

TRANSPORT LIFT

BACKGROUND

1. Field

[0001] Embodiments relate to a transport lift.

2. Description of the Related Art

[0002] In general, a transport lift for construction and civil engineering work includes a hoist rope wound several times around drums, and a rail structure installed on a basement vertical tunnel to vertically move a cage accommodating a vehicle.

[0003] However, such a transport lift for construction and civil engineering work is provided with rails to stably move a cage from the ground to a basement, thus increasing costs and time for installing the transport lift.

[0004] To address this limitation, only a hoist rope is used to vertically move a cage. However, in this case, when a vehicle comes in or out of the cage, or when the cage vertically moves, the cage hung on the hoist rope excessively shakes. This may cause a driver in the vehicle to feel nervous.

SUMMARY

[0005] An aspect of the present invention provides a transport lift that can economically and safely move a cage in the vertical direction.

[0006] Another aspect of the present invention provides a transport lift that can safely and rapidly move a cage in the vertical direction.

[0007] Another aspect of the present invention provides a transport lift that includes a tail rope as well as a hoist rope and a head rope to prevent an uneven load from being applied to a cage, regardless of the positions of the cage.

[0008] Another aspect of the present invention provides a transport lift that can safely lock a cage when the cage is stopped, and to prevent vertical shaking of the cage when a vehicle comes in and out of the cage.

[0009] Another aspect of the present invention provides a transport lift that can safely lock a vehicle in a cage.

[0010] Another aspect of the present invention provides a transport lift that can safely accommodate a vehicle, a cargo, and a person in a cage.

[0011] According to at least one of embodiments, a transport lift includes: a hoist part including a top frame, a driving motor installed on the top frame, a pair of drums installed on the driving motor, a hoist rope installed on each of the drums, and a head rope installed on each of the drums; a cage coupled to the hoist rope of the hoist part to vertically move; a counterweight coupled to the head rope of the hoist part to move in an opposite direction to a direction in which the cage moves; and a tail rope coupled to the cage and the counterweight such that the tail rope, the hoist rope, and the head rope apply an identical weight to the cage.

[0012] The hoist rope and the head rope may have an identical diameter, and be connected to each other on the drum.

[0013] A take-up sheave may be installed on the top frame at a front side of the drum, and a forward sheave may be installed at a front side of the take-up sheave, and a front top sheave may be installed at a front side of the forward sheave; a middle frame may be installed at a lower side of the top frame, and a front middle

sheave may be installed on the middle frame; and a portion of the hoist rope may be coupled to a front cage upper sheave installed on an upper portion of the cage through the take-up sheave, the forward sheave, the front top sheave, and the front middle sheave, and the hoist rope coupled to the front cage upper sheave may be fixed to the top frame.

[0014] A backward sheave and a rear top sheave may be installed on the top frame; a middle frame may be installed at a lower side of the top frame, and a rear middle sheave may be installed on the middle frame; and a portion of the hoist rope may be coupled to a rear cage upper sheave installed on an upper portion of the cage through the backward sheave and the rear top sheave, and subsequently, be coupled to the rear middle sheave, and then, be fixed to the top frame.

[0015] A take-up sheave may be installed on the top frame at a front side of the drum, and a top center sheave may be installed at a front side of the take-up sheave, and a top lower center sheave may be installed at a rear side of the top center sheave; a middle frame may be installed at a lower side of the top frame, and a middle center sheave and a middle side sheave may be installed on the middle frame; and the head rope may be coupled to the take-up sheave, the top center sheave, a top front sheave, and the top lower center sheave, and subsequently, be coupled to the middle center sheave and the middle side sheave, and be coupled to a weight upper sheave installed on an upper portion of the counterweight, and then, be fixed to the top frame.

[0016] A cage lower sheave may be installed on a lower portion of the cage, a bottom frame may be installed on a lower side of the cage, a bottom center sheave and a bottom side sheave may be installed on the bottom frame, an end of the tail

rope may be fixed to the bottom frame, and the other end of the tail rope may be coupled to the cage lower sheave, the bottom center sheave, and the bottom side sheave, and subsequently, be coupled to a weight lower sheave installed on a lower portion of the counterweight, and then, be fixed to the bottom frame.

[0017] A middle frame may be installed at an upper side of the cage, and a bottom frame may be installed at a lower side of the cage, and a cage guide rope may be installed between the middle frame and the bottom frame, and a guide roller coupled with the cage guide rope may be installed at a side of the cage.

[0018] A middle frame may be installed at an upper side of the cage, and a bottom frame may be installed at a lower side of the cage, and a weight guide rope may be installed between the middle frame and the bottom frame, and a guide part configured to guide the weight guide rope may be installed at a side of the counterweight.

[0019] At least one base frame through which the cage passes may be installed on a ground or a basement, and a bottom frame on which the cage is placed may be installed on a bottom of the basement, and cage locking devices configured to fix the cage in four directions may be installed on the base frame and the bottom frame.

[0020] The cage locking device may include: a cylinder including a rod and a body; a guide plate coupled to the body; a slide bar coupled to the rod to horizontally slide along the guide plate; and a locking block installed on the slide bar to lock or unlock the cage.

[0021] At least one base frame through which the cage passes may be installed on a ground or a basement, and a platform configured to cover a space between the cage

and the base frame may be installed in a region of the base frame through which a vehicle comes in and out.

[0022] The platform may include: a cylinder installed on the base frame; and a cover having a side coupled to the cylinder and another side hinged to the base frame, wherein the cover covers the space between the cage and the base frame when a vehicle comes in and out of the cage.

[0023] At least one base frame through which the cage passes may be installed on a ground or a basement, and an anti-shake part may be installed in a region of the base frame through which a vehicle comes in and out, to prevent vertical shaking of the cage when the vehicle comes in and out.

[0024] The anti-shake part may include: a motor; a rotation shaft coupled to the motor; a rotation rack gear coupled to the rotation shaft; and a rotation bar coupled to the rotation rack gear to rotate a set angle, wherein the rotation bar is coupled to the cage when a vehicle comes in and out of the cage.

[0025] A pair of fixing blocks may be installed on the base frame, and a support bar may be installed on the fixing block to support, from an upper side, an end of the rotation bar when the rotation bar rotates.

[0026] A car locking device may be installed on the cage to lock a wheel of a vehicle.

[0027] The car locking device may include: a motor; a pair of rotation shafts coupled to the motor to rotate; guide blocks coupled respectively to the rotation shafts to move linearly; a support shaft rotatably coupled to the guide block; a locking plate rotatably coupled to the support shaft; and a fixing block disposed at a lower end of the locking plate such that the locking plate is rotatably coupled to the

fixing block, wherein the locking plate locks or unlocks a wheel of a vehicle when the vehicle comes into the cage.

[0028] A fixing part may be installed on the top frame to fix an end of the hoist rope, wherein the fixing part includes: a cylinder lower frame installed on the top frame; a pair of length-variable cylinders installed at an upper side of the cylinder lower frame; and a cylinder upper frame installed at an upper side of the cylinders, wherein the end of the hoist rope is fixed to the cylinder upper frame.

[0029] Load cells may be installed on an end of the hoist rope and an end of the head rope, respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The accompanying drawings are included to provide a further understanding of the present disclosure, and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the present disclosure and, together with the description, serve to explain principles of the present disclosure. In the drawings:

[0031] FIG. 1 is a perspective view illustrating a transport lift according to an embodiment;

[0032] FIGS. 2A and 2B are front views illustrating a transport lift according to an embodiment;

[0033] FIG. 3 is a plan view illustrating a portion of a hoist part of a transport lift according to an embodiment;

[0034] FIGS. 4A, 4B and 4C are schematic views respectively illustrating a fixing part of a hoist rope, a fixing part of a head rope, and the integrally formed hoist rope and head rope, which constitute a transport lift according to an embodiment;

[0035] FIG. 5 is a plan view illustrating a portion of a cage guide rope of a transport lift according to an embodiment;

[0036] FIG. 6A is a perspective view illustrating a cage locking device of a transport lift according to an embodiment;

[0037] FIGS. 6B and 6C are perspective views illustrating states where a cage is locked and unlocked by the cage locking device of FIG. 6A;

[0038] FIGS. 7A and 7B are perspective views illustrating a platform of a transport lift and an operation of the platform according to an embodiment;

[0039] FIGS. 8A and 8B are a plan view and a side view illustrating anti-shake parts of a transport lift according to an embodiment;

[0040] FIG. 9A is a perspective view illustrating a car locking device of a transport lift according to an embodiment;

[0041] FIGS. 9B and 9C are perspective views illustrating an operation of the car locking device of FIG. 9A; and

[0042] FIGS. 10A and 10B are schematic views illustrating hydraulic buffers installed on a bottom frame of a transport lift according to an embodiment.

DETAILED DESCRIPTION

[0043] Example embodiments will now be described more fully hereinafter with reference to the accompanying drawings; however, they may be embodied in different forms and should not be construed as limited to the embodiments set forth

herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0044] FIG. 1 is a perspective view illustrating a transport lift 100 according to an embodiment. Referring to FIG. 1, the transport lift 100 according to the current embodiment includes a hoist part 110, a hoist rope 120, a head rope 130, a cage 140, a counterweight 150, a tail rope 160, cage guide ropes 170, and weight guide ropes 180.

[0045] The transport lift 100 further includes a top frame 211, a middle frame 221, and a bottom frame 231, and a base frame 240 (refer to FIGS. 2A and 2B). The hoist part 110 is installed on the top frame 211, and the cage 140 vertically moves between the bottom frame 231 and the base frame 240. A plurality of sheaves are installed on the cage 140, the counterweight 150, the top frame 211, the middle frame 221, the bottom frame 231, and the cage 140.

[0046] The hoist part 110 is installed on the top frame 211, and includes a driving motor 111, a speed reducer 113, and a pair of drums 114. The drums 114 and take-up sheaves 212 to be described later are coupled with the hoist rope 120 and the head rope 130. In the state where the hoist rope 120 is substantially connected with the head rope 130, the hoist rope 120 and the head rope 130 are hung on the drums 114 and the take-up sheaves 212.

[0047] The hoist rope 120 extending from the drums 114 and the take-up sheaves 212 is coupled to a plurality of sheaves provided to the top frame 211 and the middle frame 221. Subsequently, the hoist rope 120 is coupled to upper sheaves 141 and 142 of the cage 140, and then, an end of the hoist rope 120 is fixed to the top frame

211 through fixing parts 121. The fixing parts 121 substantially include load cells to sense loads applied to parts respectively of the hoist rope 120. In this case, the hoist rope 120 includes about four groups. Thus, the hoist rope 120 supports four regions of the cage 140. Each group includes three ropes, and thus, the hoist rope 120 substantially includes twelve ropes. Thus, even when a part of the hoist rope 120 is cut off, the cage 140 is prevented from falling.

[0048] The head rope 130 also extending from the drums 114 and the take-up sheaves 212 is coupled to sheaves provided to the top frame 211 and the middle frame 221. Subsequently, the head rope 130 is coupled to weight upper sheaves 151 of the counterweight 150, and then, an end of the head rope 130 is fixed to the top frame 211 through a fixing part 131. The head rope 130 also includes about four groups. Each group includes three ropes, and thus, the head rope 130 substantially includes twelve ropes.

[0049] The cage 140 has an approximately hexahedron shape. The cage 140 accommodates people as well as vehicles. The four upper sheaves 141 and 142 are installed on the upper portion of the cage 140, and four lower sheaves 143 are installed on the lower portion of the cage 140. The four upper sheaves 141 and 142 are coupled with the above described hoist rope 120, and the four lower sheaves 143 are coupled with the tail rope 160. The cage 140 is provided with guide rollers 144 that are coupled to the cage guide ropes 170 to vertically guide the cage 140. The number of the guide rollers 144 installed at sides of the cage 140 is eight.

[0050] The counterweight 150 is installed approximately at a side of the cage 140. The number of the weight upper sheaves 151 installed on the upper portion of the counterweight 150 is about four, and the number of weight lower sheaves 152

installed on the lower portion of the counterweight 150 is about four. The four weight upper sheaves 151 are coupled with the above described head rope 130. The four weight lower sheaves 152 are coupled with the tail rope 160. The weight guide ropes 180 are coupled to a short side of the counterweight 150, and a guide 153 is installed on a side of the counterweight 150 to vertically guide the counterweight 150.

[0051] Both ends of the tail rope 160 are fixed through fixing parts 161 and 162 to the bottom frame 231, respectively. The tail rope 160 is coupled to the lower sheaves 143 provided to the lower portion of the cage 140, and to bottom center sheaves 232 and bottom side sheaves 233 provided to the bottom frame 231. Moreover, the tail rope 160 is coupled to the weight lower sheaves 152 installed on the lower portion of the counterweight 150. The tail rope 160 includes about four groups, and each group includes two ropes, and thus, the tail rope 160 substantially includes eight ropes.

[0052] The cage guide ropes 170 are disposed between the middle frame 221 and the bottom frame 231. The number of the cage guide ropes 170 is about four, which are disposed at positions corresponding to a long side of the cage 140. The guide rollers 144 provided to the cage 140 are coupled with the cage guide ropes 170. Hydraulic jacks 171 are installed on the middle frame 221, and are coupled with the upper ends of the cage guide ropes 170. Thus, the hydraulic jacks 171 provide identical tensile force to the four guide ropes 170.

[0053] The weight guide ropes 180 are installed between the middle frame 221 and the bottom frame 231. The number of the weight guide ropes 180 is two, which are disposed at a position corresponding to the short side of the counterweight 150. As

described above, the guide 153 is provided to the counterweight 150, and the weight guide ropes 180 are coupled to the guide 153.

[0054] Hereinafter, a plurality of sheaves that are installed on the top frame 211 and the middle frame 221 will now be described.

[0055] The take-up sheaves 212 are installed at the front side of the drums 114. The hoist rope 120 and the head rope 130 are hung on the drums 114 and the take-up sheaves 212. That is, the hoist rope 120 and the head rope 130 as a whole are wound about one time around the take-up sheaves 212 spaced a set distance from the drums 114, and are hung on the drums 114. Thus, the hoist rope 120 and the head rope 130 are wound about one time in an oval shape around the take-up sheaves 212 and the drums 114. According to this structure, without winding the hoist rope 120 and the head rope 130 several times around the drums 114, the hoist rope 120 and the head rope 130 are prevented from being slipped. In addition, instead of winding the hoist rope 120 and the head rope 130 several times around the drums 114, the hoist rope 120 and the head rope 130 are simply hung on the take-up sheaves 212 and the drums 114, so that the cage 140 can vertically move at high speed. If the hoist rope 120 and the head rope 130 are wound several times around the drums 114, it is difficult to vertically move the cage 140 at high speed.

[0056] Forward sheaves 213 are installed at the front side of the take-up sheaves 212, and front top sheaves 214 are installed at the front side of the forward sheaves 213. Front middle sheaves 222 are installed on the front portion of the middle frame 221.

[0057] Accordingly, two groups of the hoist rope 120 hung on the drums 114 and the take-up sheaves 212 are coupled through the forward sheaves 213, the front top sheaves 214, and the front middle sheaves 222 to the upper sheaves 141 installed at

the front side on the upper portion of the cage 140. As a matter of course, the hoist rope 120 passing through the upper sheaves 141 installed at the front side on the upper portion of the cage 140 is fixed through the fixing parts 121 to the top frame 211.

[0058] Backward sheaves 215 are installed at the front side of the drums 114, and rear top sheaves 216 are installed at the rear side of the drums 114. Middle rear sheaves 225 are installed on the rear portion of the middle frame 221.

[0059] Accordingly, the rest two groups of the hoist rope 120 hung on the drums 114 are coupled through the backward sheaves 215 and the rear top sheaves 216 to the upper sheaves 142 installed on the rear upper portion of the cage 140. Subsequently, the hoist rope 120 is coupled to the middle rear sheaves 225, and then, is fixed to the top frame 211 through the fixing parts 121.

[0060] Top center sheaves 217 are installed on the top frame 211 at the front side of the take-up sheaves 212, and top front sheaves 218 are installed at the front side of the top center sheaves 217, and top lower center sheaves 219 are installed at the rear side of the top front sheaves 218. Middle center sheaves 223 and middle side sheaves 224 are installed on the middle frame 221.

[0061] Accordingly, the head rope 130 hung on the drums 114 and the take-up sheaves 212 pass through the top center sheaves 217, the top front sheaves 218, and the top lower center sheaves 219. Subsequently, the head rope 130 passes through the middle center sheaves 223 and the middle side sheaves 224, and is coupled to the weight upper sheaves 151 installed on the upper portion of the counterweight 150. Subsequently, the head rope 130 passing through the weight upper sheaves 151 is fixed to the top frame 211 through the fixing part 131.

[0062] According to this structure, for example, when the hoist rope 120 goes away from the drums 114 and the take-up sheaves 212, the cage 140 moves downward along the cage guide ropes 170. The height through which the cage 140 moves downward may substantially range from about 100 m to about 500 m. At this point, the head rope 130 comes closer to the drums 114 and the take-up sheaves 212. Thus, the counterweight 150 coupled to the head rope 130 moves upward along the weight guide ropes 180. At this point, the tail rope 160 is longer at the lower side of the counterweight 150 than at the lower side of the cage 140. That is, when the relatively long hoist rope 120 is disposed at the upper side of the cage 140, the relatively short tail rope 160 is disposed at the lower side of the cage 140.

[0063] On the contrary, for example, when the hoist rope 120 comes closer to the drums 114 and the take-up sheaves 212, the cage 140 moves upward along the cage guide ropes 170. At this point, the head rope 130 goes away from the drums 114 and the take-up sheaves 212. Thus, the counterweight 150 coupled to the head rope 130 moves downward along the weight guide ropes 180. At this point, the tail rope 160 is longer at the lower side of the cage 140 than at the lower side of the counterweight 150. That is, when the relatively short hoist rope 120 is disposed at the upper side of the cage 140, the relatively long tail rope 160 is disposed at the lower side of the cage 140. Thus, a uniform weight is applied to the cage 140 all the time, regardless of its height

[0064] FIGS. 2A and 2B are front views illustrating the transport lift 100.

[0065] Referring to FIGS. 2A and 2B, the transport lift 100 may be provided in a pair to more efficiently carry soil and sand from a basement to the ground. The base frame 240 may be disposed at a basement as well as the ground. That is, a working

space of a basement may include a plurality of floors. The top frame 211, the middle frame 221, and the base frame 240, which are disposed on the ground may be supported by a plurality of support frames 249.

[0066] FIG. 3 is a plan view illustrating a portion of the hoist part 110 of the transport lift 100.

[0067] Referring to FIG. 3, the hoist part 110 includes the driving motor 111, the speed reducer 113, and the drums 114. A brake 112 may be installed between the driving motor 111 and the speed reducer 113. Disk brakes 115 may be installed on the drums 114, respectively. Grooves may be disposed respectively in the drums 114 such that the hoist rope 120 and the head rope 130 are hung on the drums 114. The take-up sheave 212 is installed at a side of each of the drums 114, and grooves may be disposed in the take-up sheaves 212 such that the hoist rope 120 and the head rope 130 are independently hung on the drums 114. That is, the hoist rope 120 and the head rope 130, which are integrally connected, are wound at least one time in an approximately oval shape around the drums 114 and the take-up sheaves 212.

[0068] FIGS. 4A, 4B and 4C are schematic views respectively illustrating the fixing part 121 of the hoist rope 120, the fixing part 131 of the head rope 130, and the integrally formed hoist rope 120 and head rope 130 in the transport lift 100.

[0069] Referring to FIG. 4A, the top frame 211 is provided with the fixing part 121 configured to fix the upper ends of the hoist rope 120. The fixing part 121 includes a cylinder lower frame 121a installed on the top frame 211, a pair of length-variable cylinders 121b installed at the upper side of the cylinder lower frame 121a, and a cylinder upper frame 121c installed at the upper side of the cylinders 121b. The ends of the hoist rope 120 are fixed to the cylinder upper frame 121c through nuts

121d. The length of the hoist rope 120 can be minutely adjusted according to the number of the nuts 121d. Load cells 120a are installed on the hoist rope 120 to sense loads of the cage 140 applied respectively to the hoist rope 120.

[0070] According to this structure, in the current embodiment, even when an uneven load is applied to the cage 140, a horizontal state of the cage 140 is maintained. For example, when an uneven load is applied to one of four edges of the cage 140, a relatively large load is applied to the hoist rope 120 corresponding to the edge. The relatively large load is sensed by the load cell 120a. Then, a portion of the hoist rope 120 corresponding to the edge is slightly elongated, and thus, the cage 140 may be inclined. However, when the load cell 120a senses the uneven load, the cylinders 121b operate. For example, when the cylinder 121b pushes the cylinder upper frame 121c upward, the hoist rope 120 fixed to the cylinder upper frame 121c is also slightly moved upward. Thus, even when an uneven load is applied to the cage 140, a horizontal state of the cage 140 is maintained.

[0071] Various states of the cage 140 are detected by the load cells 120a. That is, in the state where the hoist rope 120 is cut off, or the state where the cage 140 is caught in a gap when the cage 140 vertically moves, the load cells 120a sense an abnormal load. Accordingly, various states of the cage 140 can be monitored.

[0072] Referring to FIG. 4B, the fixing part 131 is installed on the top frame 211 to fix the upper ends of the head rope 130. The fixing part 131 is constituted by a support frame 131a installed on the top frame 211. The upper ends of the head rope 130 are fixed to the support frame 131a, for example, through bolts 131b. The length of the head rope 130 can be minutely adjusted according to the number of the

bolts 131b. Load cells 130a are installed on the head rope 130 to sense loads of the counterweight 150 applied to the head rope 130.

[0073] According to this structure, in the current embodiment, various states of the counterweight 150 are sensed. That is, when the counterweight 150 is caught in a gap while the counterweight 150 vertically moves, the load cells 130a sense an abnormal load. Accordingly, various states of the counterweight 150 can be monitored.

[0074] Referring to FIG. 4C, substantially, the hoist rope 120 is integrally formed with the head rope 130. Thus, the hoist rope 120 and the head rope 130 have the same diameter, and are formed of the same material. As a matter of course, the integrally formed hoist rope 120 and head rope 130 are coupled to the drums 114 and the take-up sheaves 212. The hoist rope 120 and the head rope 130 are fixed to the top frame 211 through the fixing parts 121 and 131, respectively. The load cells 120a and 130a are installed on the hoist rope 120 and the head rope 13, respectively. Substantially, according to this structure, when the hoist rope 120 goes away from the drums 114 and the take-up sheaves 212, the head rope 130 comes closer to the drums 114 and the take-up sheaves 212. On the contrary, when the hoist rope 120 comes closer to the drums 114 and the take-up sheaves 212, the head rope 130 goes away from the drums 114 and the take-up sheaves 212.

[0075] FIG. 5 is a plan view illustrating a portion of the cage guide rope 170 of the transport lift 100.

[0076] Referring to FIG. 5, the upper end of the cage guide rope 170 is coupled to the hydraulic jack 171 that is coupled to the middle frame 221. The lower end of the cage guide rope 170 is coupled to the bottom frame 231 by a fixing part 172. Thus,

the hydraulic jack 171 adjusts tensile force of the cage guide rope 170. Accordingly, the tensile strengths of all the cage guide ropes 170 installed on the transport lift 100 may be set to the same value by the hydraulic jack 171.

[0077] FIG. 6A is a perspective view illustrating a cage locking device 250 of the transport lift 100. FIGS. 6B and 6C are perspective views illustrating states where the cage 140 is locked and unlocked by the cage locking device 250.

[0078] For a vehicle to stably come in and out of the cage 140, cage locking devices 250 are provided to lock the cage 140. The cage locking devices 250 are substantially installed on the base frame 240. As described above, the base frame 240 is installed on the ground or the basement, and is a region through which the cage 140 passes.

[0079] The cage locking devices 250 are respectively installed in four directions corresponding to the corners of the cage 140 to fix the cage 140 in the four directions.

[0080] As illustrated in FIG. 6A, the cage locking devices 250 each includes a cylinder 153 including a rod 251 and a body 252, a guide plate 253 coupled to the body 252, a slide bar 254 coupled to the rod 251 to horizontally slide along the guide plate 253, and locking blocks 255 installed at an end of the slide bar 254 to lock or unlock the cage 140. The locking blocks 255 may be typical rubber rollers. The guide plate 253 is installed on the base frame 240.

[0081] Accordingly, as illustrated in FIGS. 6B and 6C, when the locking blocks 255 are brought to closely contact or removed from a lower protrusion 145 installed on the corner of the cage 140, the cage locking device 250 locks or unlocks the cage 140. That is, when the locking blocks 255 closely contact the lower protrusion 145

of the cage 140, the cage 140 is locked, and when the locking blocks 255 are removed from the lower protrusion 145 of the cage 140, the cage 140 is unlocked. After the locking blocks 255 are removed from the lower protrusion 145 of the cage 140, the cage 140 is allowed to move vertically.

[0082] FIGS. 7A and 7B are perspective views illustrating a platform 260 of the transport lift 100 and an operation of the platform 260.

[0083] Substantially, a space is disposed between the cage 140 and the base frame 240. That is, the cage 140 is spaced a set distance from the base frame 240. Since wheels of a vehicle is greater than the space between the cage 140 and the base frame 240, the vehicle coming in or out of the cage 140 is substantially not affected by the space between the cage 140 and the base frame 240. However, when a person comes in the cage 140, his or her foot may fall through the space between the cage 140 and the base frame 240. Thus, the platform 260 is installed on the base frame 240 in a region where a vehicle or a person comes in or out, to cover the space between the cage 140 and the base frame 240.

[0084] The platform 260 includes cylinders 261 installed on the base frame 240, and a cover 263 having a side coupled to the cylinders 261 and another side coupled through hinges 262 to the base frame 240.

[0085] Accordingly, when a vehicle and a person come in or out of the cage 140, the cylinders 261 operate to cause the cover 263 to cover the space between the cage 140 and the base frame 240. The cage 140 vertically moves after the cover 263 is opened.

[0086] FIGS. 8A and 8B are a plan view and a side view illustrating anti-shake parts 270 of the transport lift 100.

[0087] As described above, the space is disposed between the cage 140 and the base frame 240. Thus, when a vehicle comes in and out of the cage 140, the cage 140 may vertically shake. Thus, according to the current embodiment, the anti-shake parts 270 are provided to the base frame 240 in a region where a vehicle comes in and out, to prevent vertical shaking of the cage 140.

[0088] The anti-shake parts 270 each includes a motor 271, a rotation shaft 272 coupled to the motor 271, a rotation rack gear 273 coupled to the rotation shaft 272, and a rotation bar 274 coupled to the rotation rack gear 273 to rotate a set angle. A pair of fixing blocks 275 are installed on the base frame 240, and a support bar 276 is installed between the fixing blocks 275 to press an end of the rotation bar 274 from the upper side when the rotation bar 274 rotates.

[0089] Accordingly, after the cage 140 arrives at the base frame 240, the anti-shake parts 270 operate. That is, when the motors 271 rotate the rotation shafts 272, the rotation rack gears 273 engaging with the rotation shafts 272 rotate a set angle, and thus, the rotation bars 274 support the lower surface of the cage 140. That is, an end of each of the rotation bars 274 is disposed on the lower surface of the cage 140, and another end of each of the rotation bars 274 is disposed on a lower surface of the fixing block 275.

[0090] Thus, even when a vehicle and a person come in and out of the cage 140, vertical shaking of the region where the vehicle and the person come in and out is prevented. The cage 140 vertically moves after the rotation bars 274 return to their original positions, that is, to positions where the rotation bars 274 do not interfere with the cage 140.

[0091] FIG. 9A is a perspective view illustrating a car locking device 280 of the transport lift 100, and FIGS. 9B and 9C are perspective views illustrating an operation of the car locking device 280.

[0092] The car locking device 280 is installed on the transport lift 100 to stably fix a vehicle when the cage 140 vertically moves. The car locking device 280 substantially fixes a wheel of a vehicle.

[0093] Referring to FIG. 9A, the car locking device 280 includes a motor 281 installed on a bottom of the cage 140, a pair of rotatable rotation shafts 282 coupled to the motor 281, guide blocks 283 coupled respectively to the rotation shafts 282 to move linearly, locking plates 285 coupled to the guide blocks 283 such that the locking plates 285 are rotatable through a constant angle, and fixing blocks 286 coupled to lower ends of the locking plates 285 to function as rotation center axes of the locking plates 285.

[0094] Accordingly, referring to FIGS. 9B and 9C, when a vehicle comes into the cage 140, the locking plates 285 closely contact a wheel of the vehicle, and thus, the car locking device 280 locks the vehicle. That is, when the motor 281 operates, the rotation shafts 282 connected to the motor 281 rotate in a set direction. Then, the guide blocks 283 coupled to the rotation shafts 282 move in the straight line direction. Then, the linear motions of the guide blocks 283 rotate support shafts 284 coupled to the guide blocks 283 a set angle by using the locking plates 285 as rotation center axes. At this point, the locking plates 285 rotate by using the fixing blocks 286 as rotation center axes, and the locking plates 285 closely contact a wheel of a vehicle.

[0095] FIGS. 10A and 10B are schematic views illustrating a plurality of hydraulic buffers 234 installed on the bottom frame 231 of the transport lift 100.

[0096] Referring to FIG. 10A, the hydraulic buffers 234 are installed on the bottom frame 231. That is, the hydraulic buffers 234 are arrayed in regions corresponding to the cage 140 and regions corresponding to the counterweight 150. When the cage 140 and the counterweight 150 move downward to the bottom frame 231, the hydraulic buffers 234 absorb shock transmitted to the cage 140 and the counterweight 150.

[0097] Referring to FIG. 10B, the hydraulic buffers 234 each includes a fixing block 234a fixed to the bottom frame 231, a shock absorbing block 234b, and a pressing block 234c. The cage 140 and the counterweight 150 are placed on the pressing block 234c, and the pressing block 234c moves downward a set distance into the shock absorbing block 234b.

[0098] The transport lift according to the embodiment includes the four guide ropes to economically and safely move the cage in the vertical direction.

[0099] In addition, according to the embodiment, the counterweight is used to safely and rapidly move the cage in the vertical direction.

[00100] In addition, according to the embodiment, the tail rope as well as the hoist rope and the head rope are used to prevent an uneven load from being applied to the cage, regardless of the positions of the cage.

[00101] In addition, according to the embodiment, the cage locking device and the anti-shake part are used to safely lock the cage when the cage is stopped and to prevent vertical shaking of the cage when a vehicle comes in and out of the cage.

[00102] In addition, according to the embodiment, the car locking device is installed on the cage to safely lock a vehicle when the cage vertically moves.

[00103] In addition, according to the embodiment, since the platform is installed in the region where the cage comes in and out, a vehicle, a cargo, and a person can safely come in and out of the cage.

[00104] An exemplary embodiment has been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. Accordingly, it will be understood by those of ordinary skill in the art that various changes in form and details may be made without departing from the spirit and scope of the present disclosure as set forth in the following claims.

What is claimed is

1. A transport lift comprising:

a hoist part including a top frame, a driving motor installed on the top frame, a pair of drums installed on the driving motor, a hoist rope installed on each of the drums, and a head rope installed on each of the drums;

a cage coupled to the hoist rope of the hoist part to vertically move;

a counterweight coupled to the head rope of the hoist part to move in an opposite direction to a direction in which the cage moves; and

a tail rope coupled to a lower end of the cage and a lower end of the counterweight such that the tail rope, the hoist rope, and the head rope apply an identical weight to the cage.

2. The transport lift as claimed in claim 1, wherein the hoist rope and the head rope have an identical diameter, and are connected to each other on the drum.

3. The transport lift as claimed in claim 1, wherein a take-up sheave is installed on the top frame at a front side of the drum, and a forward sheave is installed at a front side of the take-up sheave, and a front top sheave is installed at a front side of the forward sheave;

a middle frame is installed at a lower side of the top frame, and a front middle sheave is installed on the middle frame; and

a portion of the hoist rope is coupled to a front cage upper sheave installed on an upper portion of the cage through the take-up sheave, the forward sheave, the front top sheave, and the front middle sheave, and the hoist rope coupled to the front cage upper sheave is fixed to the top frame.

4. The transport lift as claimed in claim 1, wherein a backward sheave and a rear top sheave are installed on the top frame;

a middle frame is installed at a lower side of the top frame, and a rear middle sheave is installed on the middle frame; and

a portion of the hoist rope is coupled to a rear cage upper sheave installed on an upper portion of the cage through the backward sheave and the rear top sheave, and subsequently, is coupled to the rear middle sheave, and then, is fixed to the top frame.

5. The transport lift as claimed in claim 1, wherein a take-up sheave is installed on the top frame at a front side of the drum, and a top center sheave is installed at a front side of the take-up sheave, and a top lower center sheave is installed at a rear side of the top center sheave;

a middle frame is installed at a lower side of the top frame, and a middle center sheave and a middle side sheave are installed on the middle frame; and

the head rope is coupled to the take-up sheave, the top center sheave, a top front sheave, and the top lower center sheave, and subsequently, is coupled to the middle center sheave and the middle side sheave, and is coupled to a weight upper sheave installed on an upper portion of the counterweight, and then, is fixed to the top frame.

6. The transport lift as claimed in claim 1, wherein a cage lower sheave is installed on a lower portion of the cage,

a bottom frame is installed on a lower side of the cage,

a bottom center sheave and a bottom side sheave are installed on the bottom frame,

an end of the tail rope is fixed to the bottom frame, and

the other end of the tail rope is coupled to the cage lower sheave, the bottom center sheave, and the bottom side sheave, and subsequently, is coupled to a weight lower sheave installed on a lower portion of the counterweight, and then, is fixed to the bottom frame.

7. The transport lift as claimed in claim 1, wherein a middle frame is installed at an upper side of the cage, and a bottom frame is installed at a lower side of the cage, and a cage guide rope is installed between the middle frame and the bottom frame, and a guide roller coupled with the cage guide rope is installed at a side of the cage.

8. The transport lift as claimed in claim 1, wherein a middle frame is installed at an upper side of the cage, and a bottom frame is installed at a lower side of the cage, and a weight guide rope is installed between the middle frame and the bottom frame, and a guide part configured to guide the weight guide rope is installed at a side of the counterweight.

9. The transport lift as claimed in claim 1, wherein at least one base frame through which the cage passes is installed on a ground or a basement, and a bottom frame on which the cage is placed is installed on a bottom of the basement, and cage locking devices configured to fix the cage in four directions are installed on the base frame and the bottom frame.

10. The transport lift as claimed in claim 9, wherein the cage locking device comprises:

- a cylinder including a rod and a body;
- a guide plate coupled to the body;
- a slide bar coupled to the rod to horizontally slide along the guide plate; and
- a locking block installed on the slide bar to lock or unlock the cage.

11. The transport lift as claimed in claim 1, wherein at least one base frame through which the cage passes is installed on a ground or a basement, and a platform configured to cover a space between the cage and the base frame is installed in a region of the base frame through which a vehicle comes in and out.

12. The transport lift as claimed in claim 11, wherein the platform comprises:

a cylinder installed on the base frame; and

a cover having a side coupled to the cylinder and another side hinged to the base frame,

wherein the cover covers the space between the cage and the base frame when a vehicle comes in and out of the cage.

13. The transport lift as claimed in claim 1, wherein at least one base frame through which the cage passes is installed on a ground or a basement, and

an anti-shake part is installed in a region of the base frame through which a vehicle comes in and out, to prevent vertical shaking of the cage when the vehicle comes in and out.

14. The transport lift as claimed in claim 13, wherein the anti-shake part comprises:

a motor;

a rotation shaft coupled to the motor;

a rotation rack gear coupled to the rotation shaft; and

a rotation bar coupled to the rotation rack gear to rotate a set angle,

wherein the rotation bar is coupled to the cage when a vehicle comes in and out of the cage.

15. The transport lift as claimed in claim 14, wherein a pair of fixing blocks are installed on the base frame, and
a support bar is installed on the fixing block to support, from an upper side, an end of the rotation bar when the rotation bar rotates.

16. The transport lift as claimed in claim 1, wherein a car locking device is installed on the cage to lock a wheel of a vehicle.

17. The transport lift as claimed in claim 16, wherein the car locking device comprises:

- a motor;
- a pair of rotation shafts coupled to the motor to rotate;
- guide blocks coupled respectively to the rotation shafts to move linearly;
- a support shaft rotatably coupled to the guide block;
- a locking plate rotatably coupled to the support shaft; and
- a fixing block disposed at a lower end of the locking plate such that the locking plate is rotatably coupled to the fixing block,

wherein the locking plate locks or unlocks a wheel of a vehicle when the vehicle comes into the cage.

18. The transport lift as claimed in claim 1, wherein a fixing part is installed on the top frame to fix an end of the hoist rope,

wherein the fixing part includes:

- a cylinder lower frame installed on the top frame;

a pair of length-variable cylinders installed at an upper side of the cylinder lower frame; and

a cylinder upper frame installed at an upper side of the cylinders,
wherein the end of the hoist rope is fixed to the cylinder upper frame.

19. The transport lift as claimed in claim 1, wherein load cells are installed on an end of the hoist rope and an end of the head rope, respectively.