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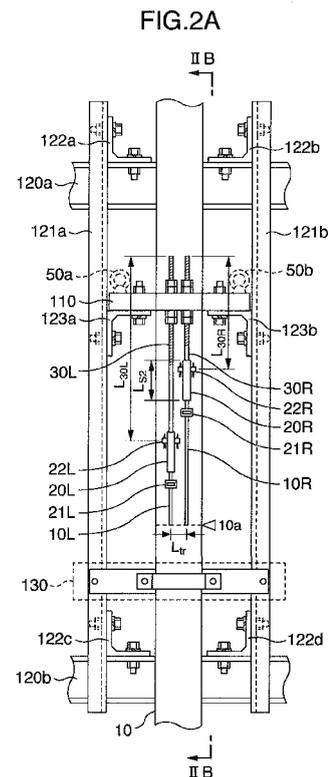
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(54) Suspending apparatus of traveling cable for elevator and elevator apparatus

(57) In a suspending apparatus of traveling cable for elevator, in order to realize a small and reliable suspending apparatus even for an elevator with a large stroke, the traveling cable (10) is configured to feed power to a car and exchange signals with the car. The traveling cable (10) includes a plurality of suspending wire ropes (10L, 10R) embedded therein. Each of the suspending wire ropes (10L, 10R) is incorporated into one of rope sockets (20L, 20R), respectively, and each of the rope sockets (20L, 20R) incorporating the suspending wire rope is fastened to one of thimble rods (30L, 30R), respectively, so that one end of the traveling cable is suspended from a hoistway side suspension apparatus (100) and the other end of the traveling cable is suspended from a car side suspending apparatus (200). The thimble rods (30L, 30R) is configured to have a different length from each other so as not to cause interference between the rope sockets (20L, 20R) to which a plurality of suspending wire ropes (10L, 10R) are attached. The suspending apparatus includes a traveling cable sway prevention mechanism (130) provided below a drawing point (10a) of the suspending wire ropes to suppress bending stress applied to the thimble rods due to rolling of the traveling cable.



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Description

Background of the invention

5 (1) Field of the invention

[0001] The present invention relates to a suspending apparatus of a traveling cable for an elevator and more particularly relates to a suspending apparatus of a traveling cable suitable for an elevator with a large stroke and such an elevator apparatus.

10 (2) Description of related art

[0002] An elevator is configured to feed power to and exchange signals with a car via a traveling cable suspended between the car and a midpoint of a hoistway.

15 **[0003]** Fig. 9 illustrates an exemplary structure of such a traveling cable. A traveling cable 10 in this drawing is configured so that a plurality of bundles of electric wires 10a is surrounded with a sheath (coating) 10b, each electric wire 10a including a conductor made of copper for power feeding and signal transmission and covered with an insulator. For large-stroke purpose, a plurality of suspending wire ropes, in the illustrated example two suspending wire ropes 10L and 10R, are embedded in the traveling cable for suspension thereof.

20 **[0004]** Fig. 10A and Fig. 10B illustrate an exemplary overall configuration for power-feeding to a car using such a traveling cable. Fig. 10A illustrates the case where the car is positioned at a bottom floor and Fig. 10B illustrates the case where the car is positioned at a top floor. In Figs. 10A and 10B, power feeding to a car 11 is performed to a car-side power-feeding device 13 from an elevator controller 12 provided in a machine room on top of a hoistway to control an elevator via the traveling cable 10 at a movable part in tandem with the travelling of the car and via the traveling cable or via a general cable at a fixed part not moving.

25 **[0005]** Next, positions for suspending of such a traveling cable 10 are described below. In Fig. 10A and Fig. 10B, a distance between the bottom floor and the top floor for elevator traveling is called a hoisting stroke (H_1) of the elevator. One end of the traveling cable 10 is suspended by a suspension mechanism 500 on the hoistway side located above a midpoint of the hoisting stroke at a position of H_2 ($\cong H_1/2$) from the bottom floor level, and the other end is suspended, using the two suspending wire ropes 10L and 10R, by a suspension mechanism 600 on the car side provided at the bottom of the car.

30 **[0006]** The following considers the load applied to each of the suspending mechanisms when the stroke is a large stroke of $H_1=200$ m. A traveling cable used for this class of apparatuses has a unit weight W_t of about 50 N/m (in the exemplary configuration of the traveling cable of Fig. 9, a conductor area per electric wire is 0.75 mm^2 and the number of wires is 100 to 150).

35 **[0007]** Firstly as for the load applied to the suspension mechanism 500 on the hoistway side, the load becomes a maximum when the car is located at the bottom floor as illustrated in Fig. 10A, and the following load W_{h1} is applied thereto:

40
$$W_{h1}=W_t \times L_{t1} \qquad \dots \text{ Expression (1).}$$

Herein, since $L_{t1} \gg L_1$ and $L_{t1} \cong H_2 = H_1/2$,

45
$$W_{h1}=W_t \times H_1/2 = 50 \times 200/2 = 5,000 \text{ (N).}$$

50 **[0008]** Similarly, the load applied to the suspension mechanism 600 on the car side becomes a maximum when the car is located at the top floor as illustrated in Fig. 10B, and the following load W_{c2} is applied thereto:

$$W_{c2}=W_t \times L_{t2} \qquad \dots \text{ Expression (2).}$$

Herein, since $L_{t2} \cong L_{t1}$,

55
$$W_{c2}=W_t \times L_{t1} = 50 \times 200/2 = 5,000 \text{ (N).}$$

[0009] Minimums W_{c1} , W_{h2} applied to the suspension mechanisms on the car side and on the hoistway side are about a few tens N as understood from Figs. 10A and 10B.

[0010] In this way, the load applied to the suspension mechanisms on the car side and on the hoistway side is about 5,000 N at maximum and repeatedly varies between a few tens N and about 5,000 N. Therefore, these suspension mechanisms are required to resist such a severe load condition.

[0011] Fig. 11 illustrates a conventional example of a suspending apparatus of traveling cable resistant to such a load condition. The suspending apparatus of traveling cable of this drawing uses a rope socket that suspends a main rope which hoists a car. Rope sockets 520L and 520R are provided for the suspending wire ropes 10L and 10R, respectively, of the traveling cable 10. The rope sockets 520L and 520R each include a holding part of a wire rope at a lower part as shown in the drawing, and the holding part has a tapered shape interiorly. The suspending wire ropes 10L and 10R bent along the periphery are pressure-connected with a wedge-shaped rope pressing members for fixing and holding, and ends of the suspending wire ropes 10L and 10R are banded with wire grips 521.

[0012] At the top of the rope sockets 520L and 520R are attached thimble rods (shackle rods) 530L and 530R connected with joint pins 522. The other ends of the thimble rods 530L and 530R are fixed and supported at a supporting bracket 540 provided at the suspension mechanism 500 on the hoistway side and at the suspension mechanism 600 on the car side illustrated in Fig. 10.

[0013] This suspending apparatus resistant to severe load conditions allows the load applied to the suspending wire ropes to be distributed uniformly. In other words, this suspending apparatus is capable of adjusting the fixed positions of the thimble rods in the height direction on the hoistway side or on the car side in accordance with the attachment state between the suspending wire ropes, the rope sockets and the thimble rods so that the load applied to the two suspending wire ropes, e.g., the load of 5,000 N as described above, can be applied to the two suspending wire ropes uniformly.

[0014] With the recent tendency to construct high-rise buildings, elevators therein are forced to have a hoisting stroke exceeding 400 m. The load applied to suspending apparatuses of the traveling cable accordingly increases in proportion to such a hoisting stroke. For instance, in the case where the hoisting stroke is 400 m, the load of a few tens to 10,000 N will be applied to the suspension mechanisms based on Expressions (1) (2) mentioned as background of the invention. In such a case, the thimble rods and the rope sockets suspending the traveling cable have to have increased durability by increasing in their size, for example.

[0015] The conventional technique disclosed in JP-A-2004-137019, however, has a problem that increased dimension L_{s1} of the rope sockets 520L and 520R of Fig. 11 with reference to the distance L_{tr} between two suspending wire ropes 10L and 10R of Fig. 11 causes interference between the rope sockets.

[0016] In order to avoid such interference, the distance between the two suspending wire ropes has to be increased to be suitable to the shape of the rope sockets. To this end, the width of the traveling cable is further increased, for example, for large scale more than needs and accordingly the weight of the traveling cable also increases, which leads to a contracting result.

[0017] Further, as the elevator travels, the traveling cable rolls back and forth and around due to wind pressure. Especially, a traveling cable used in an elevator with a large stroke becomes long and tends to roll easily. This rolling together with bending stress repeatedly applied to attached parts a1, a2 of the member 540 fixing and supporting the thimble rods 530L and 530R in Fig. 11 may cause fatigue breakdown in some cases. Conventional techniques have not considered such repeatedly applied bending stress.

[0018] As another problem, typical traveling cables for a large stroke are wound around a large drum exceeding 2 m in diameter, and are placed at the bottom of the building. In order to suspend such a traveling cable at a midpoint of the hoistway, the traveling cable has to be entered from the bottom part of the hoistway and lifted through the hoistway for suspension. Conventional techniques do not mention such a lifting method of a suspension mechanism at the midpoint of the hoistway.

Brief summary of the invention

[0019] In view of the aforementioned problems of the conventional technique, it is an object of the present invention to provide a traveling cable and a suspending apparatus therefor used in an elevator even with a large stroke without increasing the traveling cable and the suspending apparatus in size. It is another object of the present invention to provide a suspending apparatus of traveling cable for elevator capable of facilitating lifting of the traveling cable to a suspending mechanism located at a midpoint of the hoistway, and such an elevator apparatus.

[0020] In order to fulfill the aforementioned major objects, according to a first aspect of the present invention, there is provided a suspending apparatus of a traveling cable for an elevator, the traveling cable configured to feed power to a car and exchange signals with the car and including a plurality of suspending wire ropes embedded therein. The suspending apparatus includes: rope sockets into one of which each suspending wire rope is incorporated, respectively; and thimble rods to one of which each rope socket incorporating the suspending wire rope is fastened, respectively, so that one end of the traveling cable is suspended from a hoistway building and the other end is suspended from the car.

In the suspending apparatus, the thimble rods are configured to have a different length from each other; and the suspending apparatus further includes a traveling cable sway prevention mechanism provided below a drawing point of the suspending wire ropes.

5 [0021] The thus prepared thimble rods having different dimensions allow rope sockets even having an outside diameter size larger than the distance between the two suspending wire ropes embedded in the traveling cable to be attached so as not to cause mutual interference of the rope sockets. As a result, a traveling cable of an appropriate size can be used without increasing the size thereof to widen the distance between the two suspending wire ropes.

10 [0022] Since the sway prevention mechanism of a traveling cable is provided, it can suppress bending load repeatedly applied to the thimble rods due to rolling of the traveling cable back and forth and around, and thus, can eliminate the necessity of thicker thimble rods and larger rope sockets to attach the thimble rods. As a result, in view of only the strength for vertical tensile load, the suspending apparatus can be constructed of the thimble rods with small diameters and the rope sockets corresponding to such diameters, so as to achieve a small and reliable suspending apparatus.

15 [0023] In the first aspect of the present invention, the thimble rods may differ by at least a longitudinal length of the rope sockets. This configuration allows the rope sockets to be attached to two suspending wire ropes at at least positions not causing mutual interference of the rope sockets.

20 [0024] In the first aspect of the present invention, the sway prevention mechanism may include a plate steel and a hat-shaped fitting surrounding the traveling cable, and the hat-shaped fitting may have internal dimensions equal to or larger than the outside diameter size of the traveling cable. With this configuration, the weight of the traveling cable is not applied to the sway prevention mechanism, and so the sway prevention mechanism can be configured with simple members of the plate steel and the hat-shaped fitting to suppress rolling only.

25 [0025] In the first aspect of the present invention, the sway prevention mechanism may include plate steels and round bars surrounding the traveling cable, the plate steels facing a minor axis-face of the traveling cable and the round bars facing major axis-face of the traveling cable, and an area surrounded by the plate steels and the round bars may be equal to or larger than external dimensions of the traveling cable. With this configuration, similarly to the above mentioned, the weight of the traveling cable is not applied to the sway prevention mechanism, and so the sway prevention mechanism can be configured with simple members of the plate steels and the round bars to suppress rolling only.

30 [0026] In the first aspect of the present invention, the invention further may include a supporting bracket to support the thimble rods against the hoistway building. In the supporting bracket, a hole boring may be processed for lifting the supporting bracket together with the traveling cable. With this configuration, the traveling cable can be suspended easily by lifting the traveling cable to the suspension position at the midpoint of the hoistway using the supporting bracket by a crane.

35 [0027] According to a second aspect of the present invention, there is provided a suspending apparatus of a traveling cable for an elevator, the traveling cable configured to feed power to a car and exchange signals with the car and including a plurality of suspending wire ropes embedded in the traveling cable. The suspending apparatus includes: a rope socket into which each suspending wire rope is incorporated; and a thimble rod to which each rope socket incorporating the suspending wire rope is fastened so that one end of the traveling cable is suspended from a hoistway building and the other end is suspended from the car. The suspending apparatus further includes a supporting bracket to support the thimble rods against the hoistway building, and the supporting bracket includes a hole bored for lifting the supporting bracket together with the traveling cable. With this configuration, the traveling cable can be suspended easily by lifting the traveling cable to the suspension position at the midpoint of the hoistway using the supporting bracket by a crane. Furthermore, the rope sockets and the thimble rods as main elements of the suspending apparatus of the traveling cable can be set before lifting the traveling cable, and therefore the number of operations to be performed in high places at the midpoint of the hoistway can be reduced and worker's safety can be obtained.

45 [0028] In the second aspect of the present invention, in the hole boring of the supporting bracket, a hole threading may be processed for attachment of an eyebolt in a vicinity of each end of the supporting bracket. With this configuration, the traveling cable can be lifted to the suspension position at the midpoint of the hoistway by a crane simply by attaching the eyebolts to the supporting bracket.

50 [0029] In the second aspect of the present invention, in the hole boring of the supporting bracket, a through hole boring may be processed for attachment of a shackle in a vicinity of each end of the supporting bracket. With this configuration, similarly to the above mentioned, the traveling cable can be lifted to the suspension position at the midpoint of the hoistway by a crane simply by attaching the shackles to the supporting bracket.

55 [0030] According to a third aspect of the present invention, there is provided an elevator apparatus including: a car hoisted in a hoistway; and a traveling cable configured to feed power to the car and exchange signals with the car and comprising a plurality of suspending wire ropes embedded in the traveling cable, each suspending wire rope being incorporated into a rope socket, each rope socket incorporating the suspending wire rope being fastened to a thimble rod so that one end of the traveling cable is suspended from a hoistway building and the other end of the traveling cable is suspended from the car. In this elevator apparatus, each of the thimble rods is adjusted to have a different length from each other; and a traveling cable sway prevention mechanism is provided below a drawing point of the suspending wire

ropes. The thus prepared thimble rods having different dimensions allow rope sockets even having an outside diameter size larger than the distance between the two suspending wire ropes embedded in the traveling cable to be attached so as not to cause mutual interference of the rope sockets. As a result, a traveling cable of an appropriate size can be used without increasing the size thereof to widen the distance between the two suspending wire ropes. Furthermore, an elevator apparatus of this configuration can contribute to reduce the weight of the car and enables effective usage of a limited hoistway space, thus improving the usage efficiency of the space.

[0031] According to the present invention, a small and reliable suspending apparatus of traveling cable for elevator can be provided even with a traveling cable used in an elevator even for a large stroke. Further, the present invention can facilitate lifting of the traveling cable to a suspension position at the midpoint of the hoistway.

Brief description of the several views of the drawing

[0032]

Fig. 1 illustrates the overall configuration of a suspending apparatus of traveling cable for elevator according to the present invention.

Figs. 2A and 2B illustrate the detailed configuration of the suspending apparatus of traveling cable to be attached on a side of a hoistway.

Figs. 3A and 3B illustrate the detailed configuration of the suspending apparatus of traveling cable to be attached on a side of a car.

Fig. 4 is an enlarged view of a major section illustrating the details of a traveling-cable sway prevention fitting at the suspending apparatus of traveling cable on the hoistway side.

Fig. 5 is an enlarged view of a major section illustrating the details of a traveling-cable sway prevention fitting at the suspending apparatus of traveling cable on the car side.

Fig. 6 describes bending load applied to a thimble rod as an element of the suspending apparatus of traveling cable due to rolling of the traveling cable.

Fig. 7 illustrates the detailed configuration of a bracket to attach and support/fix a thimble rod in the suspending apparatus of traveling cable on the hoistway side.

Fig. 8 illustrates a way to lift a traveling cable on the hoistway side.

Fig. 9 illustrates an exemplary structure of a traveling cable used for a large stroke to feed power to a car.

Fig. 10A and Fig. 10B illustrate a typical and exemplary overall configuration for power feeding to a car using a traveling cable.

Fig. 11 illustrates a conventional suspending apparatus of traveling cable for elevator.

Detailed description of the invention

[0033] The following describes one embodiment of a suspending apparatus of traveling cable for elevator according to the present invention, with reference to Fig. 1 through Fig. 8. Fig. 1 illustrates the overall configuration of a suspending apparatus of traveling cable for elevator of the present invention. Fig. 2 illustrates the detailed configuration of the suspending apparatus of traveling cable to be attached on a side of a hoistway. Fig. 3 illustrates the detailed configuration of the suspending apparatus of traveling cable to be attached on a side of a car. Fig. 4 is an enlarged view of a major section illustrating the details of a traveling-cable sway prevention fitting at the suspending apparatus of traveling cable on the hoistway side. Fig. 5 is an enlarged view of a major section illustrating the details of a traveling-cable sway prevention fitting at the suspending apparatus of traveling cable on the car side.

[0034] Fig. 6 describes bending load applied to a thimble rod as an element of the suspending apparatus of traveling cable due to rolling of the traveling cable. Fig. 7 illustrates the detailed configuration of a bracket to attach and hold/fix a thimble rod in the suspending apparatus of traveling cable on the hoistway side. Fig. 8 illustrates a way to suspend a traveling cable on the hoistway side.

[0035] As in Fig. 1 illustrating the overall configuration of one embodiment of the suspending apparatus of traveling cable for elevator, signal exchange and power feeding to a car 11 through a traveling cable 10 is performed from a controller (refer to Fig. 10) provided in a machine room on top of a hoistway to control an elevator via a car-side power-feeding device 13. This traveling cable 10 has one end suspended at a suspension apparatus 100 at a midpoint of the hoistway and the other end suspended at a suspending apparatus 200 on the car side.

[0036] Referring now to Fig. 2A as a plan view and Fig. 2B as a cross-sectional view taken along the line IIB-IIB, the suspension apparatus 100 on the hoistway side is described in detail below. Rope sockets 20L and 20R are provided for suspending wire ropes 10L and 10R, respectively, embedded in the traveling cable 10.

[0037] The rope sockets 20L and 20R each include a holding part for a wire rope at a lower part shown in the drawing, and the holding part has a tapered shape interiorly. The suspending wire ropes 10L and 10R bent along the periphery

are pressure-connected with a wedge-shaped rope pressing members for fixing and holding, and ends of the suspending wire ropes 10L and 10R are banded with wire grips 21L and 21R.

[0038] At the top of the rope sockets 20L and 20R are attached thimble rods 30L and 30R connected with joint pins 22L and 22R. The other ends of the thimble rods 30L and 30R are supported by a supporting bracket 110. The supporting bracket 110 is supported in the following manner. Firstly, vertically extended L-section steels 121a, 121b are attached to horizontal beams 120a, 120b made of H-section steel provided at the respective floors of the building by means of channel steels 122a to 122d. Then, channel steels 123 a, 123b are attached to the L-section steels 121a, 121b and the supporting bracket 110 is mounted on the channels 123a, 123b for supporting.

[0039] This suspending apparatus further includes a sway prevention mechanism 130 to prevent the traveling cable 10 from rolling. The detailed configuration of the sway prevention mechanism 130 is described later.

[0040] Referring now to Fig. 3A as a plan view and Fig. 3B as a cross-sectional view taken along the line IIIB-IIIB, the suspension apparatus 200 on the car side is described below in detail. Similarly to the suspension apparatus on the hoistway side, rope sockets 20L and 20R each include a holding part of a wire rope at a lower part of the drawing, and the holding part has a tapered shape interiorly. Suspending wire ropes 10L and 10R bent along the periphery are pressure-connected with a wedge-shaped rope pressing members for fixing and holding, and ends of the suspending wire ropes 10L and 10R are banded with wire grips 21L and 21R.

[0041] At the top of rope sockets 20L and 20R are attached thimble rods 30L and 30R connected with joint pins 22L and 22R. The other ends of the thimble rods 30L and 30R are supported at a supporting bracket 210 attached to a reinforcing member 220 as an element of the car. The reinforcing member 220 is provided with a sway prevention mechanism 230 at brackets 221, 222 extended downward of the car to prevent the traveling cable 10 from rolling. The detailed configuration of the sway prevention mechanism 230 is described later.

[0042] The positional relationship between the rope sockets 20L, 20R and the thimble rods 30L, 30R on the hoistway side and on the car side is described below. Firstly, as shown in Fig. 2, letting that the longitudinal dimension of the rope sockets 20L, 20R is L_{S2} , the thimble rods 30L, 30R are prepared to have a length of the longitudinal dimension L_{S2} or more. That is, letting that the length of the thimble rod 30L is L_{30L} and the length of the thimble rod 30R is L_{30R} , the thimble rods 30L, 30R manufactured beforehand to satisfy the following Expression (3) are used:

$$L_{30L} \geq L_{30R} + L_{S2} \text{ or } L_{30R} \geq L_{30L} + L_{S2} \quad \dots \text{ Expression (3).}$$

[0043] The thus prepared thimble rods 30L, 30R having different dimensions allow the rope sockets even having an outside diameter size larger than the distance between the two suspending wire ropes embedded in the traveling cable to be attached so as not to cause the mutual interference of the rope sockets. As a result, a traveling cable of an appropriate size can be used without increasing the size thereof to widen the distance between the two suspending wire ropes.

[0044] In this example, the thimble rods 30L, 30R have the same lengths on the hoistway side and on the car side. However, they may have different lengths as long as Expression (3) holds.

[0045] Next, the sway prevention mechanism 130 for the traveling cable 10 is provided at the same point of or below a drawing point 10a (see Figs. 2A and 2B) of the suspending wire ropes 10L, 10R of the traveling cable 10. This is because, as described above for the problems to be solved by the invention, the traveling cable 10 rolls back and forth and around due to wind pressure as the car 11 travels. Especially, a traveling cable used in an elevator with a large stroke becomes long and tends to roll easily. To cope with this rolling, the sway prevention mechanism 130 is provided to reduce a bending force (moment) applied to the thimble rods 30L, 30R.

[0046] Referring now to Fig. 6, the bending moment applied to the thimble rods as an element of the suspending apparatus of traveling cable due to rolling of the traveling cable is described below.

[0047] Fig. 6 illustrates suspension by one of the two suspending wire ropes embedded in the traveling cable 10, i.e., the wire rope 10L, in the suspending apparatus at the midpoint of the hoistway illustrated in Figs. 2A and 2B. Attached to the suspending wire rope 10L are the rope socket 20L and the thimble rod 30L is attached to the rope socket 20L with the joint point 22L. The thimble rod 30L is fixed and supported by the bracket 110.

[0048] Herein, the bending moment M that the thimble rod 30L receives when the traveling cable 10 rolls is considered.

[0049] Firstly, letting that the inclination of the rope when the traveling cable 10 moves by L_{11} due to rolling is θ and the weight of the traveling cable is W, a force F applied to the thimble rod 30L at a horizontal part of the joint pin 22L can be represented by Expression (4):

$$F=W\times\tan\theta$$

... Expression (4).

5 **[0050]** Next, bending moment M at a part A in the vicinity of the supporting bracket 110 of the thimble rod 30L can be found by Expression (5) by multiplying the force F at the horizontal part by the length L_{12} of the thimble rod 30L:

$$10 \quad M=F\times L_{12}$$

... Expression (5).

15 **[0051]** Then, bending moment M for the class of a hosting stroke of 400 m as a large stroke can be calculated as about 900 N·m at maximum, where letting the unit weight of the traveling cable is 50N, the maximum weight W_{c1} of the traveling cable is 10,000 N based on Expression (2) and the inclination of the rope $\theta=10^\circ$ and the length L_{12} of the thimble rod 30L = 0.5 m.

20 **[0052]** The thimble rods will receive such large bending moment as well as repeated moment of 0 to about 900 N.m. In order to resist this moment, robust thimble rods of large diameters are required. Such robust thimble rods of large diameters need larger rope sockets for attachment.

25 **[0053]** The sway prevention mechanism 130 of traveling cable is to prevent this bending moment, and can eliminate the necessity of thicker thimble rods and larger rope sockets to attach the thimble rods and can achieve a configuration using thimble rods of small diameters taking account of the strength for vertical tensile load only and rope sockets corresponding to such diameters. Therefore, a small and reliable suspending apparatus can be achieved.

30 **[0054]** As for the sway prevention mechanism of traveling cable, Fig. 4 illustrates the details at the traveling cable suspending apparatus on the hoistway side and Fig. 5 illustrates the details at the traveling cable suspending apparatus on the car side. The sway prevention mechanism 130 of traveling cable on the hoistway side of Fig. 4 is attached in the following manner. After a plate steel 131 is provided on two L-section steels 121a, 121b fixed and supported at the building and provided vertically, the traveling cable 10 is attached to the plate steel 131 so as to be covered with a hat-shaped fitting 132 as illustrated in the drawing.

35 **[0055]** The hat-shaped fitting 132 covers the traveling cable 10 so as to have internal dimensions $L_{hw}\times L_{ht}$ satisfying $L_{ht}\geq L_{tw}$ and $L_{ht}\geq L_{tt}$ where L_{tw} is the width (major axis-side) of the traveling cable 10 and L_{tt} is the thickness (minor axis-side) thereof.

40 **[0056]** Such dimensions of the internal dimensions of the hat-shaped fitting equal to or slightly larger than the outside diameter size of the traveling cable prevents the weight of the traveling cable from applying to the sway prevention mechanism, and so the sway prevention mechanism can be configured with a simple plate steel and such a hat-shaped fitting to suppress rolling only.

45 **[0057]** Referring next to Fig. 5, the sway prevention mechanism 230 on the car side is described below. This configuration of the sway prevention mechanism is effective when the distance L_{ex} between the suspension position of the traveling cable 10 and the bracket 222 fixing the sway prevention mechanism is relatively large as illustrated in Fig. 3.

50 **[0058]** In Fig. 5, attached to the bracket 222 supported and fixed to the car are two brackets 231a, 231b having a U-shape, and attached to these two brackets 231a, 231b are two round bars 232a, 232b so as to sandwich the traveling cable 10 therebetween. The area surrounded by the brackets 231a, 231b and the round bars 232a, 232b, $L_{ew}\times L_{ct}$, is set similarly to the sway prevention mechanism of traveling cable on the hoistway side so that L_{hw} and L_{ht} are equal to or slightly larger than L_{tw} and L_{tt} , respectively, i.e., $L_{hw}\geq L_{tw}$, $L_{ht}\geq L_{tt}$ where L_{tw} is the width (the major axis-side) of the traveling cable 10 and L_{tt} is the thickness (the minor axis-side) thereof.

55 **[0059]** With this configuration, similarly to the sway prevention mechanism of traveling cable on the hoistway side, even when the distance L_{ex} between the suspension position of the traveling cable 10 and the bracket 222 fixing the sway prevention mechanism is relatively large, the weight of the traveling cable is not applied to the sway prevention mechanism, and so the sway prevention mechanism can be configured with simple members of the brackets 231a, 231b and the round bars 232a, 232b to suppress rolling only.

[0060] As stated above, thimble rods previously having different dimensions can prevent mutual interference between rope sockets, and sway prevention mechanisms preventing roll of the traveling cable back and forth and around enables the configuration of small thimble rods and such rope sockets, thus realizing a small and reliable suspending apparatus of traveling cable.

[0061] Next, a way to move the traveling cable to a suspension position on the hoistway side is described below. When the traveling cable is short and light, a member such as nylon sling or fiber rope is wound around the traveling cable as sheath, and the traveling cable can be easily carried to the suspension position using the member by a crane.

When the elevator has a hoisting stroke of 400 m, however, the suspension position on the hoistway side is about 200 m from the bottom floor as stated above and the weight of the traveling cable is about 10,000 N, and so it is difficult to lift the traveling cable with this method.

[0062] In the present invention, the bracket 110 for fixing and supporting the thimble rods 30L, 30R illustrated in Figs. 2A and 2B doubles as a lifting bracket. Fig. 7 and Fig. 8 illustrate the details thereof.

[0063] In Fig. 7, the bracket 110 is the bracket for fixing and supporting the thimble rods 30L, 30R illustrated in Figs. 2A and 2B. This bracket 110 is provided with through holes 111a, 111b bored for the attachment of the thimble rods 30L, 30R, through holes 112a, 112b bored to let bolts pass through to fix this bracket 110 to the channels 123a, 123b of Fig. 2 and threaded holes 113a, 113b threaded for the attachment of eyebolts 50 in the vicinity of both ends of the bracket 110.

[0064] Using the bracket 110 with the thus bored holes, the traveling cable is lifted to the suspension position on the hoistway side as seen in Fig. 8 and is installed there. Firstly, as illustrated in Fig. 2, the rope sockets 20L, 20R and the thimble rods 30L, 30R are set at the two suspending wire ropes 10L, 10R of the traveling cable 10. The thimble rods 30L, 30R are passed through the through holes 111a, 111b bored in the bracket 110, and upper and lower parts of the thimble rods 30L, 30R are fixed with nuts to the bracket 110.

[0065] Then, eyebolts 50a, 50b are attached to the bracket 110 at the threaded holes 113a, 113b in the vicinity of both ends of the bracket 110. In the thus set state, the traveling cable 10 is lifted while attaching lifting wire ropes 60a and 60b to the eyebolts 50a and 50b, respectively, and hanging the lifting wire ropes 60a and 60b on a hook 61 of the crane. At this time, since the upper and lower parts of the thimble rods 30L, 30R are fixed to the bracket 110 with nuts, rotation of the thimble rods 30L, 30R and the suspending wires 10L, 10R can be prevented as well.

[0066] After lifting the traveling cable 10 to the suspension position of the hoistway, as illustrated in Fig. 2, the supporting bracket 110 is placed on the channels 123a, 123b and is fixed and supported to the channels 123a, 123b with bolts and nuts via the through holes 112a, 112b bored in the bracket 110.

[0067] In this way, the traveling cable 10 can be lifted to the suspension position at the midpoint of the hoistway by a crane simply by attaching the eyebolts 50 to the supporting bracket 110.

[0068] Furthermore, the rope sockets 20L, 20R and the thimble rods 30L, 30R as main elements of the suspending apparatus of the traveling cable 10 can be set before lifting the traveling cable, and therefore the number of operations to be performed in high places at the midpoint of the hoistway can be reduced and worker's safety can be obtained.

[0069] Although eyebolts are used for lifting in the above description, similar effects can be obtained using a hanging ring called a shackle. In this case, a hole may be bored at a horizontal face of the bracket 110 for lifting so as to let a shaft of the shackle pass therethrough.

[0070] Elevator apparatuses using the suspending apparatus described in the present embodiment can prevent an unnecessary increase of the suspending apparatus in size, which can contribute to reduce the weight of a car and enables effective usage of a limited hoistway space, thus improving the usage efficiency of the space.

Claims

1. A suspending apparatus of a traveling cable for an elevator, the traveling cable (10) configured to feed power to a car and exchange signals with the car and including a plurality of suspending wire ropes (10L, 10R) embedded therein, the suspending apparatus comprising: rope sockets (20L, 20R) into each which a suspending wire rope (10L, 10R) is incorporated, respectively; and thimble rods (30L, 30R) to one of which each rope socket (20L, 20R) incorporating the suspending wire rope (10L, 10R) is fastened, respectively, so that one end of the traveling cable (10) is suspended from a hoistway building and the other end is suspended from the car.

2. A suspending apparatus of a traveling cable for an elevator, according to claim 1, wherein said thimble rods (30L, 30R) are configured to have a different length from each other, and the suspending apparatus further comprises a traveling cable sway prevention mechanism (130) provided below a drawing point of the suspending wire ropes (10L, 10R).

3. The suspending apparatus of a traveling cable for an elevator according to claim 1 or 11, wherein the thimble rods (30L, 30R) differ in length by at least a longitudinal length of the rope sockets (20L, 20R).

4. The suspending apparatus of a traveling cable for an elevator according to claim 1 or 11, wherein said sway prevention mechanism (130) includes a plate steel (131) and a hat-shaped fitting (132) surrounding the traveling cable (10), said hat-shaped fitting having internal dimensions equal to or larger than an outside diameter size of the traveling cable (10).

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5. The suspending apparatus of a traveling cable for an elevator according to claim 1 or 11, wherein said sway prevention mechanism (130) includes plate steels and round bars (232a, b) surrounding the traveling cable (10), the plate steels facing a minor axis-face of the traveling cable (10) and the round bars (232a, b) facing a major axis-face of the traveling cable (10), and an area surrounded by the plate steels and the round bars (232a, b) is equal to or larger than external dimensions of the traveling cable (10).
 6. The suspending apparatus of a traveling cable for an elevator according to claim 1 or 11, further comprising a supporting bracket (110) to support the thimble rods (30L, 30R) against the hoistway building, wherein a hole boring is processed in the supporting bracket for lifting the supporting bracket (110) together with the traveling cable (10).
 7. A suspending apparatus of a traveling cable (10) for an elevator according to claim 1, wherein the suspending apparatus further comprises a supporting bracket (110) to support the thimble rods (30L, 30R) against the hoistway building, and in said supporting bracket (110), a hole boring is processed for lifting the supporting bracket together with the traveling cable (10).
 8. The suspending apparatus of a traveling cable for an elevator according to claim 7 or 12, wherein in the hole boring of the supporting bracket (110), a hole threading is processed for attachment of an eyebolt in a vicinity of each end of the supporting bracket (110).
 9. The suspending apparatus of a traveling cable for an elevator according to claim 7 or 12, wherein in the hole boring of the supporting bracket (110), a through hole boring is processed for attachment of a shackle in a vicinity of each end of the supporting bracket (110).
 10. An elevator apparatus, comprising: a car hoisted in a hoistway; and including a suspending apparatus according to at least one of claims 1 to 9.
 11. A suspending apparatus of a traveling cable for an elevator, the traveling cable (10) configured to feed power to a car and exchange signals with the car and including a plurality of suspending wire ropes (10L, 10R) embedded therein, the suspending apparatus comprising: rope sockets (20L, 20R) into one of which each suspending wire rope (10L, 10R) is incorporated, respectively; and thimble rods (30L, 30R) to one of which each rope socket (20L, 20R) incorporating the suspending wire rope (10L, 10R) is fastened, respectively, so that one end of the traveling cable (10) is suspended from a hoistway building and the other end is suspended from the car, wherein said thimble rods (30L, 30R) are configured to have a different length from each other, and the suspending apparatus further comprises a traveling cable sway prevention mechanism (130) provided below a drawing point of the suspending wire ropes (10L, 10R).
 12. A suspending apparatus of a traveling cable for an elevator, the traveling cable (10) configured to feed power to a car and exchange signals with the car and including a plurality of suspending wire ropes (10L, 10R) embedded therein, the suspending apparatus comprising: rope sockets (20L, 20R) into one of which each of the suspending wire ropes (10L, 10R) is incorporated, respectively; and thimble rods (30L, 30R) to one of which each rope socket (20L, 20R) incorporating the suspending wire rope (10L, 10R) is fastened, respectively, so that one end of the traveling cable (10) is suspended from a hoistway building and the other end is suspended from the car, wherein the suspending apparatus further comprises a supporting bracket (110) to support the thimble rods (30L, 30R) against the hoistway building, and in said supporting bracket, a hole boring is processed for lifting the supporting bracket (110) together with the traveling cable (110).
 13. An elevator apparatus, comprising: a car hoisted in a hoistway; and a traveling cable (10) configured to feed power to the car and exchange signals with the car and including a plurality of suspending wire ropes (10L, 10R) embedded therein; rope sockets (20L, 20R) into one of which each of the suspending wire ropes (10L, 10R) is incorporated, respectively; thimble rods (30L, 30R) to one of which each of the rope sockets (20L, 20R) incorporating the suspending wire rope (10L, 10R) is fastened, respectively, so that one end of the traveling cable (10) is suspended from a hoistway building and the other end of the traveling cable (10) is suspended from the car, wherein thimble rods (30L, 30R) are configured to have a different length from each other, and a traveling cable sway prevention mechanism (130) is provided below a drawing point of the suspending wire ropes (10L, 10R).

FIG. 1

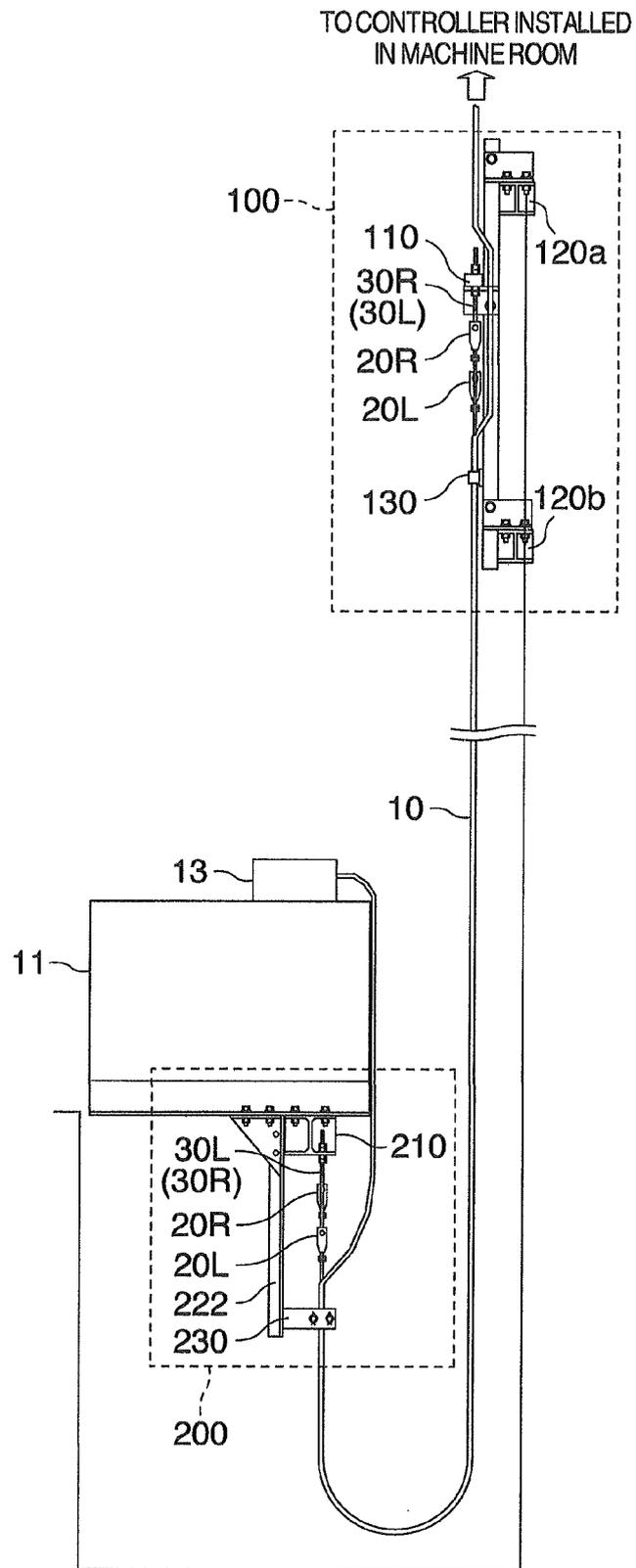


FIG.2A

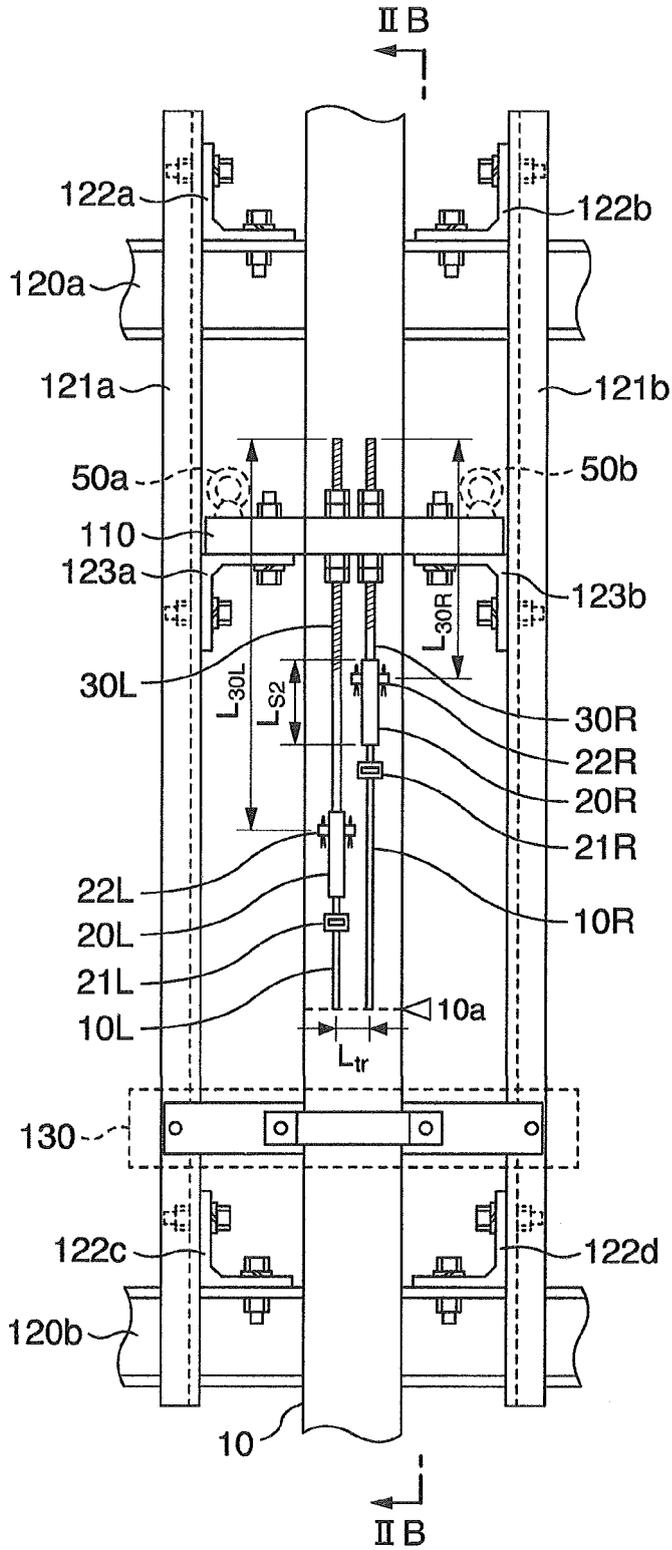


FIG.2B

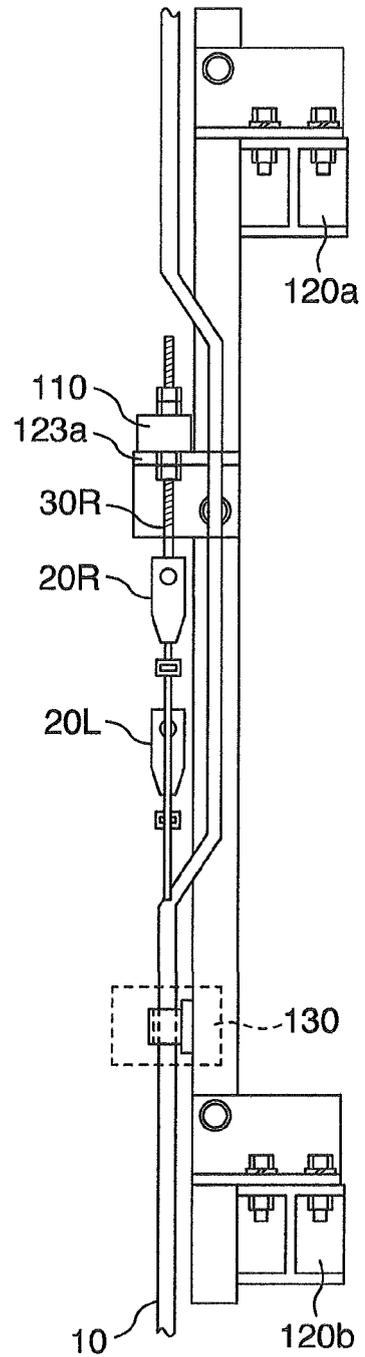


FIG.3A

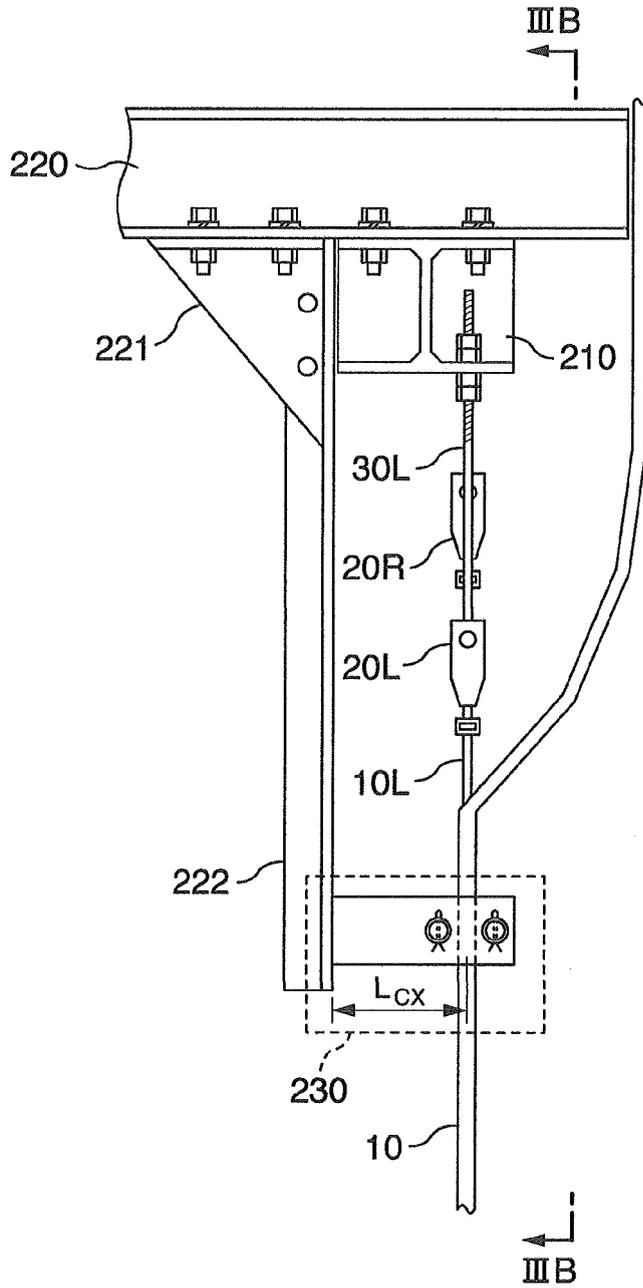


FIG.3B

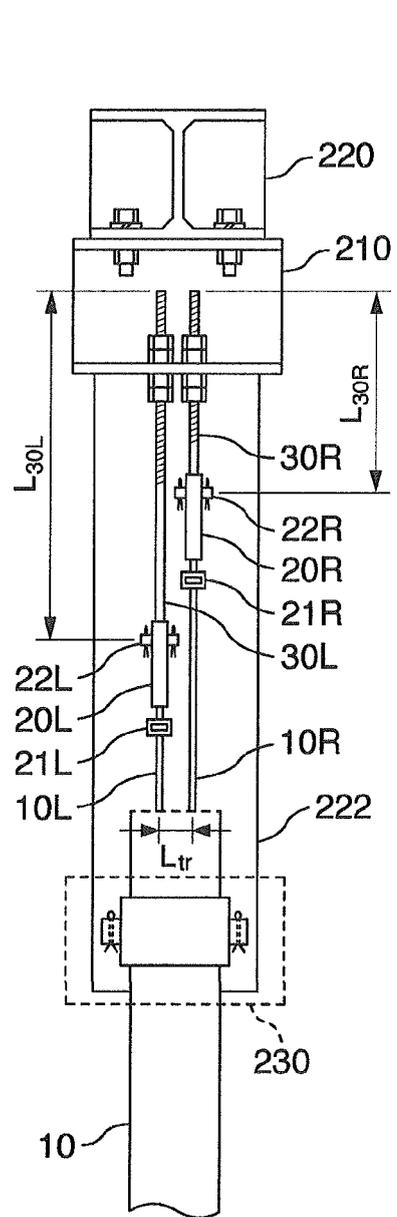


FIG.4

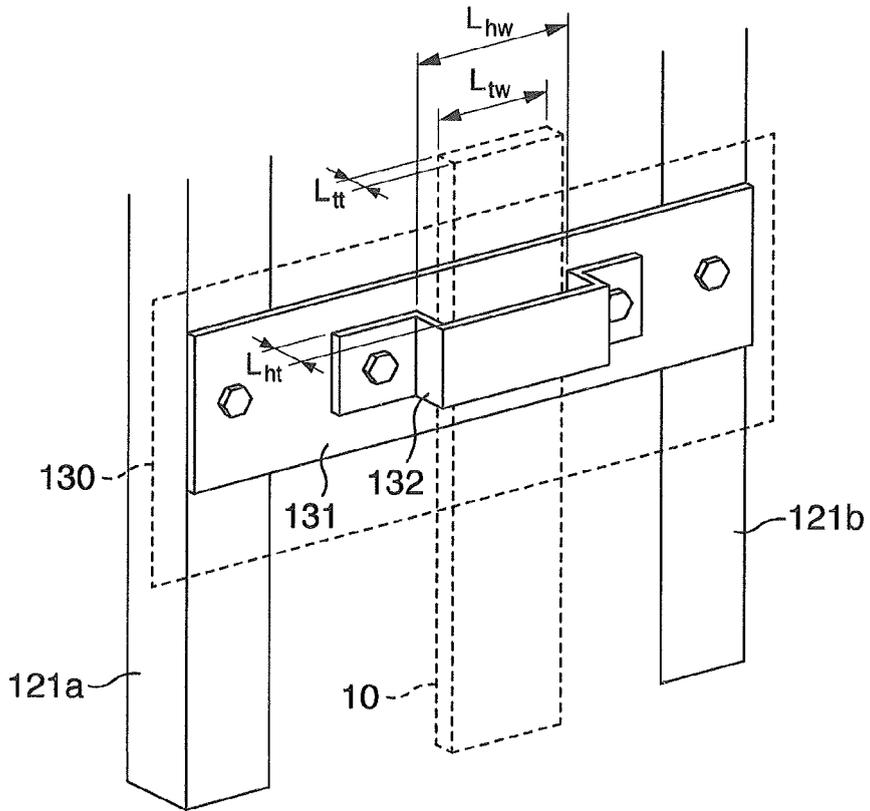


FIG.5

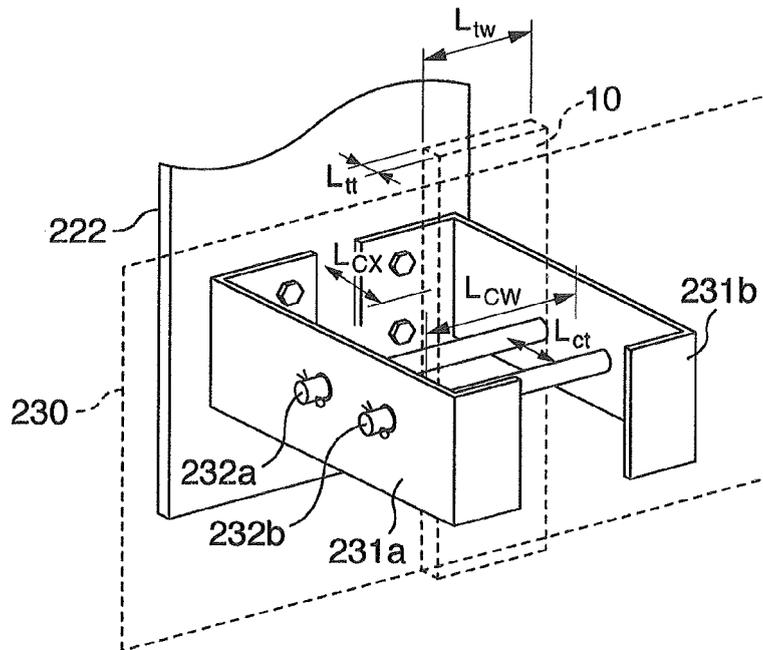


FIG.6

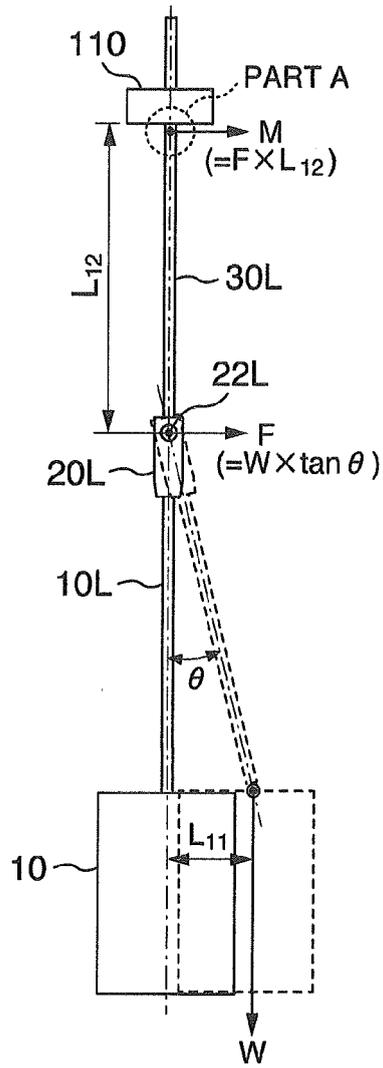


FIG.7

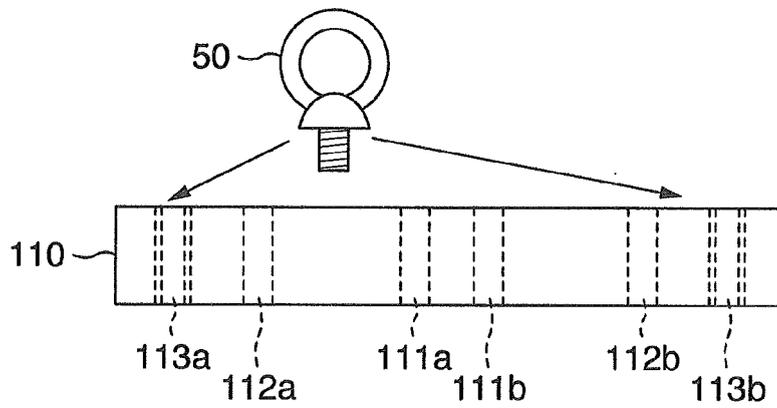


FIG.8

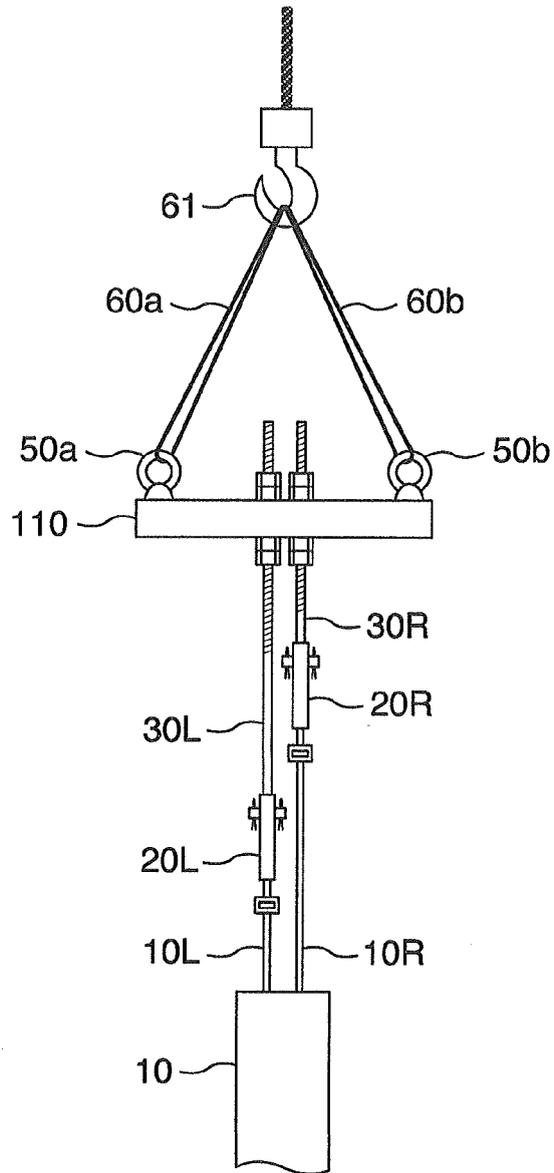


FIG.9

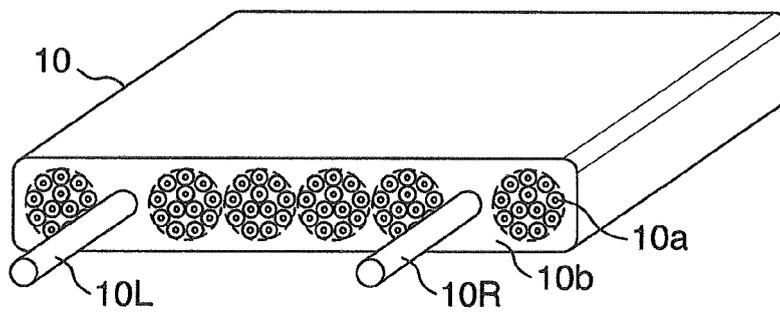


FIG.10A

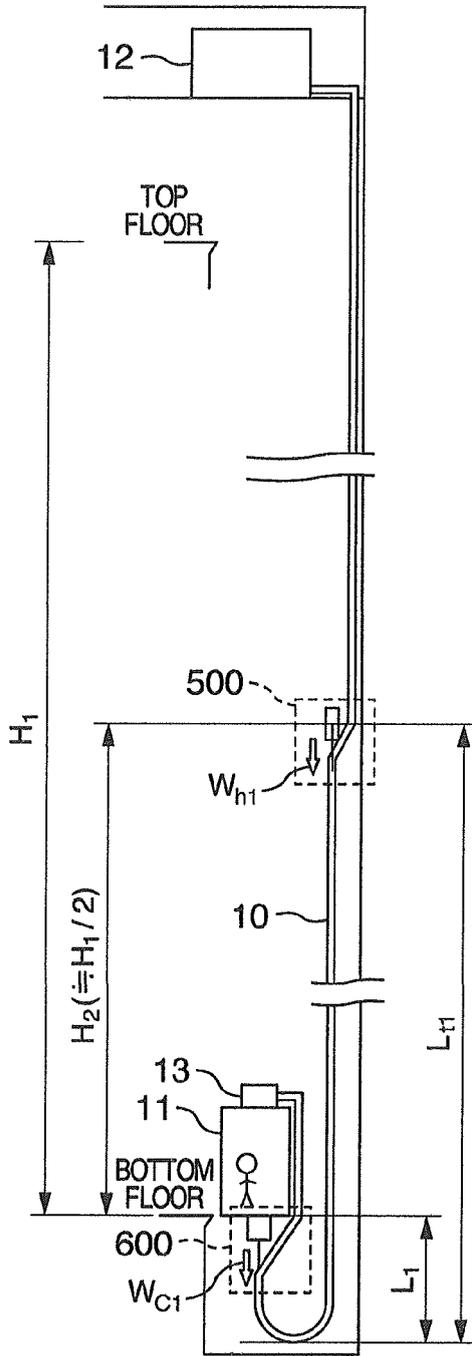


FIG.10B

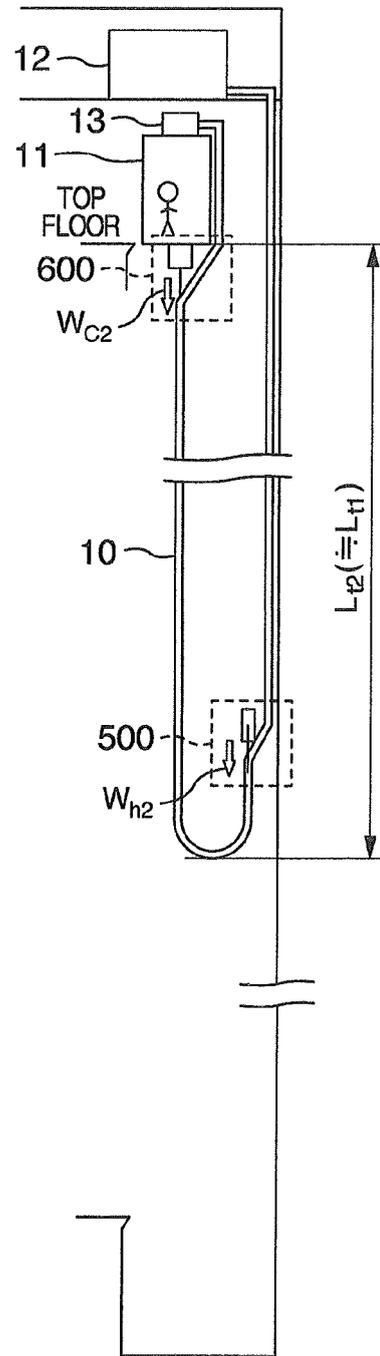
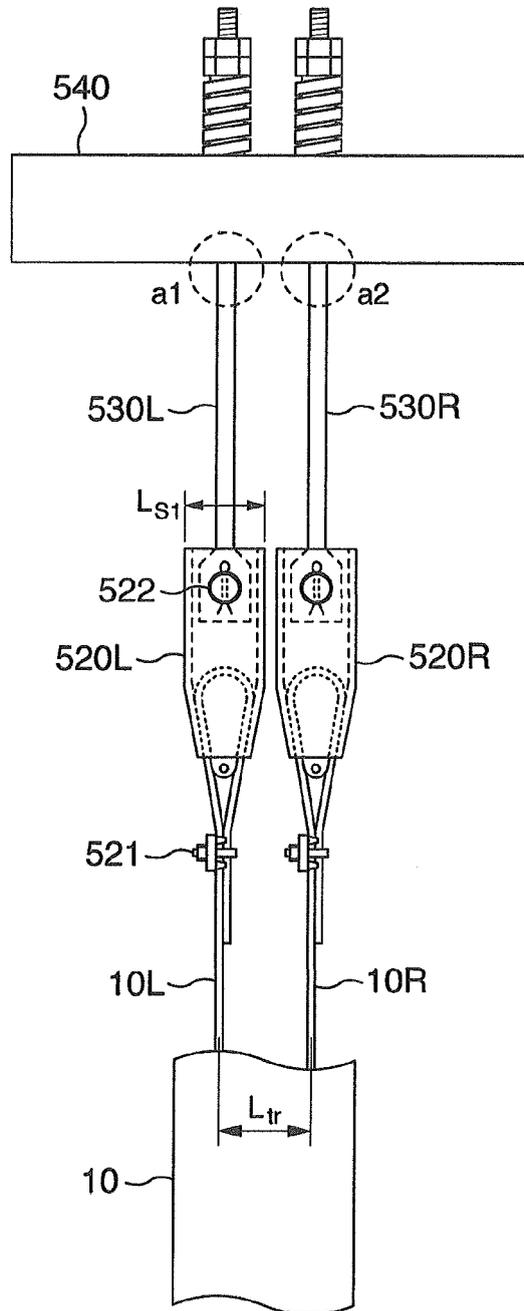


FIG.11





EUROPEAN SEARCH REPORT

Application Number
EP 11 19 2066

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* figure 8 *	2,3,6-9, 11-13	
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			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		26 March 2012	Janssens, Gerd
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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26-03-2012

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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