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(54) **Elevator system**

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Système d'ascenseur

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Description

Background of the Invention

Field of the Invention

[0001] The present invention relates to an elevator system, wherein a main cable connected to a car and a counterweight is driven by means of a hoist mounted on the car according the preamble of claim 1.

Background Art

[0002] FIG. 13 is a longitudinal cross-sectional view conceptually showing a conventional elevator system described in, for example, Japanese Utility Model Publication No. Hei-3-48142. In the drawing, reference numeral 1 designates a shaft; 2 designates a car which moves vertically along a predetermined path within the shaft 1; and 3 designates a traction hoist mounted on a lower side of an upper frame of the car 2. A sheave 4 of the hoist 3 is arranged such that the rotor axis of the sheave 4 is oriented horizontally.

[0003] Reference numeral 5 designates a counterweight which moves vertically along another predetermined path within the shaft 1, and a counterweight pulley 6 is provided in the counterweight 5. Reference numeral 7 designates a top pulley which is attached to the top of the shaft 1 such that the rotor axis of the pulley is oriented horizontally. Reference numeral 8 designates a main cable whose one end is connected to the upper end portion of the shaft 1 by means of an anchor 9 and whose remaining end is connected to the upper end portion of the shaft 1 by means of another anchor 10. The main cable 8 is coiled around the counterweight pulley 6, the top pulley 7, and the sheave 4.

[0004] In the conventional elevator system having the aforementioned configuration, the hoist 3 is energized and driven so as to rotate the sheave 4, whereupon the car 2 and the counterweight 3 are moved vertically in opposite directions. Since the hoist 3 is mounted on the car 2, a machinery room, which would otherwise be independently provided in a position above the shaft 1, is omitted, thus reducing the space occupied by the elevator system within an un-illustrated building.

[0005] In the foregoing conventional elevator system, the hoist 3 is mounted on the car 2, and the rotor axis of the sheave 4 is oriented horizontally, thus resulting in an increase in the height of the car 2. When such a car 2 is stopped at the top floor of the building, a top clearance to be insured between the lower surface of the top of the shaft 1 and the top of the car 2 must be made longer. For this reason, the lower surface of the top of the shaft 1 must be made higher than the height of the top floor of the building. Thus, ensuring a space for installing the elevator system adds to construction costs. Here, the angle at which the main cable 8 is wound around the sheave 4 exceeds 90°, and the diameter of the sheave 4 should be made more than 40 times the diameter of the main cable 8.

[0006] In FR-AS-2 640 604 there is described an elevator of the type comprising at least one elevator car driven by a traction machine with a counter weight. The traction machine is mounted together with the elevator car.

[0007] Further, in EP 0 841 283 A1 there is described a lift installation in which a lift cage and counter weight are driving by cables of a drive being arranged in a lift shaft. A carrier yoke is arranged at the upper ends of the first and second guide elements. For mounting, maintenance and repair operations of the drive unit can be pivoted into the lift shaft by means of a rotary mechanism arranged at the carrier yoke.

[0008] The present invention has been conceived to solve the problems involved in the background art, and the object of the present invention is to provide an elevator system in which a hoist is mounted on a car and which can be installed in a shaft accommodated within the height of the top floor of a building.

Summary of the Invention

[0009] According to one aspect of the present invention, as elevator having the features of claim 1 system comprises a car which moves vertically along a predetermined path within a shaft. A counterweight is provided whichmoves vertically along another predetermined path within the shaft. A hoist is provided in a plane orthogonal to the predetermined path of the car. The hoist includes a sheave of which rotor axis is oriented in the vertical direction. The hoist is configured such that the height of the hoist is smaller than the diameter of the sheave. A first and a second turning pulleys are provided on the same side of the car with said hoist. The rotor axis of the first and second turning pulleys are oriented horizontally. The first and second turning pulleys are positioned to faces a circumferential edge of the sheave. The rim surface of said first and a second turning pulleys project beyond the edge of the car. A top pulley is provided which is attached to the top of the shaft in a rotatable manner such that the rotor axis of the top pulley is oriented horizontally. Further, a main cable is wound around a pulley of the counterweight, the top pulley, the first and second turning pulleys and the sheave. Each end of said main cable is connected to the upper end of the shaft.

[0010] Other and further objects, features and advantages of the invention will appear more fully from the following description.

Brief Description of the Drawings

[0011]

FIG. 1 is a longitudinal cross-sectional view conceptually showing an elevator system according to a

first embodiment of the present invention;
FIG. 2 is a transverse cross-sectional view showing the principal elements shown in FIG. 1;
FIG. 3 is a perspective view showing the principal elements shown in FIG. 1;
FIG. 4 is a longitudinal cross-sectional view conceptually showing an elevator system according to a second embodiment of the present invention;
FIG. 5 is a transverse cross-sectional view showing the principal elements shown in FIG. 4;
FIG. 6 is a partial front view showing the principal elements of the elevator according to a third embodiment of the present invention;
FIG. 7 is a bottom view of the elements shown in FIG. 6;
FIG. 8 is a longitudinal cross-sectional view conceptually showing an elevator system according to a fourth embodiment of the present invention;
FIG. 9 is a transverse cross-sectional view showing the principal elements shown in FIG. 8;
FIGS. 10 through 12 show a fifth embodiment.
FIG. 10 is a longitudinal view conceptually showing an elevator system according to a fifth embodiment of the present invention;
FIG. 11 is a transverse cross-sectional plan view showing the principal elements shown in FIG. 10;
FIG. 12 is a perspective view showing the principal elements shown in FIG. 10; and
FIG. 13 is a longitudinal cross-sectional view conceptually showing a conventional elevator system.

Detailed Description of the Preferred Embodiments

[0012] The preferred embodiments of the present invention will be described with reference to the accompanying drawings, in which same or corresponding portions are indicated by same reference numerals.

First Embodiment

[0013] FIGS. 1 through 3 illustrate a first embodiment of the present invention. FIG. 1 is a longitudinal cross-sectional view conceptually showing an elevator system; FIG. 2 is a transverse cross-sectional view showing the principal elements shown in FIG. 1; and FIG. 3 is a perspective view showing the principal elements shown in FIG. 1. In the drawings, reference numeral 1 designates a shaft; 2 designates a car which moves vertically along a predetermined path within the shaft 1; and 3 designates a traction hoist. A mount arm 11 is provided on the lower surface of the car 2; that is, a plane orthogonal to the predetermined path of the car 2, and the traction hoist 3 is mounted on the mount arm 11. Further, a sheave 4 is attached to the hoist 3 such that the rotor axis of the sheave 4 is oriented in the vertical direction. The height of the traction hoist 3 is designed to be smaller than the diameter of the sheave 4.

[0014] Reference numeral 5 designates a counterweight which moves vertically along another path within the shaft 1, and a counterweight pulley 6 is provided on the counterweight 5. Reference numeral 7 designates a top pulley which is attached to the top of the shaft 1 in a rotatable manner such that the rotor axis of the top pulley 7 is oriented horizontally. When viewed within a horizontal plane of projection, the top pulley 7 is interposed between the car 2 and the shaft 1 such that the side surfaces of the top pulley 7 are arranged along the wall surface of the shaft 1. Reference numeral 12 designates a first turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the first turning pulley 12 is oriented horizontally. A rim surface of the first turning pulley 12 projects beyond the edge of the car 2, and the first turning pulley 12 is arranged so as to face one circumferential edge of the sheave 4.

[0015] Reference numeral 13 designates a second turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the second turning pulley 13 is oriented horizontally. A rim surface of the second turning pulley 13 projects beyond the edge of the car 2, and the second turning pulley 13 is arranged so as to face a circumferential edge of the sheave 4. The first turning pulley 12 and the second turning pulley 13 are disposed in parallel on the mount arm 11.

[0016] Reference numeral 14 designates a main cable. One end of the main cable 14 is connected to the upper end of the shaft 1 by means of an anchor 15, and the other end of the main cable 14 is connected to the upper end of the shaft 1 by means of an anchor 16. The main cable 14 is wound around the counterweight pulley 6, the top pulley 7, the first turning pulley 12, the sheave 4, and the second turning pulley 13, in this sequence.

[0017] In the elevator system having the foregoing configuration, when the hoist 3 is energized so as to rotate the sheave 4, the car 2 and the counterweight 3 are moved vertically in opposite directions by means of the main cable 14 wound around the first turning pulley 12, the second turning pulley 13, the top pulley 7, and the counterweight pulley 6, in this sequence.

[0018] The hoist 3 is provided within the plane orthogonal to the predetermined path of the car 2, and the rotor axis of the sheave 4 is oriented in the vertical direction. Further, the height of the hoist 3 is designed to be smaller than the diameter of the sheave 4.

[0019] Accordingly, the height of the car 2 becomes smaller. When such a car 2 is stopped at the top floor of a building, the top clearance to be insured between the lower surface of the top of the shaft 1 and the top of the car 2 can be made shorter. The lower surface of the top of the shaft 1 can be made lower than the height of the top floor of the building, thereby preventing an increase in construction cost, which would otherwise be caused by ensuring a space for installing an elevator system.

[0020] The main cable 14 is wound around the first turning pulley 12 and the second turning pulley 13 at an angle of about 90°. The diameter of the first and second

turning pulleys 12 and 13 can be about 36 times the diameter of the main cable 14, thus diminishing the height of the first and second turning pulleys 12 and 13. Therefore, the height of the car 2 can be reduced, which in turn results in a reduction in the height of the shaft 1. Since both the height of the car 2 and the height of the shaft 1 are reduced, expenses required for constructing a space for installing the elevator system can be diminished.

Second Embodiment

[0021] FIGS. 4 and 5 show a second embodiment of the present invention, wherein FIG. 4 is a longitudinal cross-sectional view conceptually showing an elevator system according to the second embodiment, and FIG. 5 is a transverse cross-sectional view showing the principal elements shown in FIG. 4. In these drawings, those reference elements which are the same as those provided in FIGS. 1 through 3 designate corresponding elements. Reference numeral 17 designates a deflector wheel provided on the lower surface of the car 2; that is, in a plane perpendicular to the path of the car 2 within the shaft 1. The deflector wheel 17 is mounted on the mount arm 11 such that the rotor axis of the deflector wheel 17 is oriented in the vertical direction. The deflector wheel 17 is positioned such that one circumferential edge of the deflector wheel 17 faces to one circumferential edge of the sheave 4.

[0022] Reference numeral 12 designates a first turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the first turning pulley 12 is oriented horizontally. The rim surface of the first turning pulley 12 projects beyond the edge of the car 2, and the first turning pulley 12 is placed so as to face the circumferential edge of the sheave 4. Reference numeral 13 designates a second turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the second turning pulley 13 is oriented horizontally. The rim surface of the second turning pulley 13 projects beyond the edge of the car 2, and the second turning pulley 13 is placed so as to face the circumferential edge of the deflector wheel 17.

[0023] Reference numeral 14 designates a main cable whose one end is connected to the upper end of the shaft 1 by means of the anchor 15 and whose other end is connected to the upper end of the shaft 1 by means of the anchor 16. The main cable 14 is wound around the counterweight pulley 6, the top pulley 7, the first turning pulley 12, the sheave 4, the deflector pulley 17, and the second turning pulley 13, in this sequence.

[0024] In the elevator system having the foregoing configuration, the hoist 3 is mounted on the plane orthogonal to the predetermined path of the car 2. The rotor axis of the sheave 4 is oriented in the vertical direction, and the height of the hoist 3 is designed to be smaller than the diameter of the sheave 4. When the hoist 3 is energized, the car 2 and the counterweight 5 are moved vertically in opposite directions by way of the main cable 14.

[0025] Although detailed description of the working-effects of the second embodiment is nol duplicated, the second embodiment shown in FIGS. 4 and 5 yields the same advantageous working-effects as those yielded by the first embodiment shown in FIGS. 1 through 3.

[0026] Further, the first turning pulley 12 having the main cable 14 wound therearound and the second turning pulley 13 having the main cable 14 wound therearound are disposed within the plane of the car 2 substantially symmetrically. This configuration enables suspension of the area in the vicinity of the center of mass of the car 2, thus improving the riding comfort of the car 2.

Third Embodiment

[0027] FIGS. 6 and 7 show a third embodiment of the present invention, wherein FIG. 6 is a partial front view showing the principal elements of the elevator, and FIG. 7 is a bottom view of the elements shown in FIG. 6. The remaining portion of the elevator system other than shown in FIGS. 6 and 7 is the same in configuration as that shown in FIGS. 4 and 5. In these drawings, those reference numerals which are the same as those used in FIGS. 4 and 5 designate corresponding elements. Reference numeral 4 designates a sheave around which a plurality of main cables 14 are wound in parallel to one another. The sheave 4 is provided on the lower surface of the car 2 such that the rotor axis of the sheave 4 is inclined at an angle. One circumferential edge of the sheave 4 faces the lower circumferential edge of the first turning pulley 12, and the other circumferential edge of the sheave 4 is placed in an elevated position than the one edge.

[0028] Reference numeral 17 designates a deflector wheel which is provided on the lower surface of the car 2 such that the rotor axis of the deflector 17 is inclined at an angle. One circumferential edge of the deflector wheel 17 faces the other circumferential edge of the sheave 4 placed in the elevated position. The remaining circumferential edge of the deflector wheel 17 faces the lower circumferential edge of the second turning pulley 13.

[0029] In the elevator system having the foregoing configuration, the hoist 3 is placed in the plane orthogonal to the predetermined path of the car 2. The rotor axis of the sheave 4 is inclined, and the height of the hoist 3 is designed to be smaller than the diameter of the sheave 4. Further, the first turning pulley 12 having the main cable 14 wound therearound and the second turning pulley 13 having the main cable 14 wound therearound are disposed in a same plane under the car 2 substantially symmetrically. When the hoist 3 is energized, the car 2 and the counterweight 5 are moved vertically in opposite directions by way of the main cable 14.

[0030] Although detailed description of working-effects of the third embodiment is not duplicated, the third embodiment shown in FIGS. 6 and 7 also yields the same advantageous working-effects as those yielded by the second embodiment shown in FIGS. 4 and 5.

[0031] In the second embodiment shown in FIGS. 4 and 5, the first turning pulley 12 and the sheave 4 are arranged at right angles to each other, as are the deflector wheel 17 and the second turning pulley 13, thus making the fleet angle of the main cable 14 large. In contrast, in the third embodiment shown in FIGS. 6 and 7, the sheave 4 and the deflector wheel 17 are inclined at angles, as shown in FIG. 6.

[0032] The rim surface of the sheave 4 and the rim surface of the deflector wheel 17 cross each other at an angle of 60°, thus imparting a fleet angle to the main cable 14. However, the rim surface of the first turning pulley 12 and the rim surface of the sheave 4 cross each other at angle of 60°, and the rim surface of the deflector 17 and the rim surface of the second turning pulley 13 cross each other at an angle of 60°. Consequently, the fleet angle of the main cable 14 is diminished, and hence wear of the main cable 14 is diminished, thus prolonging the life of the main cable 14.

Fourth Embodiment

[0033] FIGS. 8 and 9 show a fourth embodiment of the present invention, wherein FIG. 8 is a longitudinal cross-sectional view conceptually showing an elevator system according to the fourth embodiment, and FIG. 9 is a transverse cross-sectional view showing the principal elements shown in FIG. 8. The remaining portion of the elevator system other than shown in FIGS. 8 and 9 are the same in configuration as shown in FIGS. 4 and 5. In these drawings, those reference numerals which are the same as those used in FIGS. 4 and 5 designate corresponding elements.

[0034] Reference numeral 12 designates a first turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the first turning pulley 12 is oriented horizontally. The first turning pulley 12 is interposed between the car 2 and the wall surface of the shaft 1. When viewed in the plane of vertical projection, the side surface of the car 2 and the side surface of the first turning pulley 12 partially overlap. Reference numeral 13 designates a second turning pulley which is mounted on the mount arm 11 in a rotatable manner such that the rotor axis of the second turning pulley 13 is oriented horizontally. The second turning pulley 13 is interposed between the car 2 and the wall surface of the shaft 1. When viewed in the plane of vertical projection, the side surface of the car 2 and the side surface of the second turning pulley 13 partially overlap.

[0035] In the elevator system having the foregoing configuration, the hoist 3 is placed in a plane orthogonal to the predetermined path of the car 2. The rotor axis of the sheave 4 is vertical, and the height of the hoist 3 is designed to be smaller than the diameter of the sheave 4. Further, the first turning pulley 12 having the main cable 14 wound therearound and the second turning pulley 13 having the main cable 14 wound therearound are disposed substantially symmetrically in a plane under the car 2. When the hoist 3 is energized, the car 2 and the counterweight 5 are moved vertically in opposite directions by way of the main cable 14.

[0036] Although detailed description of working-effects of the fourth embodiment is not duplicated, the fourth embodiment shown in FIGS. 8 and 9 also yields the same advantageous working-effects as those yielded by the second embodiment shown in FIGS. 4 and 5.

[0037] In the fourth embodiment shown in FIGS. 8 and 9, the first turning pulley 12 and the second turning pulley 13 are interposed between the wall surface of the shaft 1 and the car 2, such that an overlap exists between the side surfaces of the car 2 and the first and second turning pulleys 12 and 13.

[0038] Accordingly, the height of the car 2 can be diminished by a height corresponding to the space occupied by the first and second turning pulleys 12 and 13, thus shortening the height of the shaft 1. Such reductions in the height of the shaft 1 and the height of the car 2 prevent an increase in construction cost, which would otherwise be caused by ensuring a space for installing an elevator system.

Fifth Embodiment

[0039] FIGS. 10 through 12 show a fifth embodiment of the present invention. FIG. 10 is a longitudinal view conceptually showing an elevator system according to the fifth embodiment; FIG. 11 is a transverse cross-sectional plan view showing the principal elements shown in FIG. 10; and FIG. 12 is a perspective view showing the principal elements shown in FIG. 10. In the drawings, those reference numerals which are the same as those provided in FIGS. 1 through 3 designate corresponding elements. Reference numeral 3 designates a traction hoist. The mount arm 11 is provided on the upper surface of the car 2; that is, in a plane orthogonal to the predetermined path of the car 2, and the traction hoist 3 is mounted on the mount arm 11. Further, the sheave 4 is provided on the traction hoist 3 such that the rotor axis of the sheave 4 is oriented in the vertical direction, and the hoist 3 is configured such that the height of the hoist 3 is smaller than the diameter of the sheave 4.

[0040] Reference numeral 12 designates a first turning pulley which is attached to the mount arm 11 in a rotatable manner such that the rotor axis of the first turning pulley 12 is oriented horizontally. The first turning pulley 12 is positioned so as to face one circumferential edge of the sheave 4. The rim surface of the first turning pulley 12 is positioned at the edge of the car 2. Reference numeral 13 designates a second turning pulley which is attached to the mount arm 11 in a rotatable

manner such that the rotor axis of the second turning pulley 13 is oriented horizontally. The second turning pulley 12 is positioned so as to face other circumferential edge of the sheave 4. The rim surface of the second turning pulley 13 is positioned at the edge of the car 2. The first turning pulley 12 and the second turning pulley 13 are disposed in parallel.

[0041] In the elevator system having the foregoing configuration, the hoist 3, the first turning pulley 12, and the second turning pulley 13 are provided on the upper surface of the car 2. In such a configuration, the hoist 3 is placed in a plane orthogonal to the predetermined path of the car 2. The rotor axis of the sheave 4 is oriented in the vertical direction, and the height of the hoist 3 is arranged to be smaller than the diameter of the sheave 4.

[0042] When the hoist 3 is energized, the car 2 and the counterweight 5 are moved vertically in opposite directions by way of the main cable 14.

[0043] Although detailed description of working-effects of the fifth embodiment is not duplicated, the fifth embodiment shown in FIGS. 10 through 12 also yields the same advantageous working-effects as those yielded by the first embodiment shown in FIGS. 1 through 3.

[0044] The structures and the advantages of the present invention may be summarized as follows.

[0045] In one aspect, as has been described above, the present invention provides an elevator system comprising the components as follows. A car moves vertically along a predetermined path within a shaft. A counterweight moves vertically along another predetermined path within the shaft. A hoist is provided which includes a sheave such that the rotor axis of the sheave is oriented in the vertical direction. The hoist is provided in a plane orthogonal to the predetermined path of the car. The hoist is configured such that the height of the hoist is smaller than the diameter of the sheave. A second turning pulley and a second turning pulley are provided on the same side of the car on which the hoist is placed, and the rotor axis of pulleys are oriented horizontally. The first and the second turning pulley are disposed to face a circumferential edge of the sheave respectively, and the rim surface projects beyond the edge of the car. A top pulley is attached to the top of the shaft in a rotatable manner such that the rotor axis of the top pulley is oriented horizontally. Further, a main cable is wound around a pulley of the counterweight, the top pulley, either the first or second turning pulley, the sheave, and the remaining turning pulley, and both ends of a main cable are connected to the upper end of the shaft.

[0046] In the above structure, the hoist is placed in a plane orthogonal to the predetermined path of the car. The rotor axis of the sheave is oriented in the vertical direction, and the height of the hoist is arranged to be smaller than the diameter of the sheave. Accordingly, the height of the car becomes smaller. When such a car is stopped at the top floor of a building, the top clearance to be insured between the lower surface of the top of the shaft and the top of the car can be made shorter. Therefore, the lower surface of the top of the shaft can be made lower than the height of the top floor of the building, thereby an increase in construction cost is prevented, which would otherwise be caused by ensuring a space for installing an elevator system.

[0047] In another aspect, as described above, a deflector wheel is preferably provided on the same side of the car on which the hoist is placed, such that the rotor axis of the deflector wheel is oriented in the vertical direction. One circumferential edge of the deflector wheel is positioned so as to face one circumferential edge of the sheave, and the other circumferential edge of the deflector wheel is positioned so as to face the circumferential edge of either the first or second turning pulley.

[0048] In the above structure, the hoist is placed in a plane orthogonal to the predetermined path of the car. The rotor axis of the sheave is oriented in the vertical direction, and the height of the hoist is arranged to be smaller than the diameter of the sheave. Accordingly, the height of the car becomes smaller. When such a car is stopped at the top floor of a building, the top clearance to be insured between the lower surface of the top of the shaft and the top of the car can be made shorter. Therefore, the lower surface of the top of the shaft can be made lower than the height of the top floor of the building, thereby an increase in construction cost prevented, which would otherwise be caused by ensuring a space for installing an elevator system.

[0049] By means of the deflector wheel, the first turning pulley having the main cable wound therearound and the second turning pulley having the main cable wound therearound are disposed in a plane of the car symmetrically. This configuration enables suspension of the area in the vicinity of the center of mass of the car, thus the riding comfort of the car is improved.

[0050] In further aspect, as described previously, the rotor axis of the sheave, around which a plurality of main cables are wound in parallel to one another, is tilted at an angle, and, one circumferential edge of the sheave is positioned so as to face the lower circumference of the first turning pulley and the opposite circumferential edge of the sheave is position so as to be positioned in a location closer to the car. Further, the deflector wheel is tilted at an angle, and, one circumferential edge of the deflector wheel is positioned so as to face the upper circumferential edge of the sheave positioned in the location close to the car, and the opposite circumferential edge of the deflector wheel is positioned so as to face the lower circumference of the second turning pulley.

[0051] In the above structure, the hoist is placed in a plane orthogonal to the predetermined path of the car. The rotor axis of the sheave is oriented in the vertical direction, and the height of the hoist is arranged to be smaller than the diameter of the sheave. Accordingly, the height of the car becomes smaller. When such a car is stopped at the top floor of a building, the top clearance to be insured between the lower surface of the top of the

shaft and the top of the car can be made shorter. Therefore, the lower surface of the top of the shaft can be made lower than the height of the top floor of the building, thereby an increase in construction cost is prevented, which would otherwise be caused by ensuring a space for installing an elevator system.

[0052] By means of the deflector wheel, the first turning pulley having the main cable wound therearound and the second turning pulley having the main cable wound therearound are disposed in a plane of the car and symmetrically. This configuration enables suspension of the area in the vicinity of the center of mass of the car, thus the riding comfort of the car is improved. The sheave and the deflector wheel are arranged such that their rotor axes are inclined at an angle, thereby diminishing the fleet angle of the main cable formed between the first turning pulley and the sheave and the fleet angle of the main cable formed between the sheave and the second turning pulley. Consequently, wear of the main cable is prevented, thus prolonging the life of the main cable.

[0053] In still further aspect, as described previously, the first and second turn pulleys are interposed between the car and the wall surface of the shaft such that, when viewed in the plane of vertical projection, a partial overlap exists between the first turning pulley and the side surface of the car and between the second turning pulley and the side surface of the car.

[0054] In the above structure, the hoist is placed in a plane orthogonal to the predetermined path of the car. The rotor axis of the sheave is oriented in the vertical direction, and the height of the hoist is arranged to be smaller than the diameter of the sheave. Accordingly, the height of the car becomes smaller. When such a car is stopped at the top floor of a building, the top clearance to be insured between the lower surface of the top of the shaft and the top of the car can be made shorter. Therefore, the lower surface of the top of the shaft can be made lower than the height of the top floor of the building, thereby preventing an increase in construction cost, which would otherwise be caused by ensuring a space for installing an elevator system.

[0055] Further, by means of the deflector wheel, the first turning pulley having the main cable wound therearound and the second turning pulley having the main cable wound therearound are disposed in a plane of the car and symmetrically. This configuration enables suspension of the car at the area in the vicinity of the center of mass of the car, thus the riding comfort of the car is improved.

[0056] Further, the first turning pulley and the second turning pulley are positioned between the wall surface of the shaft and the car, such that a partial overlap exists between the side surface of the car and the first and second turning pulleys. Accordingly, the height of the car can be diminished by a height corresponding to the space occupied by the first and second turning pulleys, thus shortening the height of the shaft. Such reductions in the height of the shaft and the height of the car prevent an increase in construction cost, which would otherwise be caused by ensuring a space for installing an elevator system.

[0057] Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may by practiced otherwise than as specifically described.

Claims

1. An elevator system comprising:

a car (2) which moves vertically along a predetermined path within a shaft (1);

a counterweight (5) which moves vertically along another predetermined path within the shaft;

a hoist (3) including a sheave (4);

a top pulley (7) which is attached to the top of the shaft in a rotatable manner such that the rotor axis of the top pulley (7) is oriented horizontally; and

a main cable (14) wound around a pulley of the counterweight (6), the top pulley, the first and the second turning pulleys and the sheave, each end of said main cable being connected to the upper end of the shaft;

a first (12) and a second (13) turning pulleys provided on the same side of the car with said hoist, the rotor axis of the first and second turning pulleys being oriented horizontally and the rim surface of said first and a second turning pulleys projecting beyond the edge of the car;

characterized in that

the hoist (3) is mounted to the car (2) in a plane orthogonal to the predetermined path of the car, said hoist (3) including a sheave (4) of which rotor axis is oriented in the vertical direction or is tilted at an angle, said hoist being configured such that the height of the hoist is smaller than the diameter of the sheave (4); and

said first (12) and second (13) turning pulleys being positioned to face a circumferential edge of the sheave.

2. The elevator system according to claim 1, further comprising a deflector wheel (17) provided on the same side with said hoist, the rotor axis of the de-

flector wheel being oriented in the vertical direction or is tilted at an angle, one circumferential edge of the deflector wheel being positioned so as to face one circumferential edge of the sheave, and the opposite circumferential edge of the deflector wheel being positioned so as to face the circumferential edge of either the first (12) or second 13 turning pulley.

3. The elevator system as defined in claim 2, wherein the rotor axis of the sheave is tilted at the angle, one circumferential edge of the sheave being positioned so as to face the lower circumference of the first turning pulley, the opposite circumferential edge of the sheave (4) being positioned to be closer to the car (2); and
the rotor axis of the deflector wheel (17) is tilted at an angle, one circumferential edge of the deflector wheel is positioned so as to face the upper circumferential edge of the sheave, the opposite circumferential edge of the deflector wheel being positioned to face the lower circumference of the second turning pulley (13).

4. The elevator system according to either claim 2 or 3, wherein the first (12) and the second (13) turn pulleys are disposed substantially between the car (2) and the wall surface of the shaft.

Patentansprüche

1. Aufzugsystem, umfassend:

eine Kabine (2), die sich vertikal entlang eines vorbestimmten Pfades innerhalb eines Schachtes (1) bewegt;

ein Gegengewicht (5), das sich vertikal entlang eines anderen vorbestimmten Pfades innerhalb des Schachtes bewegt;

eine Winde (3), inkludierend eine Laufrolle (4);

eine obere Rolle (7), die an dem oberen Ende des Schachtes auf eine drehbare Art und Weise befestigt ist, derart, dass die Rotorachse der oberen Rolle (7) horizontal ausgerichtet ist; und

ein Hauptkabel (14), das um eine Rolle des Gegengewichts (6), die obere Rolle, die ersten und zweiten drehenden Rollen und die Laufrolle gewunden ist, wobei jedes Ende von dem Hauptkabel mit dem oberen Ende des Schachtes verbunden ist;

eine erste (12) und eine zweite (13) drehende Rolle auf der gleichen Seite der Kabine mit der Winde vorgesehen sind, wobei die Rotorachse der ersten und zweiten drehenden Rollen horizontal ausgerichtet ist und die Randfläche der ersten und einer zweiten drehenden Rolle über die Kante der Kabine herausragen;

gekennzeichnet dadurch, dass
die Winde (3) an der Kabine (2) in einer Ebene orthogonal zu dem vorbestimmten Pfad der Kabine befestigt ist, wobei die Winde (3) eine Laufrolle (4) inkludiert, deren Rotorachse in der vertikalen Richtung ausgerichtet oder bei einem Winkel geneigt ist, die Winde derart konfiguriert ist, dass die Höhe der Winde kleiner als der Durchmesser der Laufrolle (4) ist; und
die erste (12) und die zweite (13) drehende Rolle positioniert ist, einer umlaufenden Kante der Laufrolle gegenüberzuliegen.

2. Aufzugsystem nach Anspruch 1, ferner umfassend ein Ablenkrad (17), das auf der gleichen Seite mit der Winde vorgesehen ist, wobei die Rotorachse des Ablenkrads in der vertikalen Richtung ausgerichtet oder bei einem Winkel geneigt ist, eine umlaufende Kante des Ablenkrads derart positioniert ist, um einer umlaufenden Kante der Laufrolle gegenüberzuliegen, und die entgegenliegende umlaufende Kante des Ablenkrads derart positioniert ist, um der umlaufenden Kante von entweder der ersten (12) oder der zweiten (13) drehenden Rolle gegenüberzuliegen.

3. Aufzugsystem nach Anspruch 2, wobei die Rotorachse der Laufrolle bei dem Winkel geneigt ist, wobei eine umlaufende Kante der Laufrolle derart positioniert ist, der unteren Peripherie der ersten drehenden Rolle gegenüberzuliegen, die entgegenliegende umlaufende Kante der Laufrolle (4) positioniert ist, der Kabine (2) näher zu sein; und
die Rotorachse des Ablenkrads (17) bei einem Winkel geneigt ist, eine umlaufende Kante des Ablenkrads derart positioniert ist, der oberen umlaufenden Kante der Laufrolle gegenüberzuliegen, wobei die entgegenliegende umlaufende Kante des Ablenkrads positioniert ist, der unteren Peripherie der zweiten drehenden Rolle (13) gegenüberzuliegen.

4. Aufzugsystem nach entweder Anspruch 2 oder 3, wobei die erste (12) und die zweite (13) drehende Rolle im wesentlichen zwischen der Kabine (2) und der Wandfläche des Schachtes aufgestellt sind.

Revendications

1. Un système d'ascenseur comprenant
une cabine (2) qui se déplace verticalement le long d'un itinéraire prédéterminé à l'intérieur d'un puits

(1) ;
un contrepoids (5) qui se déplace verticalement le long d'un autre itinéraire prédéterminé à l'intérieur du puits ;
un dispositif de hissage (3) incluant une roue à gorge (4) ;
une poulie supérieure (7) qui est attachée au haut du puits d'une manière rotative telle que l'axe de rotor de la poulie supérieure (7) soit orienté horizontalement et
un câble principal (14) enroulé autour d'une poulie du contrepoids (6), de la poulie supérieure, de la première et de la seconde poulies tournantes et de la roue à gorge, chaque extrémité dudit câble principal étant raccordée à l'extrémité supérieure du puits ;
une première (12) et une seconde (13) poulies tournantes installées du même côté de la cabine avec ledit dispositif de hissage, l'axe de rotor de la première et de la seconde poulies tournantes étant orienté horizontalement et la surface de la jante desdites première et seconde poulies tournantes faisant saillie au-delà du bord de la cabine ;
caractérisé par le fait que
le dispositif de hissage (3) est monté sur la cabine (2) dans un plan perpendiculaire à l'itinéraire prédéterminé de la cabine, ledit dispositif de hissage (3) incluant une roue à gorge (4) dont l'axe de rotor est orienté dans la direction verticale ou est incliné sous un certain angle, ledit dispositif de hissage étant configuré de telle façon que la hauteur du dispositif de hissage soit plus petite que le diamètre de la roue à gorge (4) et
lesdites première (12) et seconde (13) poulies tournantes étant positionnées pour faire face à un bord circonférentiel de la roue à gorge.

2. Le système d'ascenseur selon la revendication 1, comprenant en outre une roue déflectrice (17) installée du même côté avec ledit dispositif de hissage, l'axe de rotor de la roue déflectrice étant orienté dans la direction verticale ou étant incliné sous un certain angle, un bord circonférentiel de la roue déflectrice étant positionné de façon à faire face à un bord circonférentiel de la roue à gorge et le bord circonférentiel opposé de la roue déflectrice étant positionné de façon à faire face au bord circonférentiel soit de la première (12), soit de la seconde (13) poulie tournante.

3. Le système d'ascenseur tel que défini dans la revendication 2, dans lequel l'axe de rotor de la roue à gorge est incliné selon l'angle, un bord circonférentiel de la roue à gorge étant positionné de façon à faire face à la circonférence inférieure de la première poulie tournante, le bord circonférentiel opposé de la roue à gorge (4) étant positionné pour être plus proche de la cabine (2) et l'axe de rotor de la roue déflectrice (17) est incliné sous un certain angle, un bord circonférentiel de la roue déflectrice est positionné de façon à faire face au bord circonférentiel supérieur de la roue à gorge, le bord circonférentiel opposé de la roue déflectrice étant positionné pour faire face à la circonférence inférieure de la seconde poulie tournante (13).

4. Le système d'ascenseur selon l'une ou l'autre des revendications 2 ou 3, dans lequel la première (12) et la seconde (13) poulies tournantes sont disposées sensiblement entre la cabine (2) et la surface de la paroi du puits.

FIG. 1

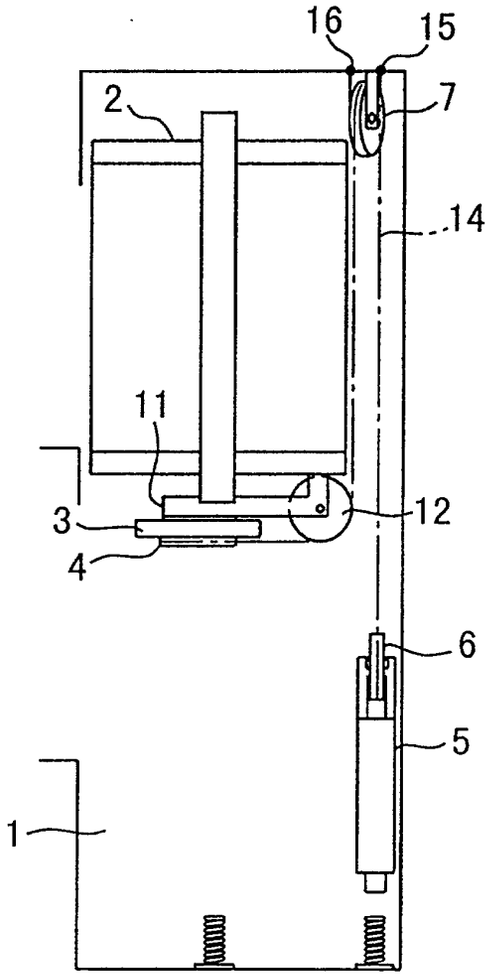

FIG. 2

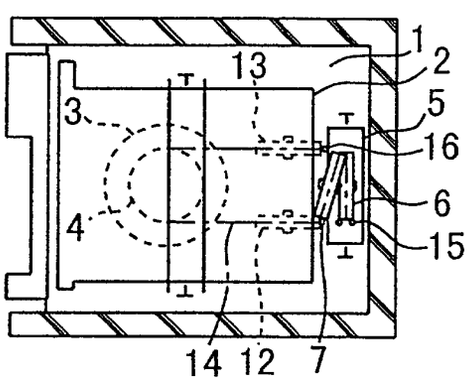

FIG. 3

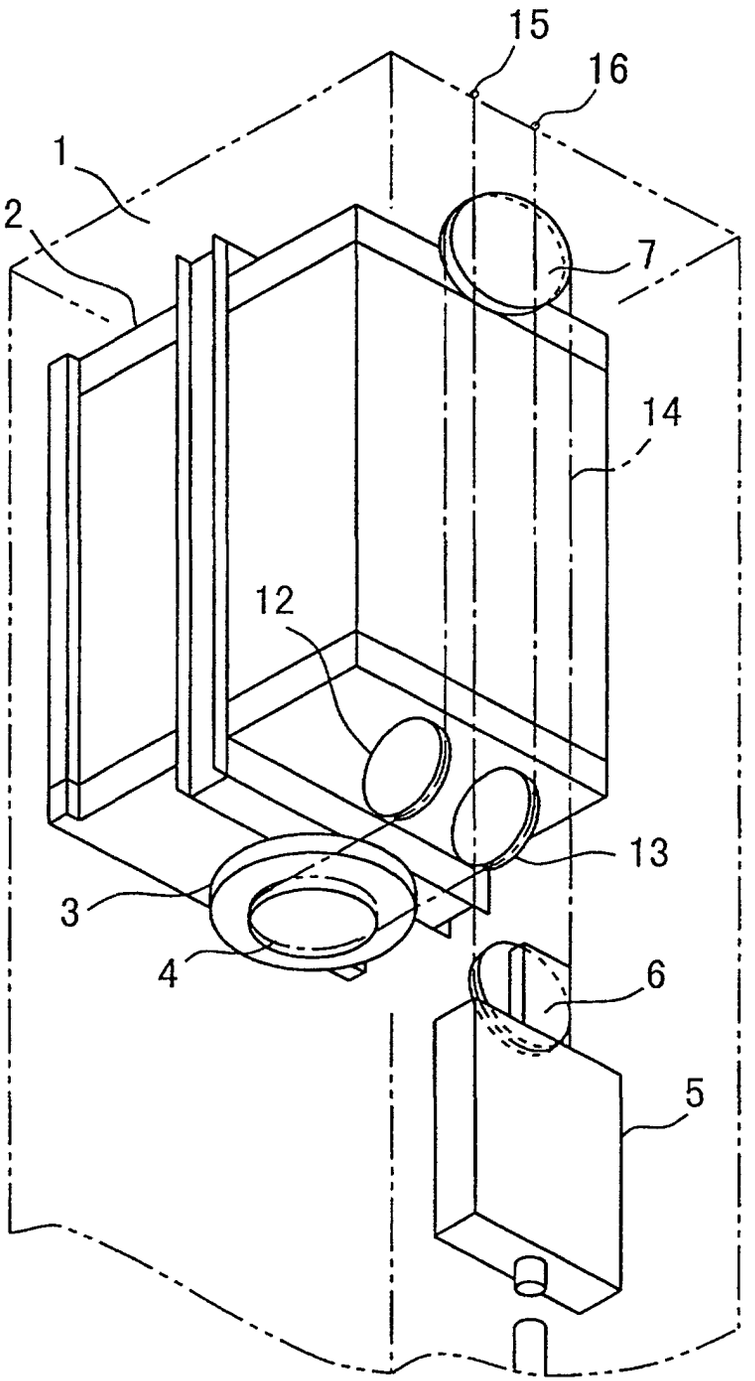

FIG. 4

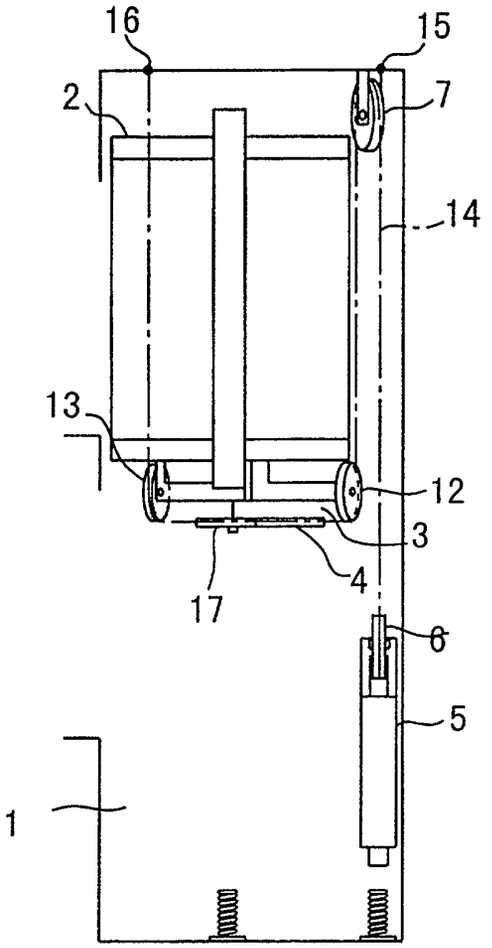

FIG. 5

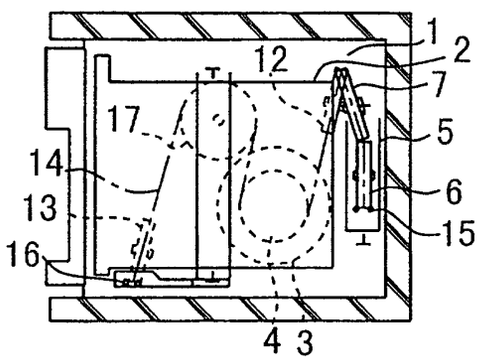

FIG. 6

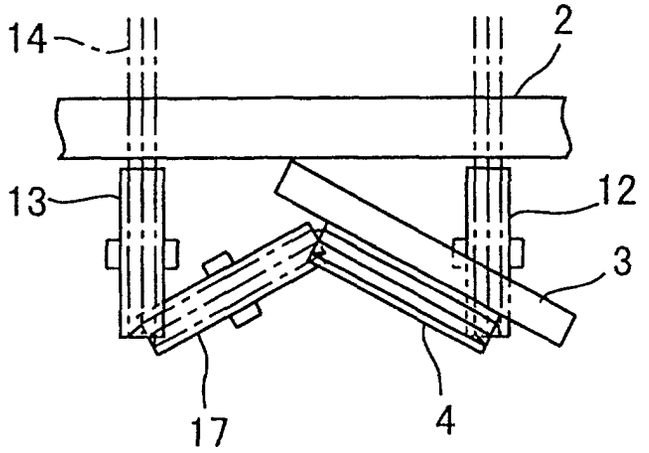

FIG. 7

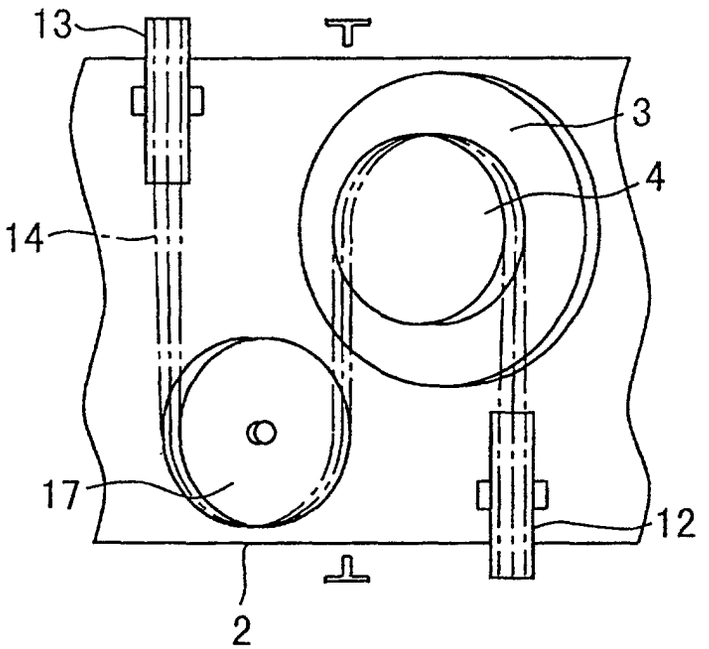

FIG. 8

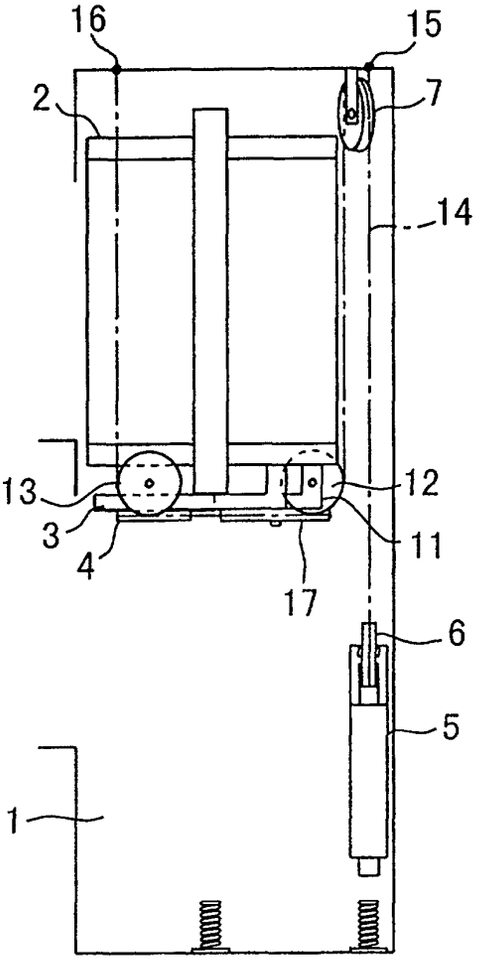

FIG. 9

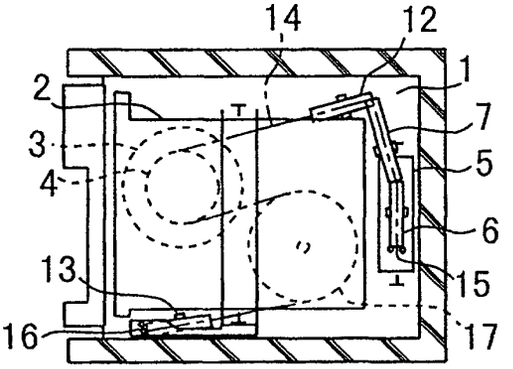

FIG. 10

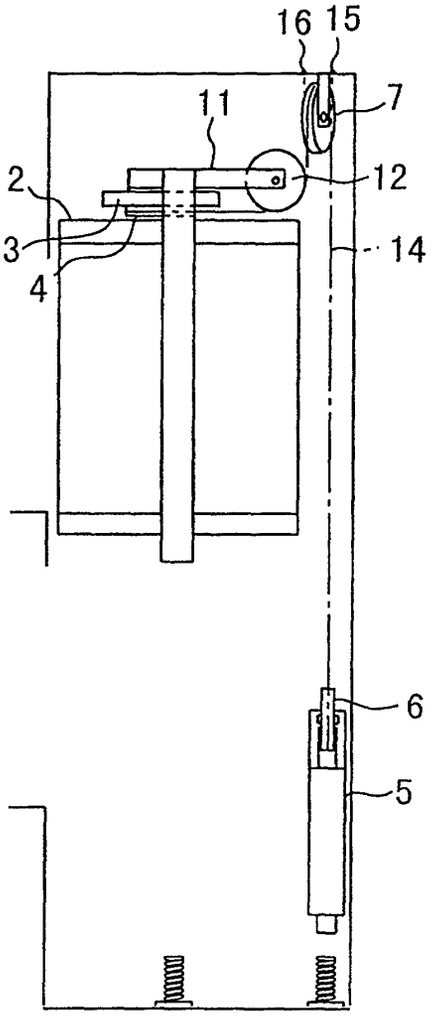

FIG. 11

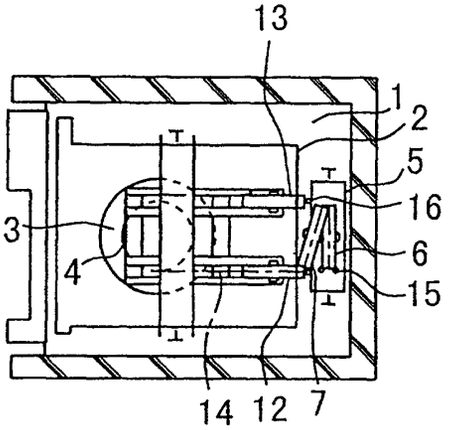

FIG. 12

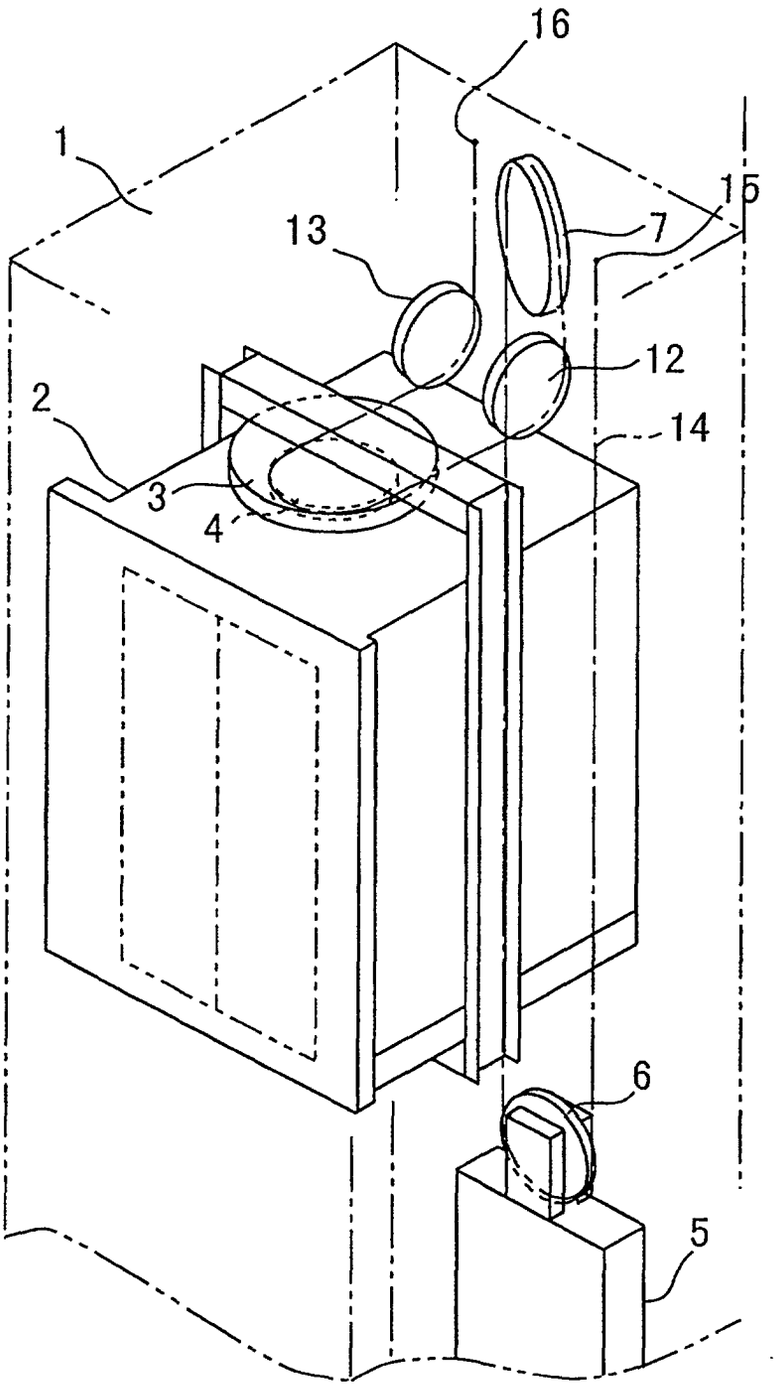

FIG. 13