(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 502 034 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
26.06.2019 Bulletin 2019/26

(51) Int Cl.:
B66B 17/12 *(2006.01)* ***B66B 5/22*** *(2006.01)*
B66B 5/28 *(2006.01)*

(21) Application number: **17208356.0**

(22) Date of filing: **19.12.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(71) Applicant: **KONE Corporation**
00330 Helsinki (FI)

(72) Inventor: **Talonen, Tapani**
00330 Helsinki (FI)

(74) Representative: **Kolster Oy Ab**
(Salmisaarenaukio 1)
P.O. Box 204
00181 Helsinki (FI)

(54) AN ELEVATOR COUNTERWEIGHT ARRANGEMENT

(57) The arrangement comprises a counterweight (41) movably supported in an elevator shaft (20), a buffer unit (100) below the counterweight (41) movably supported in the elevator shaft, at least one safety gear (70) fixedly connected to the buffer unit, and buffers (110, 120) between the counterweight and the buffer unit. The counter weight and the buffer unit are movable in relation to each other.

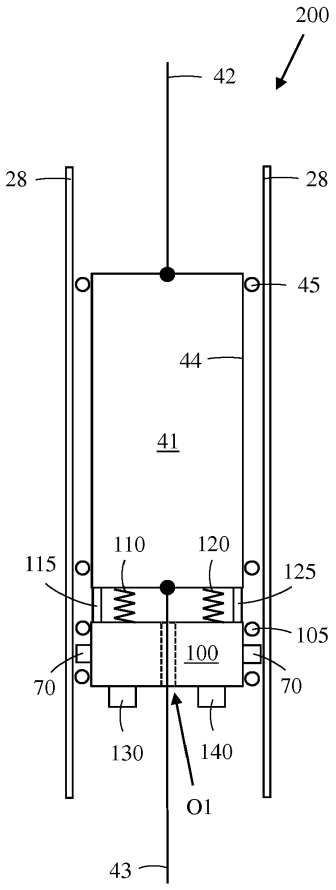

FIG. 3

EP 3 502 034 A1

Description

FIELD

[0001] The invention relates to an elevator counterweight arrangement.

BACKGROUND

[0002] An elevator comprises typically a car, an elevator shaft, lifting machinery, ropes, and a counterweight. The elevator car may be positioned within a sling that supports the car. The lifting machinery may be positioned anywhere in the shaft. The lifting machinery may comprise a drive, an electric motor, a traction sheave, and a machinery brake. The lifting machinery may move the car in a vertical direction upwards and downwards in the vertically extending elevator shaft. The ropes may connect the sling and thereby also the car via the traction sheave positioned in the upper portion of the shaft to the counterweight. The sling may further be supported with gliding means on car guide rails extending along the height of the shaft. The car guide rails may be supported with fastening brackets on the side wall structures of the shaft. The gliding means may engage with the car guide rails and keep the car in position in the horizontal plane when the car moves upwards and downwards in the elevator shaft. The counterweight may be supported in a corresponding way on counterweight guide rails supported on the wall structure of the shaft. The car may transport people and/or goods between the landings in the building. The shaft may be formed so that the wall structure is formed of solid walls or so that the wall structure is formed of an open steel structure.

[0003] Elevators may also be provided with safety equipment for stopping the elevator car and/or the counterweight if a predetermined maximum speed of the elevator car and/or the counterweight is exceeded. An overspeed situation may arise e.g. if the hoisting ropes connecting the elevator car over the traction sheave to the counterweight start slipping on the traction sheave or the hoisting ropes break or the control system fails or the shaft of the traction sheave breaks and the elevator car and/or the counterweight starts falling freely in the elevator shaft. The safety equipment may comprise a speed detector monitoring the speed of the elevator car and/or the speed of the counterweight and at least one safety gear attached to the car and/or the counterweight, said at least one safety gear acting on the guide rail of the car and/or on the counterweight. The speed detector detects an overspeed situation and controls the safety gear to stop the elevator car and/or the counterweight.

[0004] The safety equipment may be based on a mechanical pulley and rope system comprising an upper speed limiter pulley, a lower tensioning pulley and a speed limiter rope running in a closed loop around these pulleys. The speed limiter rope may be connected to a lever of the safety gear. An overspeed situation causes the upper speed limiter pulley to be stopped, whereby the speed limiter rope exerts a pull on the lever, causing the wedges of the safety gears to engage the guide rails in order to stop the elevator car or the counterweight.

[0005] The safety equipment may on the other hand be based on a speed sensor monitoring the speed of the car and/or the counterweight. The speed sensor will, in an overspeed situation, control the safety gear to stop the car and/or the counterweight.

[0006] Elevators in high-rise building may be provided with flat, light-weight belts connecting the car over the traction sheave positioned in the upper portion of the shaft to the counterweight. The friction between the flat, light-weight belts and the traction sheave is high compared to the friction between a conventional circular rope and the traction sheave.

[0007] Elevators in high-rise building may further be provided with compensation ropes connecting the car via a tensioning pulley positioned in the lower portion of the shaft to the lower end of the counterweight.

[0008] The car will stop abruptly when the counterweight stops abruptly. This is due to the fact that the car is connected with the compensation ropes over the tensioning pulley in the lower portion of the shaft directly to the counterweight.

[0009] The deceleration of the car may greatly exceed the 1 G limit set by safety regulations when the counterweight stops abruptly against the buffers or when the counterweight stops abruptly due to activation of the safety gear of the counterweight, whereby a backlash is directed to the car via the compensation ropes.

SUMMARY

[0010] An object of the present invention is an improved elevator counterweight arrangement. The arrangement aims at limiting the backlash of the compensation ropes upon a sudden stop of the counterweight.

[0011] The elevator counterweight arrangement according to the invention is defined in claim 1.

[0012] The elevator counterweight arrangement comprises:

- a counterweight movably supported in an elevator shaft,
- a buffer unit positioned below the counterweight and being movably supported in the elevator shaft,
- at least one safety gear fixedly connected to the buffer unit, the at least one safety gear acting on at least one counterweight guide rail in the elevator shaft,
- buffers extending between the counterweight and the buffer unit, whereby the counter weight is supported on the buffer unit via the buffers so that the counterweight and the buffer unit are movable in relation to each other.

[0013] The buffer unit will stop almost immediately when the at least one safety gear of the buffer unit is

activated to grip the counterweight guide rail. The counterweight will, however, not stop immediately. The counterweight may instead continue the downwards directed movement towards the stationary buffer unit as the buffers between the counterweight and the buffer unit allow a certain downwards directed movement of the counterweight towards the stationary buffer unit.

[0014] The buffers between the counterweight and the buffer unit will thus receive and absorb the impact of the counterweight. This means that the counterweight and thereby also the car will not stop abruptly when the at least one safety gear attached to the buffer unit is activated. The jerk of the compensation ropes on the car will be eliminated or reduced significantly. It may be possible to restrict the deceleration of the car to a value below 1 G in a sudden stop of the counterweight.

[0015] The buffers between the counterweight and the buffer unit will also receive and absorb the impact of the counterweight when the counterweight arrangement hits the bottom of the shaft. Separate buffers at the bottom of the shaft may not be necessary in some cases or their size can be reduced.

[0016] The invention can be used in connection with any kind of safety equipment for stopping the counterweight.

[0017] The safety equipment may be based on a mechanical overspeed detection system e.g. based on a pulley and rope system comprising an upper speed limiter pulley, a lower tensioning pulley and a speed limiter rope running in a closed loop around these pulleys. The speed limiter rope will then activate the safety gear or the safety gears connected to the buffer unit.

[0018] The safety equipment may on the other hand be based on an electronic overspeed detection system e.g. based on electronical devices such as one or more acceleration sensors or it may be based on encoder data. The encoder may be used to measure the rotation speed of the electric motor driving the traction sheave. The overspeed detection system may on the other hand be based on mechanical devices e.g. a roller acting on the car guide rail.

[0019] The invention can be used in connection with any kind of safety gear. The safety gear may be provided only in connection with one counterweight guide rail or in connection with both counterweight guide rails or there may be more than one safety gear on each counterweight guide rail.

[0020] The invention can be used in connection with any kind of elevators. The invention is especially suitable to be used in high-rise or mega-high rise buildings in which flat, light-weight belts connecting the car over the traction sheave to the counterweight may be used. Also compensation ropes may be used in high-rise buildings.

[0021] The hoisting height in a high-rise building is at least 30 m. The friction between flat, light-weight belts used in high-rise buildings and the traction sheave is high compared to the friction between a conventional circular rope and the traction sheave.

DRAWINGS

[0022] The invention will in the following be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 shows a cross sectional view of an elevator,
Figure 2 shows a side view of the elevator,
Figure 3 shows a cross-sectional view of a first embodiment of an elevator counterweight arrangement according to the invention,
Figure 4 shows a cross-sectional view of a second embodiment of an elevator counterweight arrangement according to the invention,
Figure 5 shows a cross sectional view of the safety gear,
Figure 6 shows a further cross sectional view of the safety gear.

DETAILED DESCRIPTION

[0023] Fig. 1 shows a vertical cross section in the side to side direction of a first embodiment of an elevator.

[0024] The elevator may comprise a car 10, an elevator shaft 20, lifting machinery 60, ropes 42, and a counterweight 41. A separate or an integrated sling 11 may surround the car 10.

[0025] The lifting machinery 60 may comprise a drive 61, an electric motor 62, a traction sheave 63, and a machinery brake 64. The lifting machinery 60 moves the car 10 in a vertical direction Z upwards and downwards in the vertically extending elevator shaft 20. The machinery brake 64 stops the rotation of the traction sheave 63 and thereby the movement of the elevator car 10.

[0026] The sling 11 is connected by the ropes 42 via the traction sheave 63 to the counterweight 41. The sling 11 is further supported with gliding means 27 at car guide rails 25 extending in the vertical direction in the shaft 20. The gliding means 27 can comprise rolls rolling on the car guide rails 25 or gliding shoes gliding on the car guide rails 25 when the car 10 is moving upwards and downwards in the elevator shaft 20. The car guide rails 25 are attached with fastening brackets 26 to the side wall structures 21 in the elevator shaft 20. The gliding means 27 keep the car 10 in position in the horizontal plane when the car 10 moves upwards and downwards in the elevator shaft 20. The counterweight 41 is supported in a corresponding way on guide rails that are attached to the wall structure 21 of the shaft 20.

[0027] The car 10 transports people and/or goods between the landings in the building. The elevator shaft 20 can be formed so that the wall structure 21 is formed of solid walls or so that the wall structure 21 is formed of an open steel structure.

[0028] Figure 2 shows a side view of the elevator.

[0029] The car 10 is connected with the hoisting rope 42 over the traction sheave 63 positioned in the upper portion of the shaft 20 to the counterweight 41. The car

10 is further connected with the compensation rope 43 over the tensioning pulley 31 positioned in the lower portion of the shaft 20 to the counterweight 41. There is further a diverting pulley 33 after the traction sheave 63 in the upper portion of the shaft 20 and a diverting pulley 32 after the tensioning pulley 31 in the lower portion of the shaft 20. The diverting pulleys 33, 32 may be needed in order achieve a sufficient horizontal distance between the car 10 and the counterweight 41. Compensation ropes 43 are used especially in high-rise buildings in order to offset the imbalance of the weight of the hoisting ropes 42 on the car 10 side of the traction sheave 63 and that on the counterweight 41 side of the traction sheave 63. If compensation ropes where not used, driving motors of considerably larger size would have to be used. There is also the problem that the friction between the hoisting rope and the traction sheave might not be big enough to keep the hoisting rope from slipping in high-rise buildings. The expression compensation rope includes any types of ropes e.g. ropes, belts and chains.

[0030] Figure 3 shows a cross-section of a first embodiment of an elevator counterweight arrangement according to the invention.

[0031] The elevator counterweight arrangement 200 may comprise a counterweight 41, a buffer unit 100 positioned below the counterweight 41, buffers 110, 120 positioned between the counterweight 41 and the buffer unit 100, and at least one safety gear 70 fixedly connected to the buffer unit 100.

[0032] The counterweight 41 may be movably supported on vertical counterweight guide rails 28. The vertical counterweight guide rails 28 may be parallel and positioned at a distance from each other. The counterweight 41 may move vertically upwards and downwards along the counterweight guide rails 28. The counterweight 41 may be supported with gliding means or roller means 45 on the counterweight guide rails 28.

[0033] The hoisting ropes 42 may be connected to an upper end of the counterweight 41. The compensation ropes 43 may be connected to a lower end of the counterweight 41. The compensation ropes 43 may pass through the buffer unit 100, e.g. through an opening O1 arranged in the buffer unit 100. The compensation ropes 43 may on the other hand by-pass the buffer unit 100 so that the buffer unit 100 becomes supported by the counterweight 41 and movement of the buffer unit 100 relative to the counterweight 41 is allowed.

[0034] The counterweight 41 may be formed of a stack of weights positioned within a frame 44. The frame 44 may surround the stack of weights. The frame 44 may have a rectangular form. The stack of weights is fixedly attached to the frame 44.

[0035] The buffer unit 100 may be positioned below the counterweight 41. The counterweight 100 may be supported via buffers 110, 120 on the buffer unit 100. The counterweight 41 and the buffer unit 100 may be movable in relation to each other. The movement may be limited by the maximum vertical distance between the counterweight 41 and the buffer unit 100. There may further be guide means 115, 125 extending between the counterweight 41 and the buffer unit 100. The guide means 115, 125 may keep the buffer unit 100 in line with the counterweight 41. The buffer unit 100 may on the other hand also be movably supported on the counterweight guide rails 28, whereby guide means 115, 125 between the counterweight 41 and the buffer unit 100 might not be needed. The buffer unit 100 may be supported with gliding means or roller means 125 on the counterweight guide rails 28. Limiting means may further be provided between the counterweight 41 and the buffer unit 100. The limiting means limit the distance between the counterweight 41 and the buffer unit 100 to a maximum value. The buffers 110, 120 may as such form also the limiting means or the limiting means may be integrated to the buffers 110, 120. The guide means 115, 125 may on the other hand as such also form the limiting means or the limiting means may be integrated into the guide means 115, 125.

[0036] The buffer unit 100 may have a rectangular form.

[0037] At least one safety gear 70 may further be fixedly connected to the buffer unit 100. The at least one safety gear 70 may act on the counterweight guide rail 28. There may thus be one safety gear 70 acting on the first counterweight guide rail 28 and a second safety gear 70 acting on the second counterweight guide rail 28. There may also be two safety gears 70 at each side of the buffer unit 100.

[0038] Buffers 110, 120 may extend between the counterweight 41 and the buffer unit 100. An upper end of the buffers 110, 120 may be attached to a bottom portion of the counterweight 41. A lower end of the buffers 110, 120 may be attached to a roof portion of the buffer unit 100. The buffers 110, 120 form dampers between the counterweight 41 and the buffer unit 100. The buffers 110, 120 may be formed of an elastic material or they may be springs or they may be hydraulic buffers. The buffers 110, 120 may be constructed so that they allow only a certain predetermined maximum vertical distance between the counterweight 41 and the buffer unit 100.

[0039] Buffer strikers 130, 140 may further be attached to the bottom of the buffer unit 100. The buffer strikers 130, 140 may strike on separate shock receiving elements positioned on the bottom of the shaft 20. The shock receiving elements may be formed of additional bottom buffers positioned on the bottom of the shaft 20. The shock receiving elements may be rigid or in case they are formed as additional bottom buffers they may be formed of an elastic material or they may be springs or they may be hydraulic buffers.

[0040] The buffer unit 100 will stop almost immediately when the safety gears 70 fixedly connected to the buffer unit 100 are activated to grip on the counterweight guide rail 28. The counterweight 41 will, however, not stop immediately. The counterweight 41 will instead continue the downwards directed movement as the counterweight

41 may glide downwards along the counterweight guide rails 28 towards the stationary buffer unit 100. The buffers 110, 120 between the counterweight 41 and the buffer unit 100 will thus receive and absorb the impact of the counterweight 41. This means that the counterweight 41 and thereby also the car 10 will not stop abruptly when the safety gears 70 are activated. The jerk of the compensation ropes 43 on the car 10 will be eliminated or reduced significantly.

[0041] The buffers 110, 120 will also receive and absorb the impact of the counterweight 41 when the counterweight arrangement hits the bottom of the shaft 20 i. e. the buffer strikers 130, 140 hit the shock receiving elements on the bottom of the shaft 20. The shock receiving elements at the bottom of the shaft 20 may thus at least in some cases be rigid elements. This means that separate buffers at the bottom of the shaft 20 may not necessary be needed.

[0042] Figure 4 shows a cross-sectional view of a second embodiment of an elevator counterweight arrangement according to the invention.

[0043] The elevator counterweight arrangement 200 may comprise a counterweight 41, a buffer unit 100 positioned below the counterweight 41, buffers 110, 120 positioned between the counterweight 41 and the buffer unit 100, and at least one safety gear 70 fixedly connected to the buffer unit 100.

[0044] The counterweight 41 and the buffer unit 100 may be positioned within a common frame 144. The common frame 144 may be movably supported on the counterweight guide rails 28. The common frame 144 may be supported with gliding means or roller means 105 on the counterweight guide rails 28. The counterweight 41 may further be movably supported within the common frame 144. The counterweight 41 may be supported with gliding means or roller means 45 on guide rails in the common frame 144. The buffer unit 100 may be fixedly supported at a bottom of the common frame 144.

[0045] The hoisting ropes 42 may be connected to an upper end of the counterweight 41. The hoisting ropes 42 may pass through an opening in the common frame 144 to the upper end of the counter weight 41. The hoisting ropes 42 are not in any way connected to the common frame 144. The compensation ropes 43 may be connected to a lower end of the counterweight 41. The compensation ropes 43 may pass through or by the buffer unit 100 e.g. through an opening O1 arranged in the buffer unit 100. The compensation ropes 43 are not connected in any way to the buffer unit 100. The compensation ropes 43 are also not connected in any way to the common frame 144.

[0046] The counterweight 41 may move vertically upwards and downwards within the frame 144, whereas the buffer unit 100 may be fixed within the frame 144.

[0047] The counterweight 41 may be formed of a stack of weights positioned within a frame 44. The frame 44 may surround the stack of weights. The frame 44 may have a rectangular form. The stack of weights may be fixedly attached to the frame 44.

[0048] The buffer unit 100 may be positioned below the counterweight 41. The counterweight 41 may be supported with buffers 110, 120 on the buffer unit 100. The counterweight 41 and the buffer unit 100 may be movable in relation to each other. The movement may be limited by the maximum vertical distance between the counterweight 41 and the buffer unit 100. The buffer unit 100 may be fixed at the bottom of the common frame 144 and the counterweight 41 may be movably supported with gliding means or roller means 45 within the common frame 144. There is thus no need for additional guide means between the counterweight 41 and the buffer unit 100. The upwards movement of the counterweight 41 may be restricted with stoppers 145, 146 extending downwards from the upper horizontal portion of the common frame 144.

[0049] The buffer unit 100 may have a rectangular form.

[0050] At least one safety gear 70 may be fixedly connected to the buffer unit 100. The at least one safety gear 70 may act on the counterweight guide rail 28. There may thus be one safety gear 70 acting on the first counterweight guide rail 28 and a second safety gear 70 acting on the second counterweight guide rail 28. There may also be two safety gears 70 at each side of the buffer unit 100.

[0051] The at least one safety gear 70 need not necessary be positioned in connection with the buffer unit 100 in this embodiment. The at least one safety gear 70 could be positioned anywhere on the common frame 144. The at least one safety gear 70 would still be fixedly connected to the buffer unit 100 as the buffer unit 100 is fixedly attached to the common frame 144.

[0052] Buffers 110, 120 may extend between the counterweight 41 and the buffer unit 100. An upper end of the buffers 110, 120 may be attached to a bottom portion of the counterweight 41. A lower end of the buffers 110, 120 may be attached to a roof portion of the buffer unit 100. The buffers 110, 120 form dampers between the counterweight 41 and the buffer unit 100. The buffers 110, 120 may be formed of an elastic material or they may be springs or they may be hydraulic buffers.

[0053] Buffer strikers 130, 140 may further be attached to the bottom of the buffer unit 100. The buffer strikers 130, 140 may strike on separate shock receiving elements positioned on the bottom of the shaft 20. The shock receiving elements may be formed of additional bottom buffers positioned on the bottom of the shaft 20. The shock receiving elements may be rigid or in case they are formed as additional bottom buffers they may be formed of an elastic material or they may be springs or they may be hydraulic buffers.

[0054] The buffer unit 100 and the thereby also the common frame 144 will stop almost immediately when the safety gears 70 are activated to grip on the counterweight guide rail 28. The counterweight 41 will, however, not stop immediately. The counterweight 41 will instead

continue the downwards directed movement as the counterweight 41 may glide downwards within the common frame 144 towards the stationary buffer unit 100. The buffers 110, 120 between the counterweight 41 and the buffer unit 100 will thus receive and absorb the impact of the counterweight 41. This means that the counterweight 41 and thereby also the car 10 will not stop abruptly when the safety gears 70 are activated. The jerk of the compensation ropes 43 on the car 10 will be eliminated or reduced significantly.

[0055] The buffers 110, 120 will also receive and absorb the impact of the counterweight 41 when the counterweight arrangement 200 hits the bottom of the shaft 20 i.e. the buffer strikers 130, 140 hit the shock receiving elements on the bottom of the shaft 20. The shock receiving elements at the bottom of the shaft 20 may thus at least in some cases be rigid elements. This means that separate buffers at the bottom of the shaft 20 may not be necessary.

[0056] Figure 5 shows a cross section of a safety gear and figure 6 shows a further cross section of the safety gear.

[0057] The safety gear 70 comprises a frame 74, a force element 73, a brake surface 71, and a support surface 72. The frame 74 has a shape of a letter C, whereby the guide portion of the counterweight guide rail 28 protrudes into the opening in the letter C. The brake surface 71 is at a distance from a first side surface of the guide portion 28A of the counterweight guide rail 28 and the support surface 72 is at a distance from an opposite, second side surface of the guide portion 28A of the counterweight guide rail 28. The force element 73 may be a roll rotating on a shaft 76. An outer end of the shaft 76 may be supported on a shield 75 of the frame 74. The outer end of the shaft 76 may pass through an oblong guide opening in the shield 75. The oblong guide opening in the shield 75 has the same form as the support surface 72. The support surface 72 may form a straight or inclined track or the support surface 72 may have any other form. The support surface 72 may form one or several curved tracks or one or several curved tracks and straight tracks positioned after each other in any order. The curvature of the curved tracks may be the same or they may have a different curvature.

[0058] The general idea is that the roll 73 is pressed to the left towards the side surface of the guide portion 28A of the counterweight guide rail 28 when the shaft 76 of the roller 73 moves upwards in the guide opening in the shield 75. The form of the support surface 72 will determine the time it takes for the roller 73 to come into contact with the side surface of the guide portion 28A of the counterweight guide rail 28 at a certain speed of the counterweight 41. Once the roller 73 comes into contact with the side surface of the guide portion 28A and is further urged towards the side surface of the guide portion 28A of the counterweight guide rail 28 by the support surface 72, the safety gear 70 will be moved to the right so that the brake surface 71 comes into contact with the opposite side surface of the guide portion 28A of the counterweight guide rail 28. The safety gear 70 will thereby start braking with the brake surface 71. The roll 73 can still after this move a bit upwards whereby the braking force of the brake surface 71 is intensified. The rotation of the roll 73 will at the upper end of the support surface 72 be stopped, whereby the outer surface of the roll 73 forms a second brake surface against the side surface of the guide portion 28A of the counterweight guide rail 28.

[0059] There could be two or four or any number of buffers 110, 120 between the counterweight 41 and the buffer unit 100.

[0060] There could also be two or four or any number of guide means 115, 125 between the counterweight 41 and the buffer unit 100.

[0061] There could also be two or four or any number of buffer strikers 130, 140 attached to the bottom of the buffer unit 100.

[0062] The invention can be used in connection with any kind of safety gear arrangement i.e. the use of the invention is not limited to the safety gear arrangement disclosed in the figures.

[0063] The invention can be used in connection with any kind of counterweight guide rail i.e. i.e. the use of the invention is not limited to the counterweight guide rail disclosed in the figures.

[0064] The invention can be used in any type of elevator i.e. the use of the invention is not limited to the elevator disclosed in the figures. The elevator may or may not be provided with a machine room. The counterweight could be positioned on either side wall or on both side walls or on the back wall of the elevator shaft. The drive, the motor, the traction sheave, and the machine brake could be positioned in a machine room or somewhere in the elevator shaft. The car guide rails could be positioned on opposite side walls of the shaft or on a back wall of the shaft in a so called ruck-sack elevator.

[0065] It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. An elevator counterweight arrangement (200) comprising:

a counterweight (41) movably supported in an elevator shaft (20),
a buffer unit (100) positioned below the counterweight (41) and being movably supported in the elevator shaft (20),
at least one safety gear (70) fixedly connected to the buffer unit (100), the at least one safety

gear (70) acting on at least one counterweight guide rail (28) in the elevator shaft (20),
buffers (110, 120) extending between the counterweight (41) and the buffer unit (100), whereby the counter weight (41) is supported on the buffer unit (100) via the buffers (110, 120) so that the counterweight (41) and the buffer unit (100) are movable in relation to each other.

2. The counterweight arrangement (200) according to claim 1, wherein an upper end of the buffers (110, 120) is attached to the counterweight (41) and a lower end of the buffers (110, 120) is attached to the buffer unit (100).

3. The counterweight arrangement (200) according to claim 1 or 2, wherein the counterweight (41) is supported with gliding means or roller means (45) on the counterweight guide rails (28).

4. The counterweight arrangement (200) according to any one of claims 1 to 3, wherein the buffer unit (100) is movably supported on the counterweight guide rails (28).

5. The counterweight arrangement (200) according to claim 4, wherein the buffer unit (100) is supported with gliding means or roller means (105) on the counterweight guide rails (28).

6. The counterweight arrangement (200) according to any one of claims 1 to 5, wherein guide members (115, 125) are provided between the counterweight (41) and the buffer unit (100) in order to keep the buffer unit (100) in line with the counterweight (41) when the counterweight (41) and the buffer unit (10) move in relation to each other.

7. The counterweight arrangement (200) according to claim 1, wherein the counterweight (41) and the buffer unit (100) are positioned within a common frame (144), the common frame (100) being movably supported on the counterweight guide rails (28).

8. The counterweight arrangement (200) according to claim 7, wherein the counterweight (41) is movably supported within the common frame (144) and the buffer unit (100) is fixed within the common frame (144).

9. The counterweight arrangement (200) according to any one of claims 1 to 8, wherein buffer strikers (130, 140) are attached to a bottom of the buffer unit (100).

10. An elevator comprising an elevator car (10) movably supported in an elevator shaft (20), a counterweight (41) movably supported in the shaft (20), hoisting ropes (42) connecting the elevator car (10) over a traction sheave (63) positioned in an upper portion of the elevator shaft (20) to an upper end of the counterweight (41), and compensation ropes (43) connecting the car (10) via a tensioning pulley (31) positioned in a lower portion of the elevator shaft (20) to a lower end of the counterweight (41), the car (10) and the counterweight (41) moving in opposite directions upwards and downwards in the elevator shaft (20), whereby the elevator comprises an elevator counterweight arrangement (200) according to any one of claims 1 to 9.

11. The elevator according to claim 10, whereby the hoisting ropes (42) are formed of flat, light-weight belts, whereby the friction between the traction sheave (63) and the flat, light-weight belts is high compared to the friction between a conventional circular rope and the traction sheave (63).

12. The elevator according to claim 10 or 11, whereby the elevator is in a high-rise building having a hoisting height of at least 30 m.

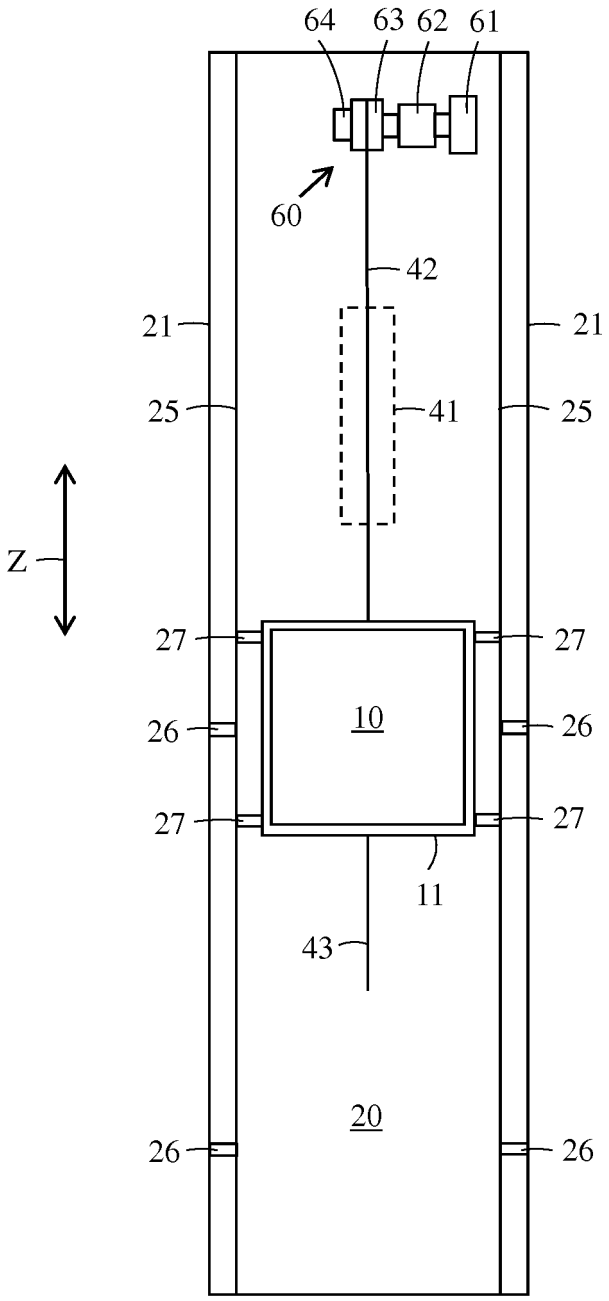

FIG. 1

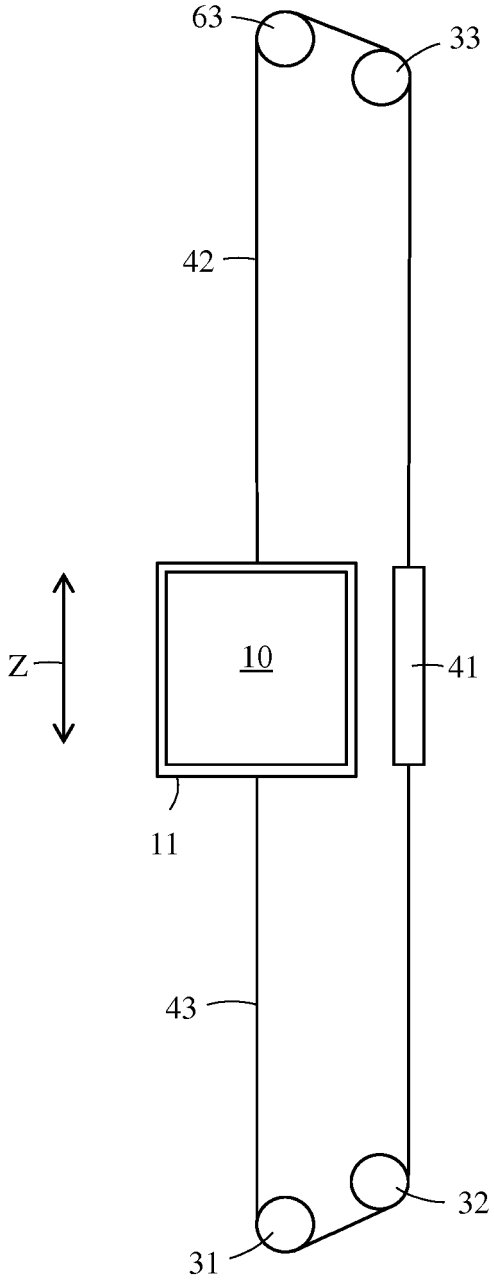

FIG. 2

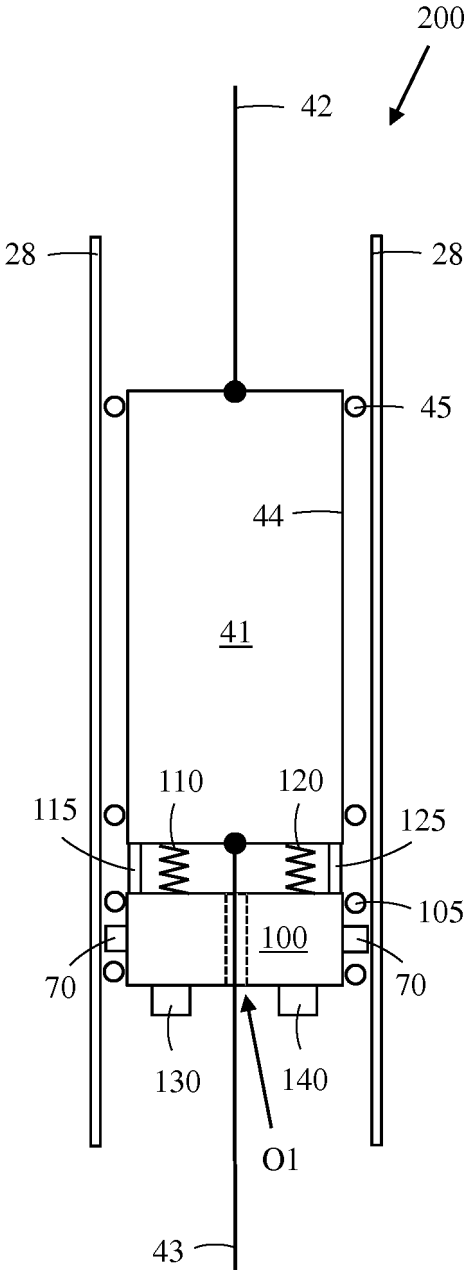

FIG. 3

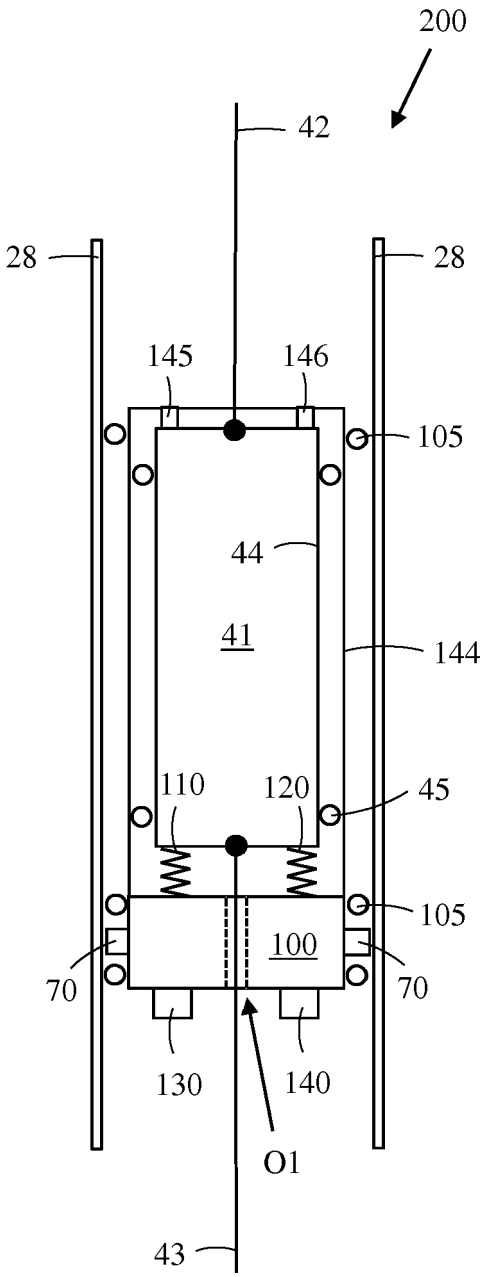
200
42
28
28
145
146
105
44
41
144
110
120
45
105
100
70
70
130
140
O1
43

FIG. 4

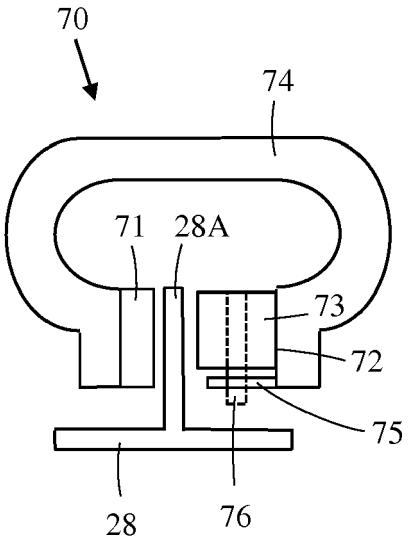

FIG. 5

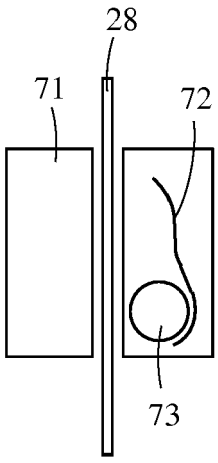

FIG. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 20 8356

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 22 01 735 A1 (HEIN LEHMANN AG) 19 July 1973 (1973-07-19) * figures 6, 7 * * page 11, line 12 - page 12, line 10 * * page 13, lines 18-25 *	1-6,9-12 7,8	INV. B66B17/12 B66B5/22 B66B5/28
Y	GB 2 270 292 A (HITACHI LTD [JP]) 9 March 1994 (1994-03-09) * abstract; figures 1, 10 *	7,8	
A	DE 10 2008 049379 A1 (WIDMANN MANUELA [DE]) 17 September 2009 (2009-09-17) * the whole document *	1-12	
A	JP 4 578957 B2 (TOSHIBA ELEVATOR CO LTD) 10 November 2010 (2010-11-10) * the whole document *	1-12	

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 July 2018	Dogantan, Umut H.

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 8356

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-07-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2201735 A1	19-07-1973	NONE	
GB 2270292 A	09-03-1994	GB 2270292 A	09-03-1994
		HK 193796 A	01-11-1996
		JP 3428042 B2	22-07-2003
		JP H06100273 A	12-04-1994
		SG 44469 A1	19-12-1997
DE 102008049379 A1	17-09-2009	NONE	
JP 4578957 B2	10-11-2010	JP 4578957 B2	10-11-2010
		JP 2006168927 A	29-06-2006

EPO FORM P0459

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