitudinal directions of the first machine beam 2a and the second machine beam 2b. A length in the longitudinal direction of the rope end beam 2c is configured to be the same as the length in the longitudinal direction of the first machine beam 2a and the second machine beam 2b. On the other hand, a length in the lateral direction of the rope end beam 2c is configured to be shorter than the length in the lateral direction of the first machine beam 2a and the second machine beam 2b.

[0033] The rope end beam 2c includes a lower flange part 15, an upper flange part 16 facing the lower flange part 15, and a connection part 19 connecting the lower flange part 15 and the upper flange part 16. The lower flange part 15 is provided with a plurality of bolt holes used when fixing to the first spacer 3a and the second spacer 3b. Here, among the plurality of bolt holes provided in the rope end beam 2c, the bolt hole provided on at least one side in the longitudinal direction (in the present embodiment, a side fixed to the first spacer 3a) is the elliptical beam hole 40 (see Fig. 6). The elliptical beam hole 40 has the same configuration as the elliptical beam hole 40 provided in the first machine beam 2a and

the second machine beam 2b. This elliptical beam hole 40 will be described in detail later.

[0034] In addition, a pair of support plates 21 and 21 for supporting thimble rods 132 (see Fig. 3) of the rope adjustment units 131 is disposed at the top of the upper flange part 16 of the rope end beam 2c.

[0035] Each of the pair of support plates 21 and 21 is formed of a flat plate member, and the support plate 21 is provided with a plurality of through holes 135 through which the thimble rods 132 of the rope adjustment units 131 described later pass. The pair of support plates 21 and 21 is arranged to be spaced apart from each other in the longitudinal direction of the rope end beam 2c, and the through holes 135 are arranged to be between the second machine beam 2b and the rope end beam 2c. Each of the pair of support plates 21 and 21 is fastened to the upper flange part 16 of the rope end beam 2c with a bolt (not illustrated). In the present embodiment, the rope support mechanism 20 is configured by the rope end beam 2c and the pair of support plates 21 and 21.

[0036] Here, the rope adjustment unit 131 supported by the support plate 21 will be described. The rope adjustment unit 131 is provided at both axial end parts of the main rope 130. As illustrated in Fig. 3, the rope adjustment unit 131 includes the thimble rod 132, a spring member 133, and a nut 134.

[0037] The thimble rod 132 is a rod-shaped member having an outer peripheral surface on which a male screw is formed, and is fixed to each of both axial end parts of the main rope 130. When the main rope 130 is supported by the rope support mechanism 20, first, this thimble rod 132 is passed through the through hole 135 of the support plate 21 from a lower side in the vertical direction. Then, the spring member 133 is inserted into the thimble rod 132 passing through the through hole 135 of the support plate 21, and the nut 134 is screwed from an end part of the thimble rod 132 so as to generate predetermined tension in the spring member 133 and fixed at a predetermined position. The tension of the main rope 130 can be adjusted by expansion and contraction of the spring member 133.

[0038] In the present embodiment, one end part of the main rope 130 is supported by one support plate 21 via the rope adjustment unit 131, and another end part of the main rope 130 is supported by another support plate 21 via the rope adjustment unit 131.

3. Configuration of Main Part of Hoistway Top Structure

[0039] When the hoistway top structure 30 is installed, in order to install the first spacer 3a and the second spacer 3b at the top of the beam 112 of the building, as illustrated in Fig. 5, there is a case where the wall surface 180 of the hoistway 110 is dug to provide a recess 111. In this case, after the recess 111 is provided, the first spacer 3a and the second spacer 3b are disposed at the top of the beam 112. Then, it is necessary to adjust arrangement positions of the first machine beam 2a, the second ma-

chine beam 2b, and the rope end beam 2c with respect to arrangement positions of the first spacer 3a and the second spacer 3b. Even when the recess 111 is not provided, the arrangement positions of the first spacer 3a and the second spacer 3b and the arrangement positions of the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c with respect to those of the first spacer 3a and the second spacer 3b are adjusted on site in accordance with dimensions of the building. Therefore, when the hoistway top structure 30 is installed, a process of cutting the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c in accordance with the dimensions of the building may be required.

[0040] Fig. 6 is an exploded perspective view of a main part of the hoistway top structure 30. Fig. 6 illustrates the first spacer 3a, and the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c fixed to the upper flange part 12 of the first spacer 3a. Hereinafter, the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c are collectively referred to as the supporting beam 2.

[0041] In the present embodiment, among the bolt holes for fixing to the first spacer 3a and the second spacer 3b in the supporting beam 2, at least the bolt hole on the side fixed to the first spacer 3a (one side in the present invention) is configured by the plurality of elliptical beam holes 40. Furthermore, among the first spacer 3a and the second spacer 3b, the bolt hole of the first spacer 3a corresponding to the elliptical beam hole 40 of the supporting beam 2 is formed of the elliptical spacer holes 50. As a result, even when an end part on one side of the supporting beam 2 where the plurality of elliptical beam holes 40 is provided is cut for dimensional adjustment, the elliptical beam hole 40 that is not divided can be used for bolt fastening (see Fig. 9).

[0042] Note that, in the present embodiment, although not illustrated, in the supporting beam 2, a bolt hole on another side to be fixed to the second spacer 3b and a bolt hole of the second spacer 3b provided at a position overlapping with the bolt hole are constituted by a round hole having a perfect circular shape used for normal bolt fastening.

[0043] Hereinafter, detailed configurations of the elliptical beam hole 40 provided in the supporting beam 2 and the elliptical spacer hole 50 provided in the first spacer 3a will be described. Note that, since the configurations of the elliptical beam holes 40 in the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c are the same, the elliptical beam hole 40 of the first machine beam 2a will be representatively described below.

[0044] Fig. 7 is a diagram of the first machine beam 2a as viewed from a lower part in the lateral direction. The lower flange part 5 of the first machine beam 2a has a first flange piece 5a and a second flange piece 5b. The first flange piece 5a is formed so as to protrude to one side from the connection part 7 provided at the center of

the lower flange part 5 in the width direction. The second flange piece 5b is formed to protrude from the connection part 7 to another side.

[0045] As illustrated in Fig. 7, the elliptical beam hole 40 is provided on one side in a direction along the longitudinal direction of the first machine beam 2a, and is constituted by an elliptical hole elongated in the longitudinal direction of the first machine beam 2a. Further, the elliptical beam hole 40 is provided in the first flange piece 5a and the second flange piece 5b of the first machine beam 2a symmetrically with respect to the connection part 7. Furthermore, the plurality of (two in Fig. 7) elliptical beam holes 40 is provided at a predetermined distance W_2 in the direction along the longitudinal direction of the first machine beam 2a. Here, the distance W_2 between the plurality of elliptical beam holes 40 arranged in the direction along the longitudinal direction of the first machine beam 2a is secured to be equal to or longer than a distance necessary for strength. Further, a length W_1 of the elliptical beam hole 40 in the longitudinal direction of the first machine beam 2a will be described later.

[0046] Fig. 8 is a diagram of the first spacer 3a as viewed from an upper part in the lateral direction. The upper flange part 12 of the first spacer 3a includes a first flange piece 12a and a second flange piece 12b. The first flange piece 12a is formed to protrude from the connection part 13 provided at the center of the upper flange part 12 in the width direction toward a side where the hoist 100 is installed. The second flange piece 12b is formed to protrude to a side opposite to the side where the hoist 100 is installed.

[0047] The elliptical spacer hole 50 is provided in the first flange piece 12a of the upper flange part 12 on the hoist 100 side, and is configured by an elliptical hole elongated in the width direction of the upper flange part 12. In addition, the plurality of elliptical spacer holes 50 is provided along the longitudinal direction of the first spacer 3a so as to correspond to the elliptical beam holes 40 provided in the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c arranged at the top.

[0048] Here, a length W_3 of the elliptical spacer hole 50 in the width direction of the first spacer 3a is configured to be equal to or more than $W_3 = 2W_5 + W_2$, where W_5 is a diameter of a bolt inserted when the first spacer 3a and the supporting beam 2 are fixed. In addition, it suffices if the length W_3 of the elliptical spacer hole 50 is smaller than a width of the first flange piece 12a in the width direction and is equal to or smaller than a width that can secure strength of the first flange piece 12a.

[0049] On the other hand, as illustrated in Fig. 7, the length W_1 of the elliptical beam hole 40 in the longitudinal direction of the first machine beam 2a is configured to be longer than the diameter W_5 of the bolt and smaller than $W_5 + W_4$. Here, as illustrated in Fig. 8, a length W_4 is a distance from an end part of the first spacer 3a on another side opposite to one side where the supporting beam 2 extends to an end part of the elliptical spacer hole 50 on

another side. Further, the length W_1 of the elliptical beam hole 40 is configured to be more preferably smaller than $W_5 + W_4 - W_2$.

[0050] Note that a width of the elliptical beam hole 40 in the width direction of the first machine beam 2a and a width of the elliptical spacer hole 50 in the longitudinal direction of the first spacer 3a are set to widths through which a bolt to be used can be inserted.

[0051] Fig. 9 is a perspective view of a main part when the end part on one side of the first machine beam 2a is fixed to the first spacer 3a after the end part on one side of the first machine beam 2a is cut. In the present embodiment, in the first machine beam 2a, the plurality of elliptical beam holes 40 is provided at the end part on one side fixed to the first spacer 3a. As a result, even when the elliptical beam hole 40 on the end side is divided along with the cutting of the first machine beam 2a, it is possible to fasten the first spacer 3a with a bolt using the undivided elliptical beam hole 40 provided on the other side of the divided elliptical beam hole 40.

[0052] Meanwhile, in a case where the bolt hole of the first spacer 3a is configured by a round hole having a perfect circular shape, a situation in which the bolt hole of the first spacer 3a exists between the two adjacent elliptical beam holes 40 of the supporting beam 2 occurs after adjustment of a fixing position of the supporting beam 2. In this case, the first spacer 3a and the supporting beam 2 cannot be bolted at appropriate positions. On the other hand, in the present embodiment, by setting the length W_3 of the elliptical spacer hole 50 to $2W_5 + W_2$ or more, it is possible to reliably fasten the supporting beam 2 and the first spacer 3a with the bolt after adjusting the fixing position of the supporting beam 2.

[0053] Further, in the present embodiment, by making the length W_1 of the elliptical beam hole 40 of the supporting beam 2 smaller than $W_5 + W_4$, even when the supporting beam 2 is cut, the elliptical beam hole 40 that is not divided can be used for bolt fastening. Furthermore, more preferably, by making the length W_1 of the elliptical beam hole 40 smaller than $W_5 + W_4 - W_2$, even when the supporting beam 2 is cut, the elliptical beam hole 40 that is not divided can be used for bolt fastening while maintaining strength of the supporting beam 2.

[0054] In the present embodiment, it is possible to fasten each supporting beam 2 and the first spacer 3a with a bolt at any position as long as the position is within a range from the end part on one side in the longitudinal direction of each supporting beam 2 to the elliptical beam hole 40 arranged on the most other side in the longitudinal direction. Therefore, the length of each supporting beam 2 can flexibly correspond to a dimensional error caused by the arrangement positions of the first spacer 3a and the second spacer 3b.

[0055] Note that, in the first machine beam 2a, in an initial state before cutting, a length W_6 of an interval from an end part on the first spacer 3a side in the longitudinal direction to an end part on the first spacer 3a side of the elliptical beam hole 40 is preferably $W_4 + W_5 - W_5$. As a

result, when the supporting beam 2 is not cut, the bolt fastening can be performed in a state where the end part on one side in the longitudinal direction of the supporting beam 2 and the end part on one side in the width direction of the first spacer 3a are aligned in the vertical direction.

4. Method for Installing Hoistway Top Structure

[0056] Next, an example of a method for installing the hoistway top structure 30 of the present embodiment will be described. First, arrangement positions of the first spacer 3a and the second spacer 3b are determined in the machine room 190. For example, the first spacer 3a and the second spacer 3b are adjusted to be arranged at the top of the beam 112 of the building, and if necessary, the wall surface 180 of the hoistway 110 is dug to form the recess 111.

[0057] Next, a length in the longitudinal direction of each supporting beam 2 is determined. In this case, as illustrated in Fig. 5, a length L from an end part in the width direction of the first spacer 3a on a side opposite to the second spacer 3b side to an end part in the width direction of the second spacer 3b on a side opposite to the first spacer 3a side is the length in the longitudinal direction of each supporting beam 2. Therefore, each supporting beam 2 is cut so that the length of each supporting beam 2 is the length L. For example, when a length in the longitudinal direction of the first machine beam 2a is adjusted, an end part on one side where the elliptical beam holes 40 are provided in the longitudinal direction of the first machine beam 2a is cut. Similarly, when a length in the longitudinal direction of the second machine beam 2b or the rope end beam 2c is adjusted, an end part on one side where the elliptical beam holes 40 are provided in the longitudinal direction is cut.

[0058] Here, a cuttable dimension (adjustment allowance) of the supporting beam 2 is a dimension from an end part on one side of the supporting beam 2 to a position where the elliptical beam hole 40 provided on the most other side is not divided. As a result, at least the elliptical beam hole 40 provided on the most other side of the supporting beam 2 can be maintained in an undivided state. For this reason, in the supporting beam 2, the plurality of elliptical beam holes 40 is provided according to a necessary adjustment allowance in advance.

[0059] After each supporting beam 2 is cut, each of the supporting beams 2 is arranged on the first spacer 3a and the second spacer 3b to adjust a fixing position. At this time, each supporting beam 2 is arranged such that the end part on one side where the elliptical beam holes 40 are provided overlaps the top of the first spacer 3a.

[0060] In the present embodiment, the length in the longitudinal direction of each supporting beam 2 is set to the length L from the end part in the width direction of the first spacer 3a on the side opposite to the second spacer 3b side to the end part in the width direction of the second spacer 3b on the side opposite to the first spacer 3a side. Therefore, both end parts in the longitu-

dinal direction of each supporting beam 2 are arranged so as to be aligned in the vertical direction with the end parts in the width direction of the first spacer 3a and the second spacer 3b on the side opposite to the side on which the hoist 100 is provided.

[0061] As illustrated in Fig. 9, even when the elliptical beam hole 40 on the end side in the longitudinal direction is divided by cutting each supporting beam 2, the elliptical beam hole 40 which is not divided overlaps the elliptical spacer hole 50 in a state where a position where the elliptical spacer hole can be bolted is maintained. At this position, the bolt 17 is passed through the elliptical spacer hole 50 provided in the first spacer 3a and the elliptical beam hole 40 located at the top of the elliptical spacer hole via a washer 18, and a lower portion of the bolt 17 is fastened with a nut (not illustrated). As a result, each supporting beam 2 can be fixed to the first spacer 3a.

[0062] On the other hand, since the end part in the longitudinal direction of each supporting beam 2 on the side opposite to the side on which the elliptical beam holes 40 are provided is not cut in the present embodiment, a relative positional relationship with the second spacer 3b does not change from a design stage. Therefore, for the bolt hole of each supporting beam 2 for fixing to the second spacer 3b and the bolt hole of the second spacer 3b for fixing to each supporting beam 2, a generally applied perfect circular bolt hole (round hole) can be used. Therefore, on the second spacer 3b side, it is possible to fasten each supporting beam 2 with a bolt using the perfect circular bolt hole.

[0063] Incidentally, even when only one elliptical beam hole 40 is formed in each supporting beam 2 in the longitudinal direction of the supporting beam 2, the fixing position between each supporting beam 2 and the first spacer 3a can be adjusted according to the length of the elliptical beam hole 40. However, in this case, when the supporting beam 2 is cut in accordance with the length L determined by the arrangement positions of the first spacer 3a and the second spacer 3b, the elliptical beam hole 40 may also be divided. Even if the supporting beam 2 can be bolted to the first spacer 3a using the divided elliptical beam hole 40, when the hoist support base 60 is displaced in a horizontal direction due to an earthquake or the like, an end part of the elliptical beam hole 40 cannot receive the displacement of the bolt in a shearing direction. Then, there is a problem that the hoist 100 falls.

[0064] On the other hand, in the present embodiment, the plurality of elliptical beam holes 40 for bolting each supporting beam 2 to the first spacer 3a is provided in the longitudinal direction. Therefore, after the fixing positions of each supporting beam 2 and the first spacers 3a are adjusted, bolt fastening can be performed using the elliptical beam hole 40 that is not divided. Therefore, even when a horizontal force is generated in the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c due to an earthquake or the like, the bolt abuts on the end part of the elliptical beam hole 40. As a result, it is possible to stop the displacement of the

first machine beam 2a, the second machine beam 2b, and the rope end beam 2c.

[0065] In the present embodiment, an example has been described in which the bolt hole formed in the first spacer 3a is an elliptical hole (elliptical spacer hole 50), and the bolt hole provided on the side of each supporting beam 2 fixed to the first spacer 3a is an elliptical hole (elliptical beam hole 40). However, the present invention is not limited thereto. For example, the elliptical spacer hole 50 of the present embodiment may be provided in the second spacer 3b, and the elliptical beam hole 40 of the present embodiment may be provided at the end part on the other side fixed to the second spacer 3b in the longitudinal direction of each supporting beam 2. Also in this case, when the length in the longitudinal direction of each supporting beam 2 is adjusted, it suffices if the end part on the other side where the elliptical beam holes 40 are provided is cut.

[0066] Furthermore, the first spacer 3a and the second spacer 3b may be provided with the elliptical spacer holes 50 of the present embodiment, and the plurality of elliptical beam holes 40 of the present embodiment may be provided at both end parts in the longitudinal direction of each supporting beam 2. In this case, since both end parts in the longitudinal direction of each supporting beam 2 can be cut for length adjustment, a larger adjustment allowance can be secured as compared with the present embodiment.

5. Second Embodiment

[0067] Next, a hoistway top structure 200 according to a second embodiment of the present invention will be described. Fig. 10 is a schematic configuration diagram of the hoistway top structure 200 according to the second embodiment. In Fig. 10, portions corresponding to those in Fig. 5 are denoted by the same reference numerals, and redundant description is omitted.

[0068] In the hoistway top structure 200 according to the second embodiment, the first spacer 3a is fixed to the top of a first auxiliary spacer 3c via a spacer vibration-proof member 51, and the second spacer 3b is fixed to the top of a second auxiliary spacer 3d via the spacer vibration-proof member 51.

[0069] The first auxiliary spacer 3c and the second auxiliary spacer 3d are made of the same H-shaped steel as the first spacer 3a and the second spacer 3b, respectively. Further, lengths in the longitudinal direction, the lateral direction, and the width direction of the first auxiliary spacer 3c and the second auxiliary spacer 3d are equal to the lengths of the first spacer 3a and the second spacer 3b, respectively.

[0070] Each of the first auxiliary spacer 3c and the second auxiliary spacer 3d is fixed to a floor surface in the machine room 190 by a bolt (not illustrated), and the spacer vibration-proof member 51 is fixed to the top in the vertical direction by a bolt. Further, the first spacer 3a and the second spacer 3b are fixed by bolts to the top

in the vertical direction of the spacer vibration-proof member 51 fixed to the top in the vertical direction of the first auxiliary spacer 3c and the second auxiliary spacer 3d, respectively.

[0071] In the present embodiment, the first spacer 3a and the second spacer 3b are fixed to the top of the first auxiliary spacer 3c and the second auxiliary spacer 3d, respectively, with the spacer vibration-proof member 51 interposed therebetween. Therefore, vibration transmitted to each supporting beam 2 and vibration related to the hoist 100 can be reduced. In addition, since the configuration is similar to that of the first embodiment, similar effects can be obtained.

[0072] Incidentally, in the first embodiment and the second embodiment, the first spacer 3a and the second spacer 3b are formed of members extending from the first machine beam 2a to the rope end beam 2c in the width direction of each supporting beam 2. However, a pair of spacers may be provided for each supporting beam 2. That is, in this case, a total of six spacers are arranged in order to arrange the first machine beam 2a, the second machine beam 2b, and the rope end beam 2c.

[0073] Even in a case where the pair of spacers is provided for each supporting beam 2, the plurality of elliptical beam holes 40 illustrated in Fig. 7 is provided at an end part on a cut side in the longitudinal direction of each supporting beam 2. Further, the elliptical spacer hole 50 illustrated in Fig. 8 is provided in one of the pair of spacers to which the end part on the cut side in the longitudinal direction of each supporting beam 2 is fixed. As a result, effects similar to those of the first embodiment can be obtained.

[0074] Further, in the embodiments described above, the first spacer 3a, the second spacer 3b, and each supporting beam 2 are formed of the H-shaped steel having the H-shaped cross section, but the present invention is not limited thereto. For example, it may be configured by a member having a U-shaped cross section including a pair of rectangular flange parts extending in one direction and a connection part connecting the pair of flange parts at end parts in the width direction orthogonal to the longitudinal direction of the pair of flange parts. In addition, various shapes can be applied.

[0075] Further, in the above-described embodiments, the beam hole in the present invention is configured by the elliptical beam hole elongated in the direction along the longitudinal direction of the supporting beam, but the present invention is not limited thereto. The bolt hole (beam hole) provided on the supporting beam side may be configured by a normal perfect circle, and even in this case, the same effects as those of the above-described embodiments can be obtained.

[0076] The above-described embodiments have been described in detail in order to describe the present invention in an easy-to-understand manner, and are not necessarily limited to those having all the described configurations. For example, a part of the configuration of the embodiment can be replaced with another configuration,

and another configuration can be added to the configuration of the embodiment. In addition, it is possible to add, delete, and replace another configuration for a part of the configuration of the embodiment.

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Reference Signs List

[0077]

10	1	elevator
	2	supporting beam
	2a	first machine beam
	2b	second machine beam
	2c	rope end beam
15	3a	first spacer
	3b	second spacer
	5	lower flange part
	5a	first flange piece
	5b	second flange piece
20	6	upper flange part
	7	connection part
	11	lower flange part
	12	upper flange part
	12a	first flange piece
25	12b	second flange piece
	13	connection part
	15	lower flange part
	16	upper flange part
	17	bolt
30	18	washer
	20	rope support mechanism
	21	support plate
	30	hoistway top structure
	40	elliptical beam hole
35	41	vibration-proof member
	45	bolt
	50	elliptical spacer hole
	51	spacer vibration-proof member
	60	hoist support base
40	100	hoist
	101	sheave
	102	drive unit
	103	base part
	110	hoistway
45	111	recess
	112	beam
	121	on-car pulley
	130	main rope
	131	rope adjustment unit
50	132	thimble rod
	133	spring member
	134	nut
	135	through hole
	141	weight-side pulley
55	161	floor surface
	180	inner wall surface
	190	machine room
	200	hoistway top structure

Claims

1. A hoistway top structure comprising:

at least a pair of spacers disposed on a floor surface of a machine room at a hoistway top; and a supporting beam disposed such that both end parts in a longitudinal direction are fixed to respective tops of the pair of spacers, wherein an elliptical spacer hole, which is longer in a direction along the longitudinal direction of the supporting beam, is provided on an upper surface of at least one spacer of the pair of spacers at the supporting beam side, in the supporting beam, a plurality of beam holes is provided along the longitudinal direction of the supporting beam at an end part on a side disposed on the top of the at least one spacer, and the one spacer and the end part in the longitudinal direction of the supporting beam arranged at the top of the one spacer are fixed with a bolt that passes through the elliptical spacer hole and the beam hole provided at an upper position overlapping the elliptical spacer hole.

2. The hoistway top structure according to claim 1, wherein

the beam hole is configured by an elliptical hole elongated in the direction along the longitudinal direction of the supporting beam.

3. The hoistway top structure according to claim 1, wherein

a length of the elliptical spacer hole in the longitudinal direction of the supporting beam is set to be larger than $2W_5 + W_2$, where W_5 is a diameter of the bolt, and W_2 is a distance between the adjacent beam holes provided in the longitudinal direction of the supporting beam.

4. The hoistway top structure according to any one of claims 1 to 3, wherein

a length of the beam hole in the longitudinal direction of the supporting beam is set to be smaller than $W_5 + W_4$, where W_5 is a diameter of the bolt, and W_4 is a distance from an end part on another side opposite to one side where the supporting beam extends to an end part of the elliptical spacer hole on another side of the one spacer in the direction along the longitudinal direction of the supporting beam.

5. The hoistway top structure according to any one of claims 1 to 3, wherein

a length of the beam hole in the longitudinal direction of the supporting beam is set to be smaller than $W_5 + W_4 - W_2$, where W_5 is a diameter of the bolt, W_2 is a distance between the adjacent beam holes provided in the longitudinal direction of the supporting

beam, and W_4 is a distance from an end part on another side opposite to one side where the supporting beam extends to an end part of the elliptical spacer hole on another side.

6. The hoistway top structure according to claim 1, wherein

the supporting beam constitutes a hoist support base that supports a hoist.

7. The hoistway top structure according to claim 1, wherein

the plurality of the supporting beams is arranged in parallel in the longitudinal direction of the supporting beam, and the plurality of supporting beams constitutes a hoist support base that supports a hoist and a rope support mechanism that supports end parts of a main rope wound around the hoist.

8. A method for installing a hoistway top structure, comprising:

preparing a supporting beam in which a plurality of beam holes is provided at an end part on at least one side in a longitudinal direction; preparing a pair of spacers in which an elliptical spacer hole, which is longer in a direction along the longitudinal direction of the supporting beam, is provided on an upper surface at the supporting beam side of at least one spacer of the pair of spacers; arranging the pair of spacers at predetermined positions on a floor surface at a hoistway top; adjusting an arrangement position of the supporting beam according to an interval between the pair of spacers, arranging an end part on one side where the beam holes of the supporting beam are provided at a top of the one spacer where the elliptical spacer hole is provided, and arranging an end part on another side of the supporting beam at a top of another spacer; and inserting a bolt into the elliptical spacer hole and the beam hole and fixing with a nut.

9. The method for installing the hoistway top structure according to claim 8, wherein

in the adjustment of the arrangement position of the supporting beam, the end part of the supporting beam on the side where the beam holes are provided is cut according to the interval between the pair of spacers, and a position of the cutting is a position closer to one side than a beam hole provided on a most other side from the end part on one side of the supporting beam.

10. An elevator comprising: a hoistway top structure, including

at least a pair of spacers disposed on a floor surface of a machine room at a hoistway top, and a supporting beam disposed such that both end parts in a longitudinal direction are fixed to respective tops of the pair of spacers, wherein an elliptical spacer hole, which is longer in a direction along the longitudinal direction of the supporting beam, is provided on an upper surface of at least one spacer of the pair of spacers at the supporting beam side, in the supporting beam, a plurality of beam holes is provided along the longitudinal direction at an end part on a side disposed on the top of the at least one spacer, and the one spacer and the end part in the longitudinal direction of the supporting beam arranged at the top of the one spacer are fixed with a bolt that passes through the elliptical spacer hole and the beam hole provided at an upper position overlapping the elliptical spacer hole.

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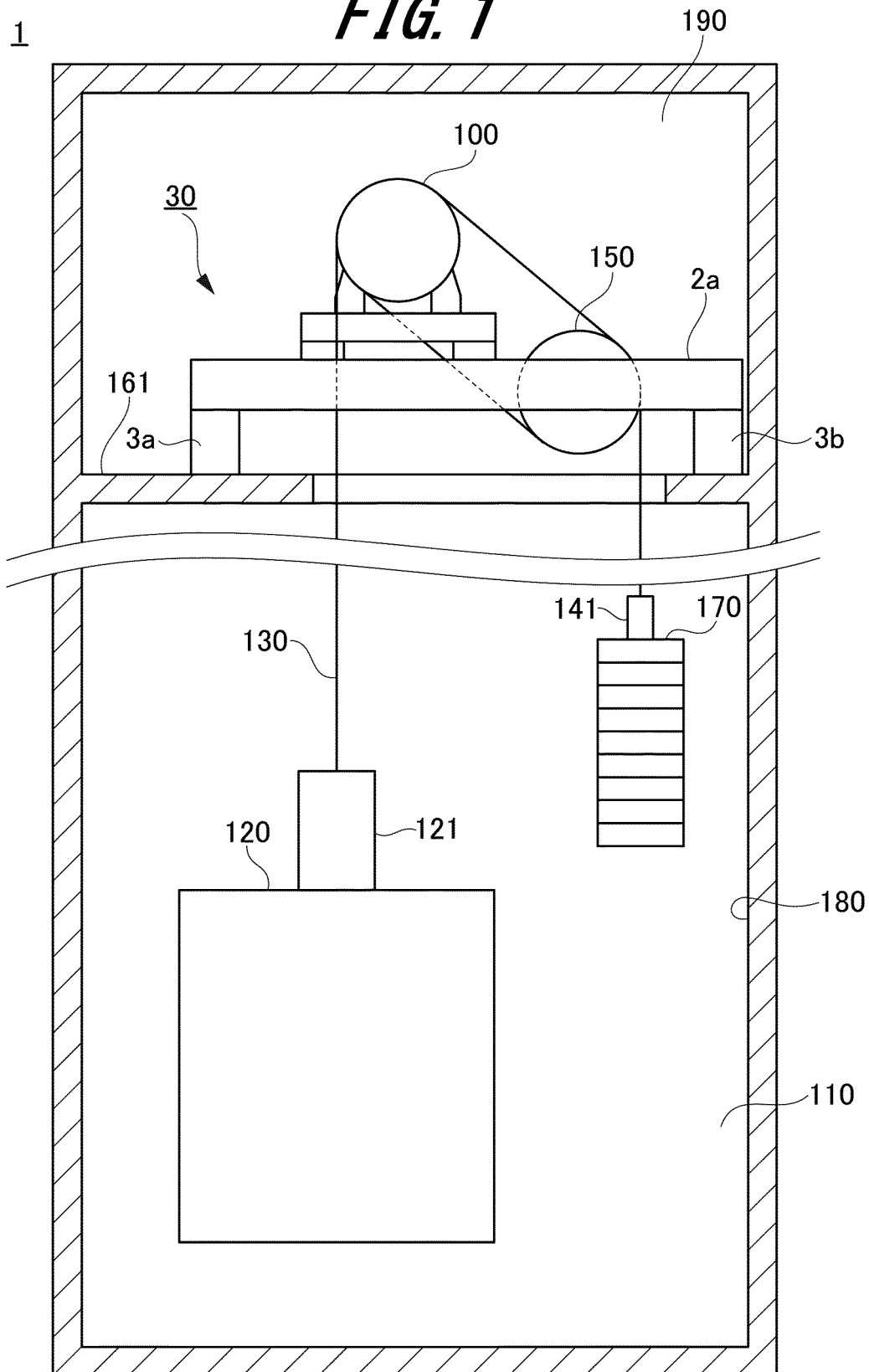
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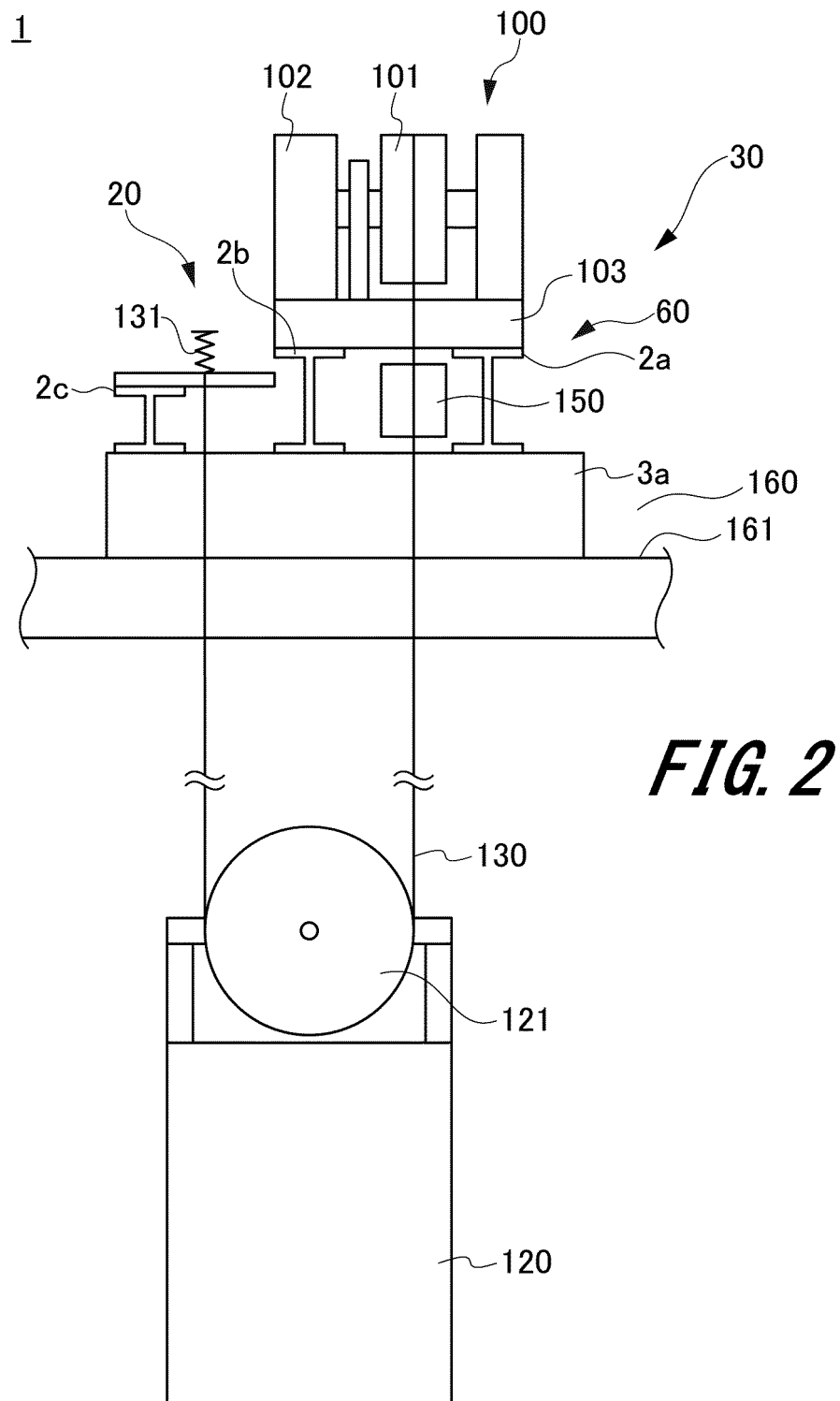
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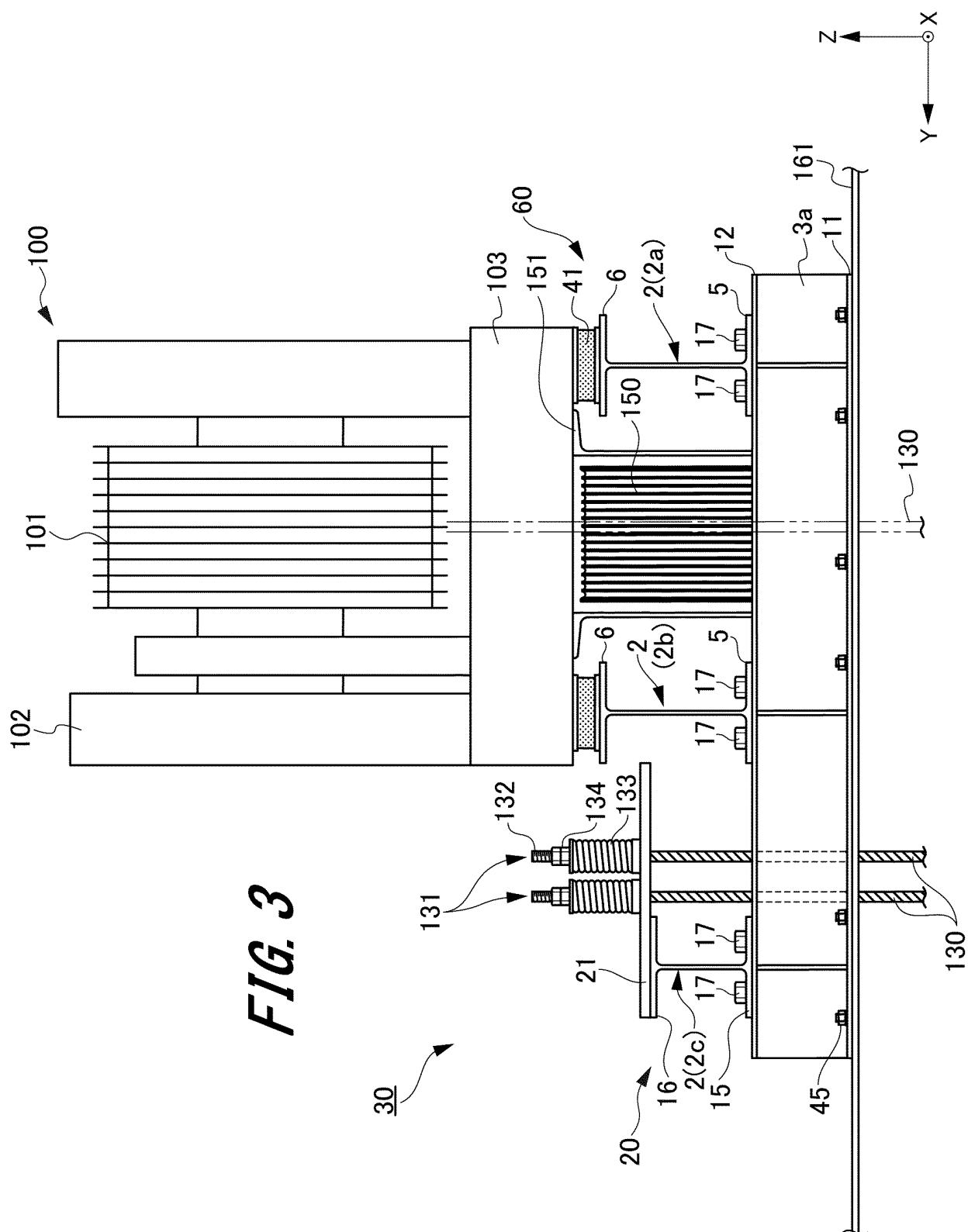
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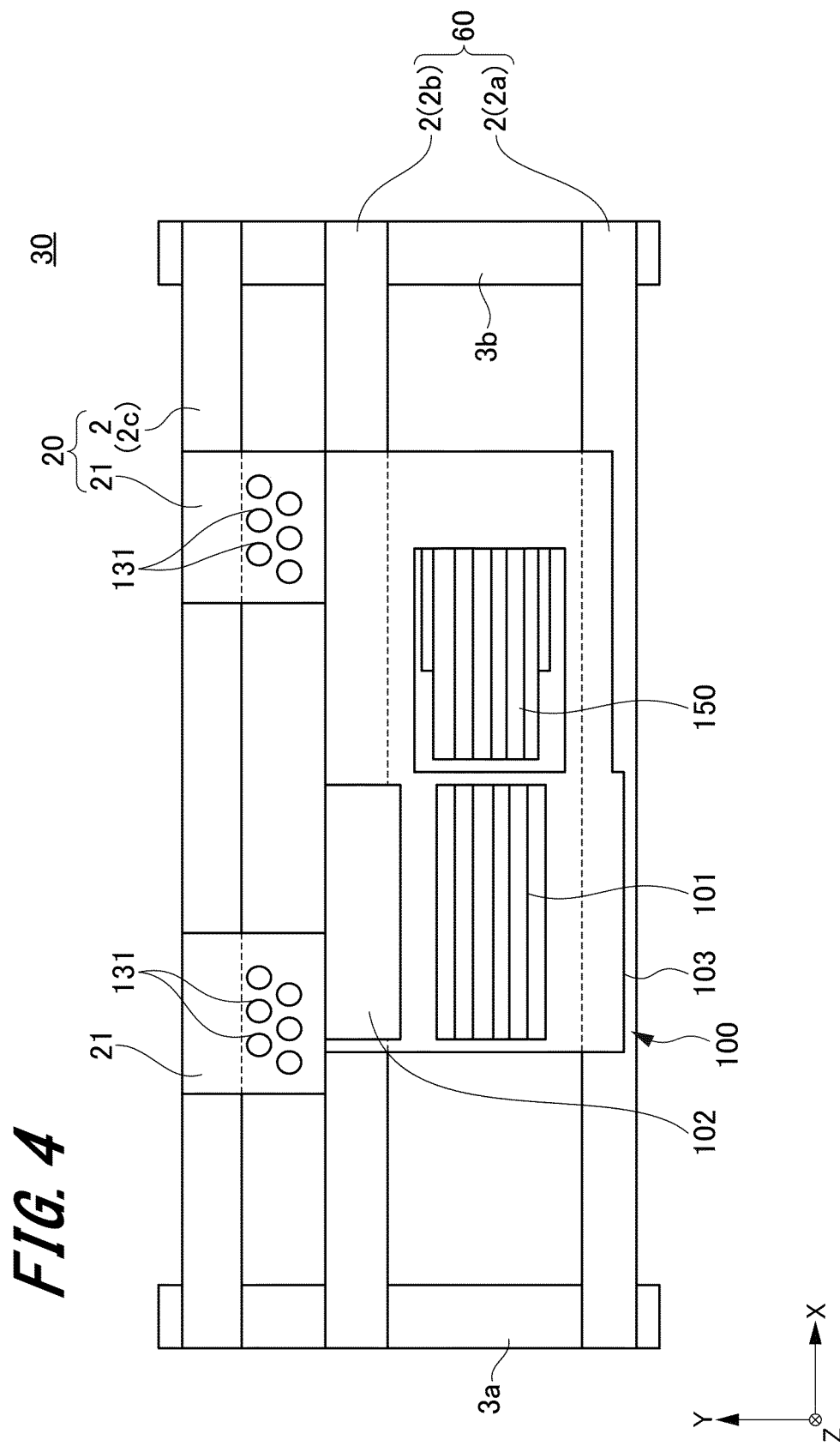
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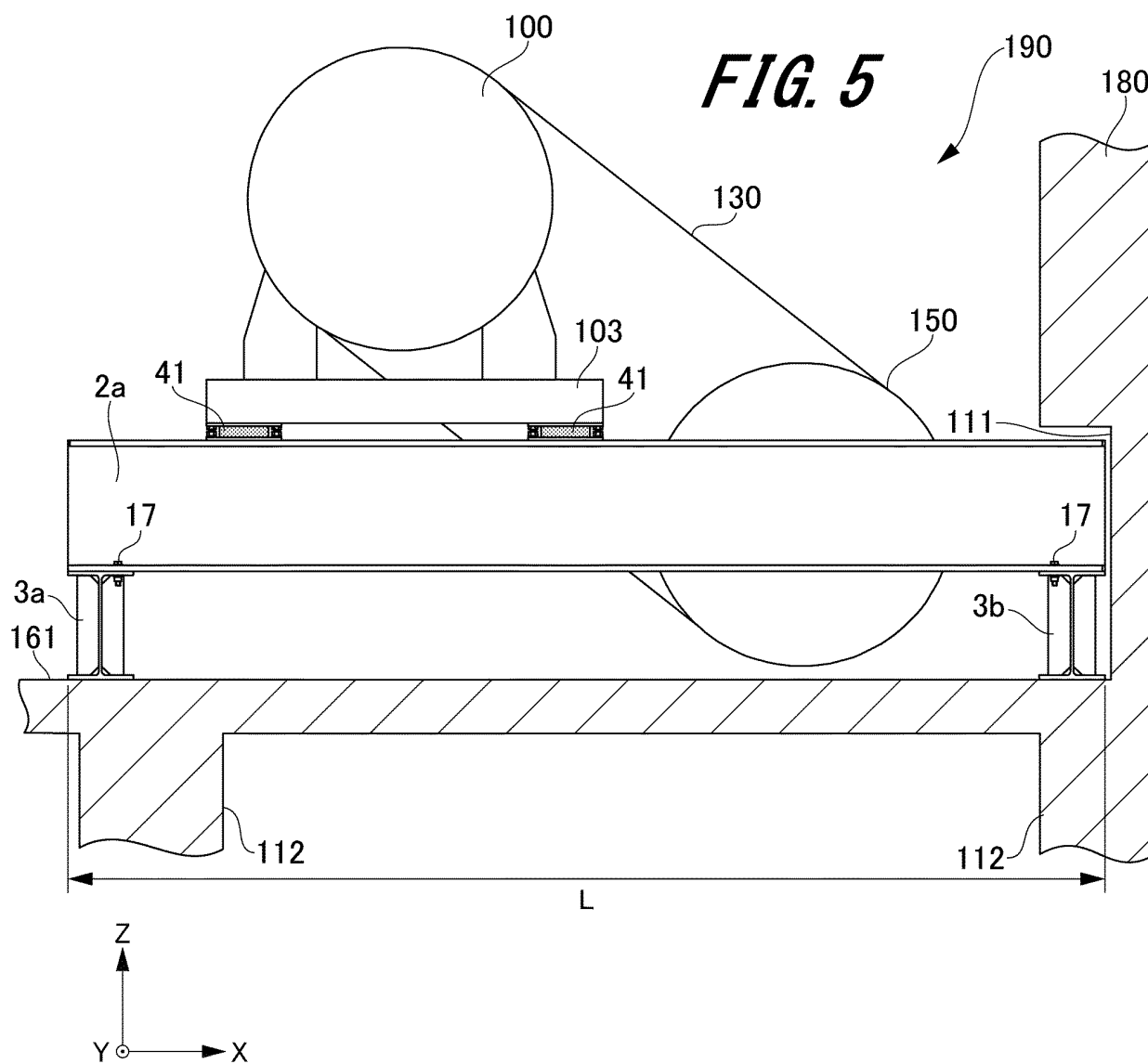
FIG. 1

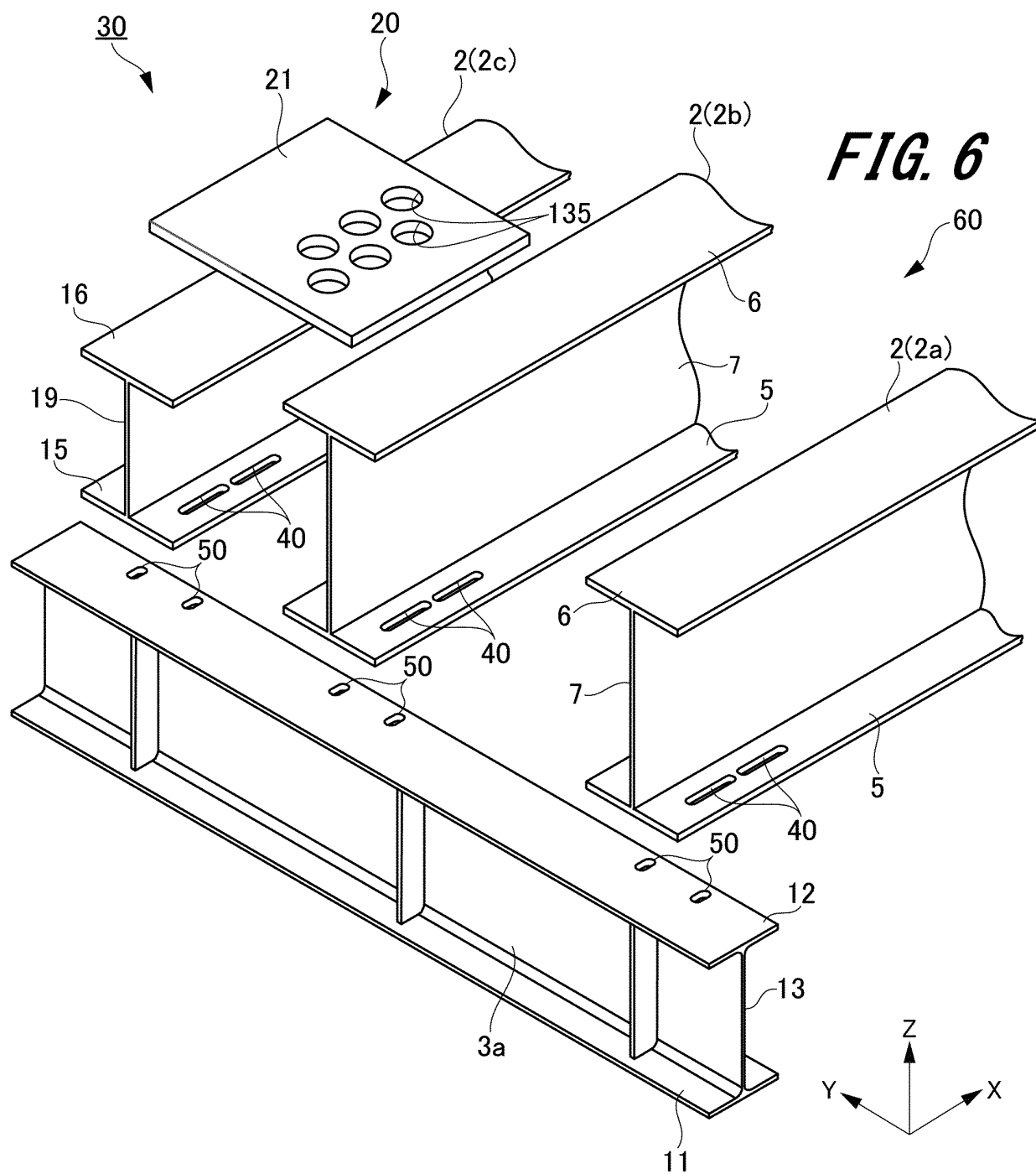


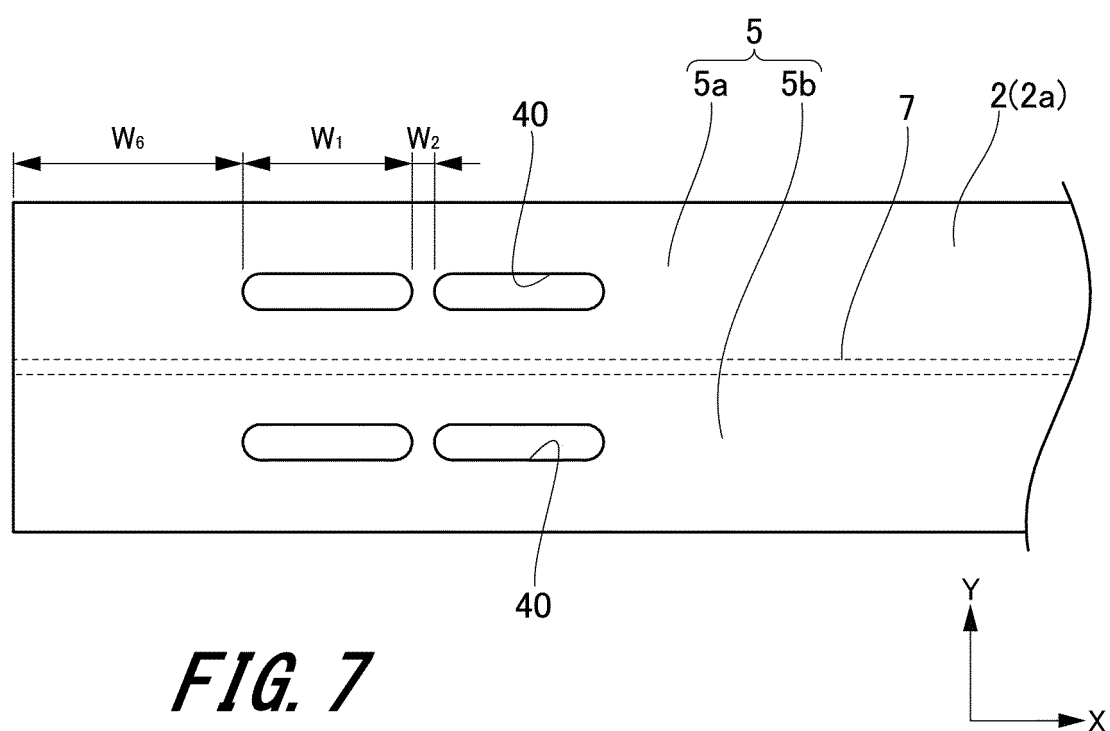


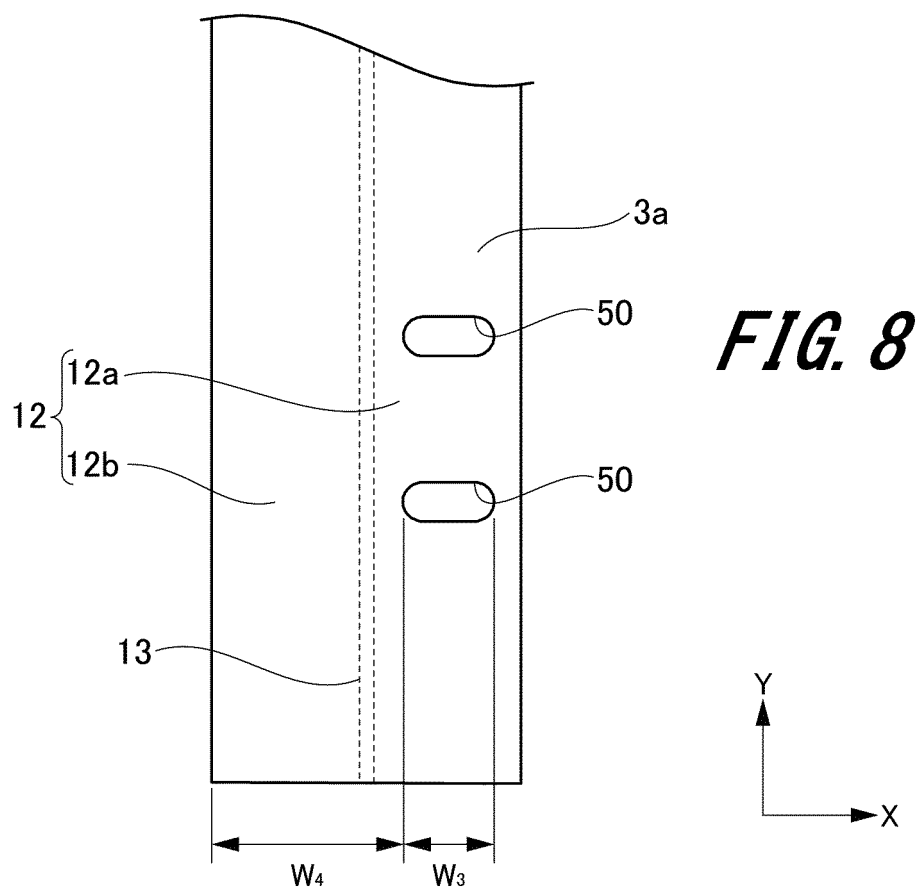


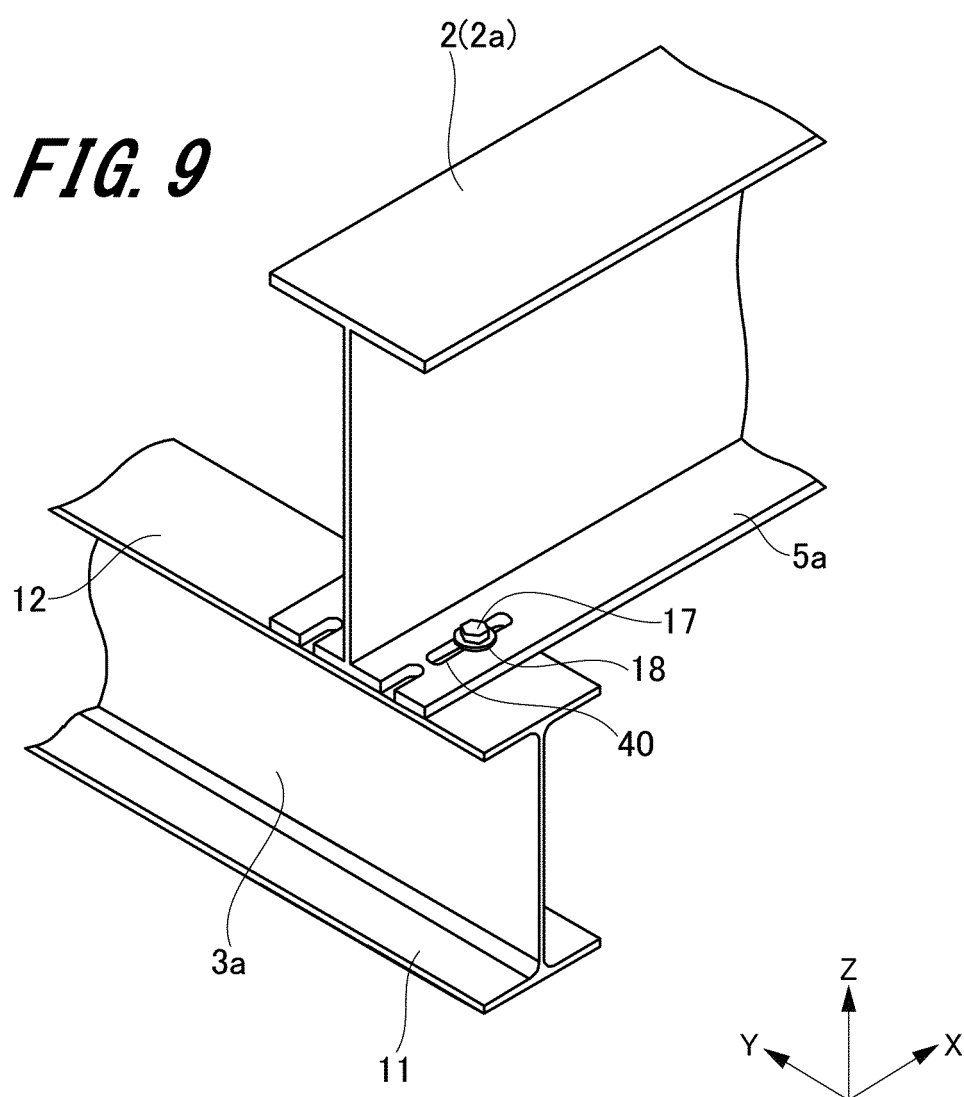


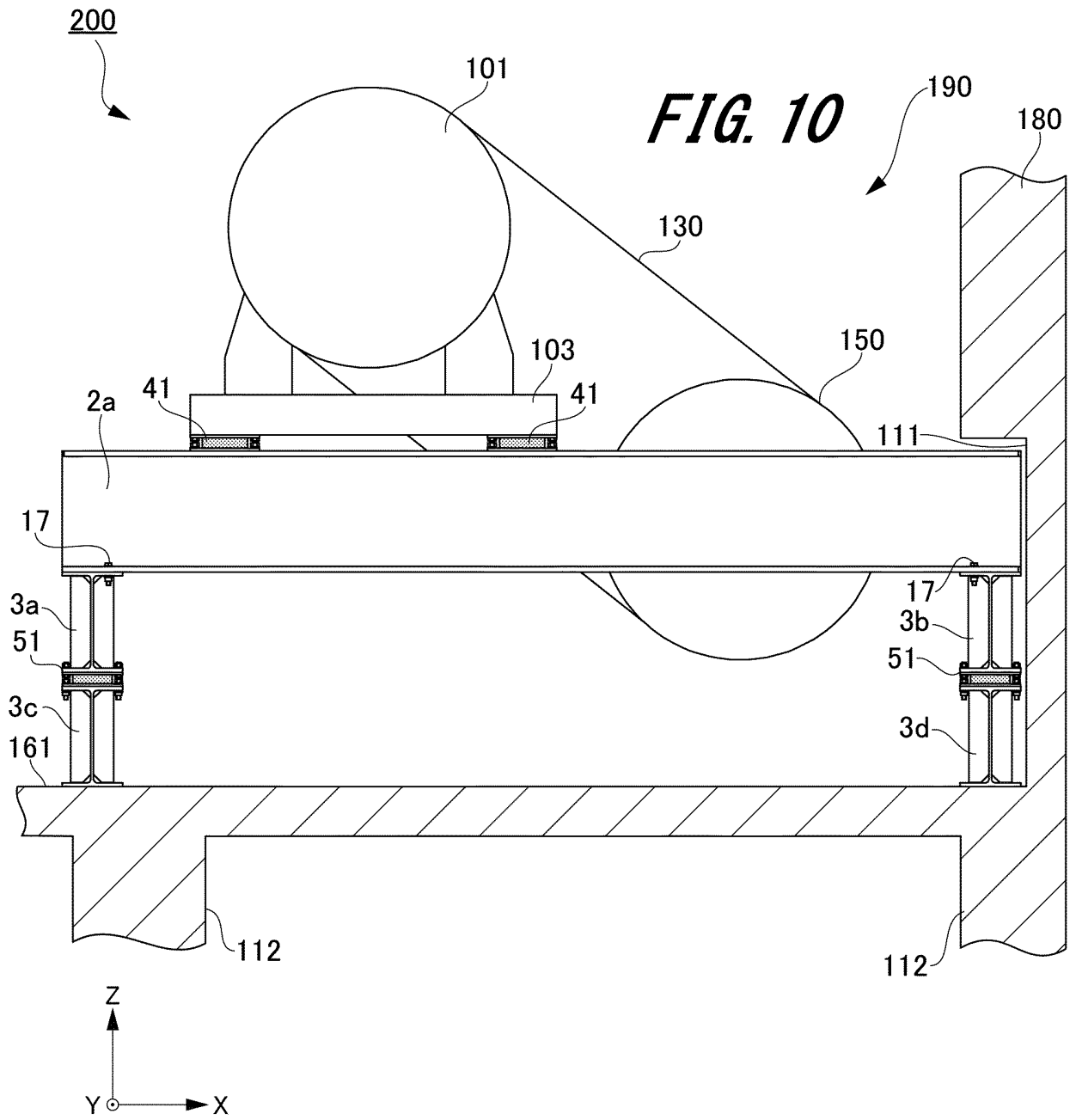












INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/031111

5	A. CLASSIFICATION OF SUBJECT MATTER B66B 11/04 (2006.01)i FI: B66B11/04 B According to International Patent Classification (IPC) or to both national classification and IPC		
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B66B11/04 ;B66B7/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2021 Registered utility model specifications of Japan 1996-2021 Published registered utility model applications of Japan 1994-2021 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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35	☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
40	* 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		
50	Date of the actual completion of the international search 27 October 2021		Date of mailing of the international search report 09 November 2021
55	Name and mailing address of the ISA/JP Japan Patent Office (ISA/JP) 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915 Japan		Authorized officer Telephone No.

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