Oct. 8, 1946. J. DUNLOP ET AL 2,408,762

LOCKING APPARATUS FOR ELEVATOR PLATFORMS

Filed Dec. 16, 1943 4 Sheets-Sheet 1

Fig. 1.

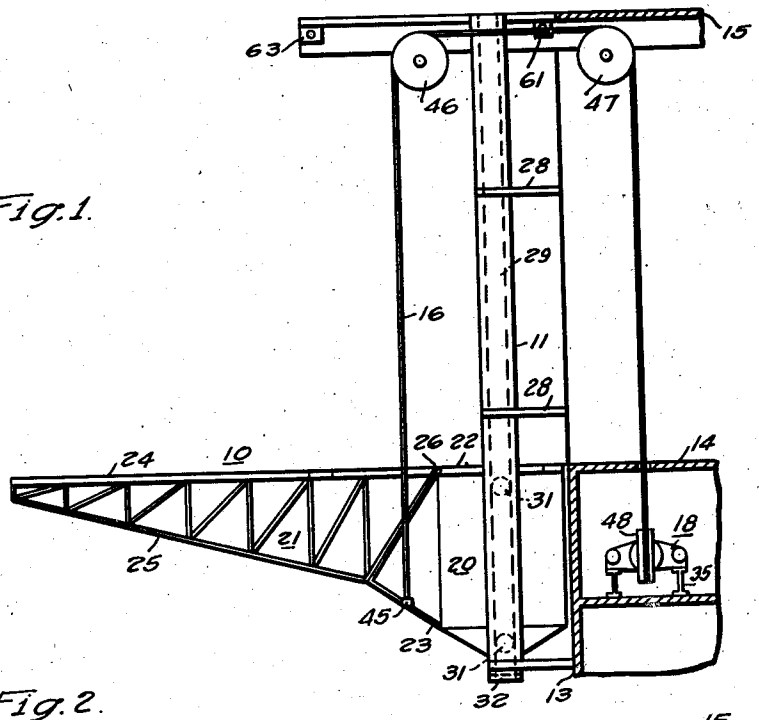
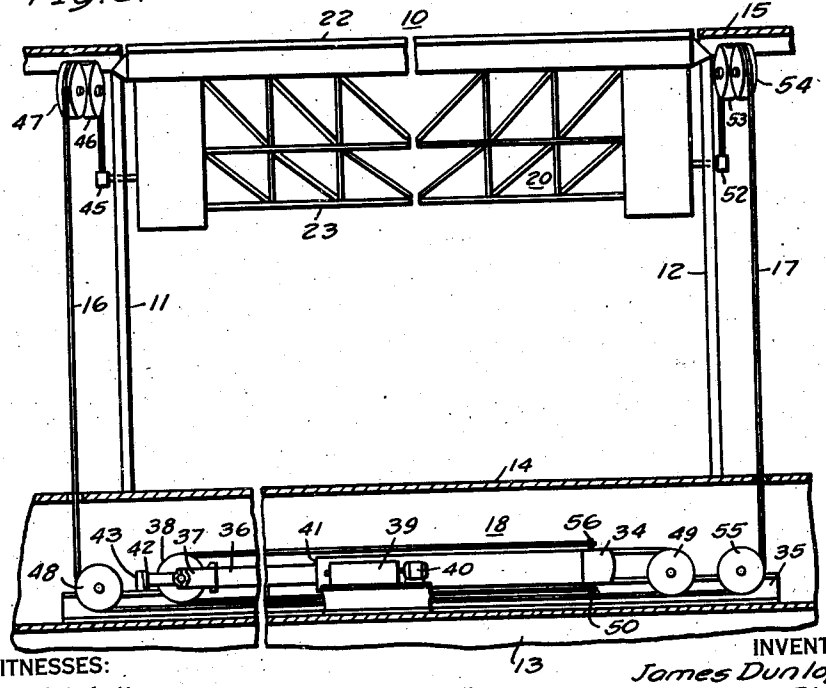



Fig. 2.




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LOCKING APPARATUS FOR ELEVATOR PLATFORMS

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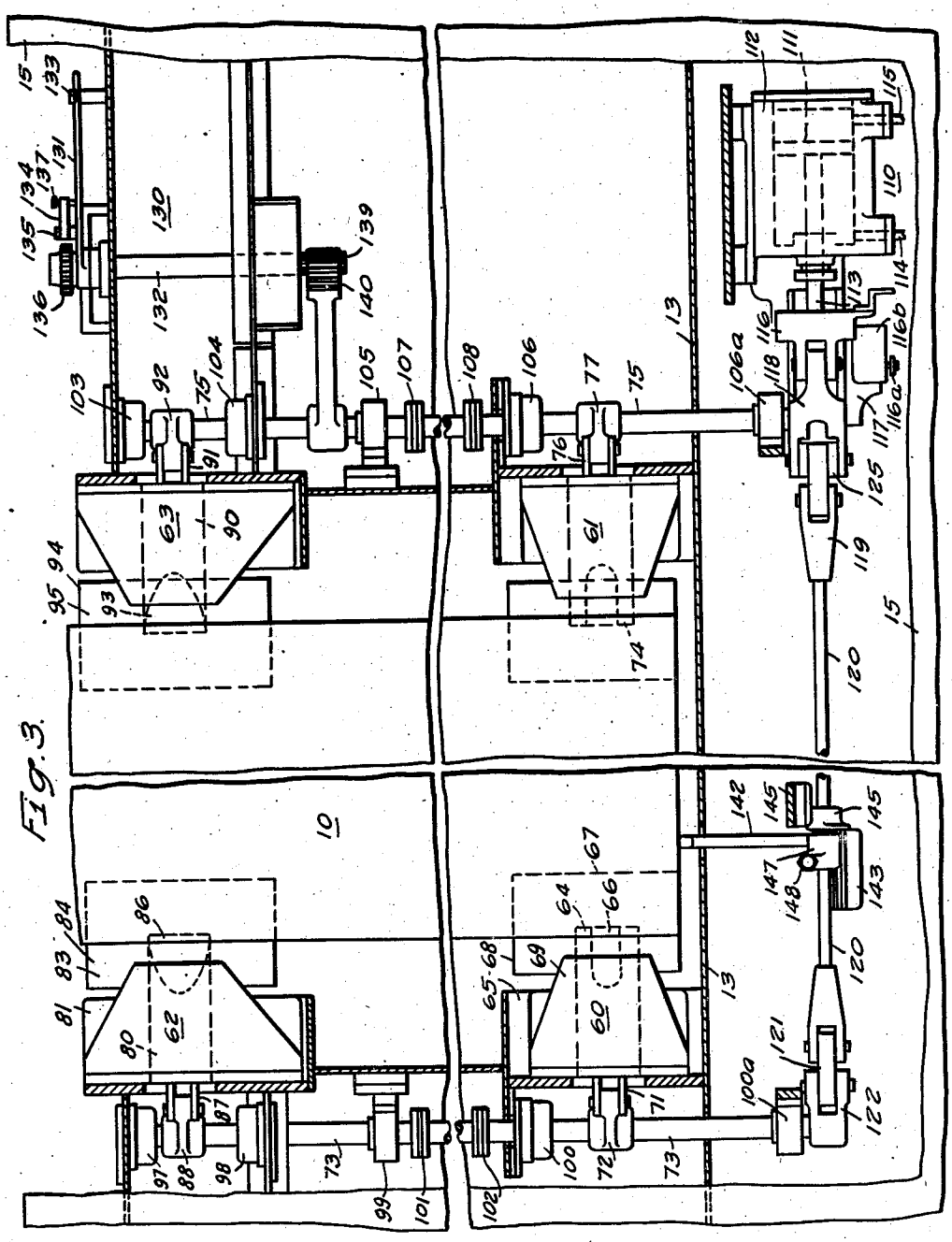


FIG. 3.

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LOCKING APPARATUS FOR ELEVATOR PLATFORMS

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Fig. 4.

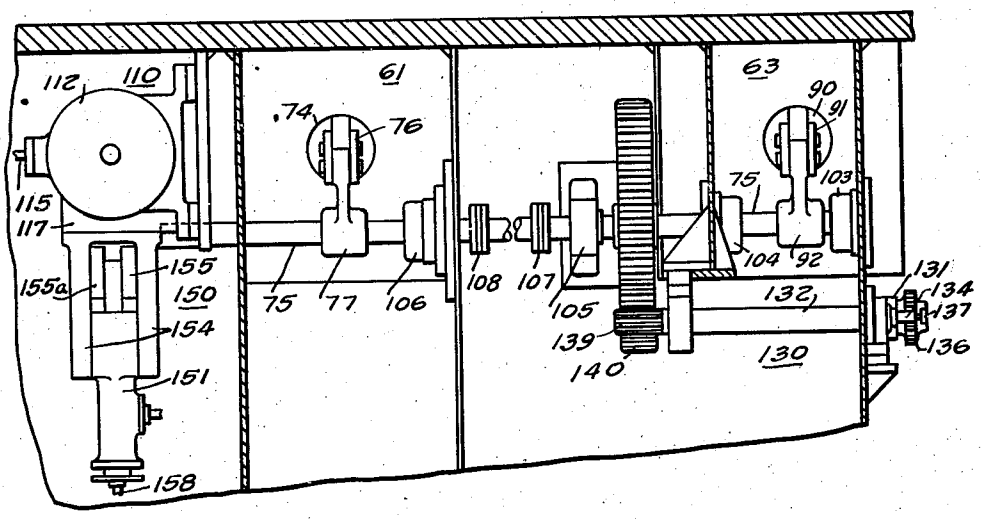



Fig. 5.

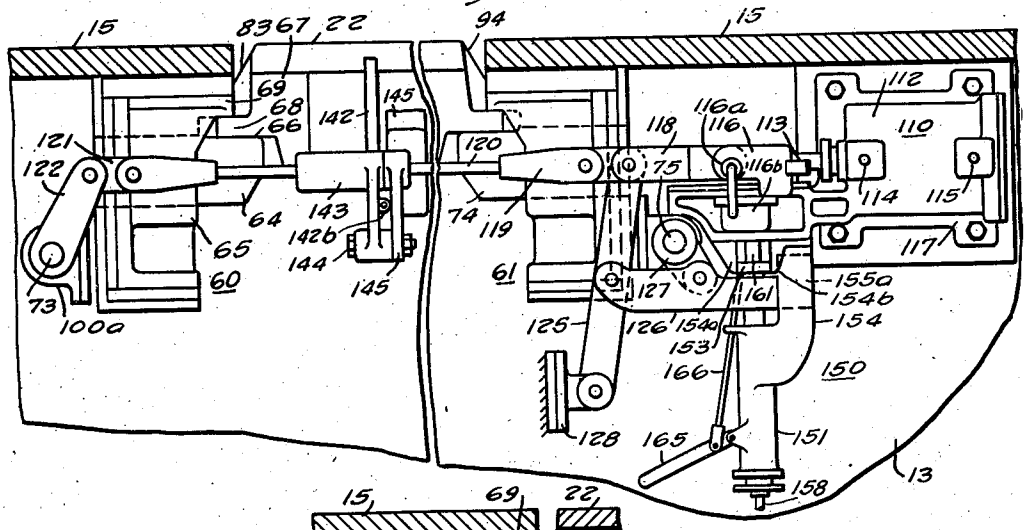
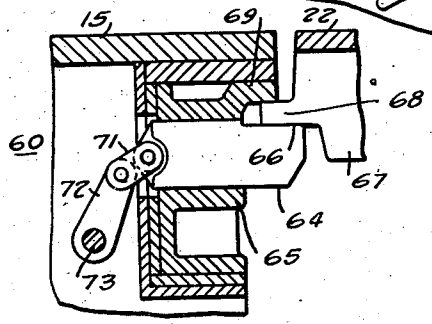



Fig. 6.




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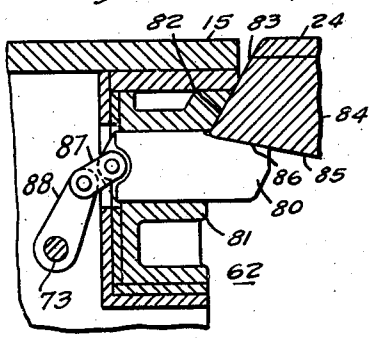
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LOCKING APPARATUS FOR ELEVATOR PLATFORMS

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Fig. 7.



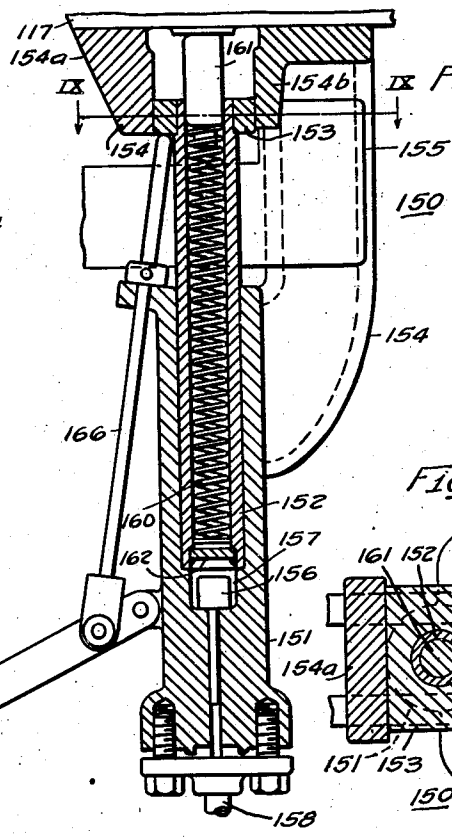




Fig. 8.

Fig. 9.

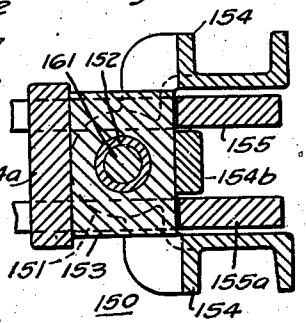






Fig. 10.

Fig. 11.




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Patented Oct. 8, 1946

2,408,762

# UNITED STATES PATENT OFFICE

2,408,762

## LOCKING APPARATUS FOR ELEVATOR PLATFORMS

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Application December 16, 1943, Serial No. 514,520

20 Claims. (Cl. 187—75)

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Our invention relates to locking apparatus for elevator platforms and more particularly to locking apparatus for securely holding large elevator platforms in a wedge-locked position at a landing.

One object of our invention is to provide for firmly wedging and locking large elevator platforms at a parking floor.

Another object is to provide a wedge lock for large elevator platforms at a parking floor which will maintain its wedging action as long as the lock is in locking position.

A further object is to so lock and wedge the platform of a deck-edge elevator at a flight deck on a ship as to overcome the battering-ram effect of the platform on the ship due to pitch and roll and also to the wind and the sea.

A still further object is to provide a wedge and locking apparatus which will maintain an elevator platform securely in position at a flight deck on a ship regardless of the action of the ship, the elements or any warpage of the deck or change in the size of the platform opening in the deck due to changes in temperature.

It is also an object to provide a wedging and locking apparatus for elevator platforms which may be easily operated either by power or by hand and which may be easily maintained in sound operative condition under all circumstances.

For a better understanding of the invention, reference may be had to the accompanying drawings; in which:

Figure 1 is a view in aft end elevation of a deck edge elevator for an airplane carrier ship, with the elevator platform at the main deck,

Fig. 2 is a view in side elevation taken from the inside of the ship and looking in the outboard direction, with the platform at the flight deck,

Fig. 3 is an enlarged top-plan view of the elevator platform lock in position at the flight deck, part of the flight deck being broken away to disclose our improved locking apparatus and the platform being shown in broken parts to accommodate the figure to the drawing,

Fig. 4 is a view in fore end elevation of the locking apparatus illustrated in Fig. 3,

Fig. 5 is a view in inboard side elevation of the locking apparatus illustrated in Figure 3,

Fig. 6 is a vertical longitudinal section through the inboard lock at the aft end of the platform,

Fig. 7 is a vertical longitudinal section through the outboard wedge lock at the aft end of the platform,

Fig. 8 is an enlarged vertical longitudinal section from the inboard side of the mechanism for interlocking the hoisting engine and the platform locking apparatus shown in Fig. 5,

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Fig. 9 is a view taken on the line IX—IX of Fig. 8.

Fig. 10 is an enlarged view in side elevation, taken from the aft end of the platform, of the cam mechanism responsive to the position of the platform for preventing operation of the locking apparatus until the platform is level with the flight deck; and

Fig. 11 is a view in side elevation of the hand lever and ratchet wheel for operating the locking apparatus by hand.

The invention is illustrated as applied to a deck edge elevator on an airplane carrier ship. In a typical ship of this character having a deck edge elevator the flight deck overhangs the edge of the ship about 16 feet and out of this overhanging part of the deck is notched a space for the elevator platform. Such a platform is about 60 feet long and 34 feet wide and weighs approximately 60 tons. The outboard portion of the platform extends approximately 18 feet beyond the overhanging edge of the flight deck. The guides for the platform are mounted on the outside of the ship hull and the platform is suspended and operated in the guides by a plurality of hoisting cables which pass over sheaves mounted on the underside of the overhanging part of the deck and which are attached to the fore and aft ends of the platform. The platform is suspended entirely by its hoisting cables and is not counterweighed.

When the platform is not in ordinary use and the roll of the ship exceeds 10°, it should be locked at the flight deck. For this purpose, we provide two locks at its fore end and two locks at its aft end. The inboard lock at the fore end and the inboard lock at the aft end are mounted on the underside of the overhanging deck close to the ship hull. The outboard lock at the fore end and the outboard lock at the aft end are mounted underneath the flight deck near its outboard edge. The locks are connected together so that they may be operated in unison either by pneumatic power or by hand.

This arrangement of locks will permit a movement of the platform under the action of externally applied forces, such as the platform dipping into a wave with the ship under motion. This platform movement will progress until the externally applied turning moment is balanced by a countermoment exerted by the roller guides against the rollers of the platform. Any turning

moment is therefore resisted by reactions at opposite ends of the platform, instead of by reactions at the locking members, which have a much shorter lever arm.

When the ship rolls heavily the outer portion of the platform dips into the water. As the platform strikes the water severe stresses are set up. On coming out of the water the platform lifts many tons of water, thereby creating heavy additional stresses. The stresses are taken on by the four locks. The inboard locks are designed to take vertical reactions only and the outboard locks are designed to take both vertical and fore and aft loads. The reactions athwartship are not taken on any of the locks but are taken on the elevator guides. In order to prevent a battering ram effect of the platform on the ship due to pitch and roll and also to wind and sea, the outboard locks are made wedge shaped so that the platform will be locked tightly to the flight deck and there can be no looseness between the flight deck and the ship even though there should be warpage of the flight deck or a change in size of the notch in the deck due to changes in temperature.

Although the invention is described in connection with a deck edge elevator on an airplane carrier ship, it may be used in connection with any movable body which should be securely locked and wedged in a particular position.

Referring more particularly to the drawings, we have illustrated a deck edge elevator comprising an elevator platform 10 disposed between a pair of guide rails 11 and 12 mounted on the outside of a ship hull 13, in position to be supported by and to be raised and lowered between a main deck 14 and a flight deck or parking floor 15 by a plurality of hoisting cables 16 and 17 operated by a hoisting engine 18.

The platform 10 comprises a base section 20 and a hinged or outboard section 21 the floors of which normally lie in the same plane and provide a large level area upon which airplanes may be moved and carried from one deck to another. The base section of the platform is constructed with a suitable flooring 22 laid upon a frame 23 made of seamless steel tubing, structural steel sections and steel plate welded together in bridge like construction to form a relatively light but strong structure. The outboard section of the platform is also constructed with a suitable floor 24 laid upon a frame 25 of seamless steel tubing, structural steel and steel plate welded together in bridge like construction in the same manner as the base and is mounted upon and connected to the base with a suitable hinged joint 26 so that it may be raised from its normal horizontal position into a vertical position on the base when the ship has to pass through a canal lock or other narrow opening, as described and claimed in the copending application, Serial No. 513,029 filed Dec. 6, 1943.

The guide rails 11 and 12 are mounted in vertical position and facing each other on the side of the ship hull by means of a plurality of horizontally disposed brackets 28.

The guide rails are provided with vertical slots 29 in their sides facing each other which are disposed to receive a plurality of rollers 31 rotatably mounted on the base section 20 for the purpose of guiding the movement of the elevator platform as it is raised or lowered and for also maintaining the platform in its horizontal position. A block 32 is securely fastened by welding to the lower end of each guide rail to prevent



the elevator from dropping on down through the slots in case of failure of the safeties and cables, etc. In normal use the platform is suspended entirely on its hoisting cables and no counterweights are provided.

The hoisting engine 18 is a hydraulic engine comprising a single cylinder 34 mounted in a horizontal position on a frame or engine bed 35 and a power plunger 36 disposed in the cylinder. The outer end of the plunger is provided with a power head 37 in which a pair of power sheaves 38 are rotatably mounted. The plunger slides back and forth in the cylinder and thus moves the power sheaves back and forth with it. The plunger is designed for operation by a suitable hydraulic medium such as oil placed under pressure by any suitable pumping apparatus (not shown). A valve block 39 is mounted on the cylinder for controlling the operation of the plunger by controlling the admission of the oil to the cylinder. An electric motor 40 is connected with the valve block for operating the valve mechanism therein.

A pair of down stopping blocks 41 are mounted on the cylinder block in position to engage the power head for the purpose of limiting the rearward motion of the plunger when the elevator is being lowered to the main deck and a pair of up stopping blocks 42 are mounted on a projection 43 on the engine bed in position to limit the forward stroke of the plunger when the platform is being raised to the flight deck.

The hoisting cables 16 at the aft end of the platform (Fig. 2) are secured to the base 20 by a bracket 45 and pass upwardly and over an idler sheave 46 fastened to the ship structure underneath the overhanging portion of the flight deck, thence rearwardly over a second idler sheave 47 mounted on the ship frame inside the hull, thence downwardly and under a deflector sheave 48 mounted on the engine bed 35, thence around a stationary sheave 49 mounted on the engine bed, thence forward and around the one of the power sheaves 38 and thence to a dead end hitch 50 on the lower part of the rear end of the engine cylinder 34.

The hoisting cables 17 at the fore end of the elevator are secured to the base 20 by a bracket 52 and pass upwardly and over an idler sheave 53 fastened to the ship structure underneath the overhanging portion of the flight deck, thence rearwardly over a second idler sheave 54 mounted on the ship frame inside the hull, thence downward and under a deflector sheave 55 mounted on the engine bed, thence under and over one of the power sheaves 38, and thence to a dead-end hitch 56 on the upper part of the rear end of the engine cylinder. This roping arrangement is described and claimed in the copending application Serial No. 507,132, filed October 21, 1943.

We have provided an aft inboard lock 60, a forward inboard lock 61, an aft outboard lock 62 and a forward outboard lock 63 for locking the elevator platform 10 in its position level with the flight deck when it is not in use or when its cables are to be renewed.

The aft inboard lock 60 (Fig. 6) comprises a horizontal cylindrical bolt 64 slidably disposed in a housing 65 made in the form of a casting and securely fastened to the underside of the overhanging portion of the flight deck. A flattened face 66 is provided on the upper side of the locking end of the bolt 64 for engaging the underside of a stop casting 67 mounted in the edge of the elevator platform. The casting 67 is provided

with an extended lip 68 disposed to be locked between a stopping device or ledge 69 on the lock housing and the upper face of the lock bolt 64.

The rear end of the bolt 64 is connected by a link 71 to one end of a lever arm 72, the other end of which is fixed on an aft outboard lock shaft 73 so that rotation or rocking of the aft outboard lock shaft 73 will move the lock bolt 64 into or out of locking position. It will be observed that the lip or stop 68 held between the lock bolt and the casting ledge 69 has horizontal flat faces so that it will lock the platform against vertical reaction only.

The forward inboard lock 61 is constructed and mounted at the forward end of the platform in the same manner and its lock bolt 74 is connected to a forward outboard lock shaft 75 by a link 76 and a lever arm 77.

The aft outboard lock 62 (Fig. 7) is provided with a longitudinal cylindrical lock bolt 80 slidably disposed in a housing or casting 81. The housing 81 is bolted or otherwise securely fastened to the underside of the overhanging portion of the flight deck 15. The upper portion of the casting 81 is provided with a stopping device having a beveled or downwardly and inwardly retreating face 82 disposed to engage the downwardly and outwardly extending beveled face 83 of a stop casting 84 which is bolted or otherwise firmly secured to the aft end of the elevator platform 10. The bottom face 85 of the stop casting 84 is inclined rearwardly and downwardly at an angle to its face 83. The upper front top portion 86 of the bolt 80 is cut away at an angle extending outwardly and downwardly for wedging the faces 83 and 86 of the stop casting on the edge of the elevator platform between the beveled edge 82 of the lock housing and the lock bolt when the lock bolt is moved forward to lock the platform in its flight deck position, so that the aft end of the elevator will be tightly locked and wedged against the flight deck when the lock bolt is in its locking and wedging position.

The rear end of the bolt 80 is connected by a link 87 to the upper end of a lever arm 88, the other end of which is fixed on the outboard lock shaft 73, so that rotation or rocking of the lock shaft 73 will move the lock bolt 80 into or out of locking position.

The forward outboard lock 63 is constructed and mounted at the forward end of the platform in the same manner and its lock bolt 90 is connected to the forward outboard lock shaft 75 by a link 91 and a lever 92. The lock bolt 90 is also provided with an outwardly and downwardly beveled face 93 disposed to engage a beveled face 94 on the stop casting 95 associated with the lock 63. The beveled faces on the lock bolts and the stop members of the lock 62 and 63 will not only lock the platform firmly in its position at the flight deck, but will also wedge it firmly against the flight deck so that there can be no looseness between the flight deck and the ship even though there should be warpage of the flight deck or a change in size of the notch in the deck due to changes in temperature. This wedging action will prevent any battering ram effect of the platform on the ship due to pitch and roll and, also, to wind and sea.

It will also be noted the links and lever arms between the lock bolts and the lock shafts form toggle-like connectors which exert a powerful pressure to maintain the bolts in their locking position.

The lock shaft 73 for operating the lock bolts 64 and 80, is rotatably mounted in a plurality of pillow blocks 97, 98, 99 and 100, mounted on the underside of the overhanging edge of the flight deck platform and in a pillow block 100a mounted within the ship hull. In order to prevent binding of the shaft 73 and its bearings, it is constructed in several sections connected by universal joints 101 and 102. The lock shaft 75 at the forward end of the elevator platform is rotatably mounted in a plurality of pillow blocks 103, 104, 105 and 106, secured at suitable intervals on the underside of the overhanging edge of the flight deck and in a pillow block 106a mounted within the ship hull. The shaft 75 is constructed in several sections which may be connected by suitable universal joints 107 and 108 in order to avoid binding of the shaft in any of its bearings.

The means for operating the lock shafts 73 and 75 comprise an air engine 110 mounted within the ship hull on a frame 117. The engine is provided with a piston 111 disposed in a cylinder 112 for driving a piston rod 113. The engine is connected by inlet and outlet air pipes 114 and 115 by means of which it may be connected to a suitable air force (not shown) mounted in the ship.

The outer end of the rod 113 is fixed in a crosshead 116 which is slidably disposed on a part of the engine frame 117. The forward end of the cross head 116 is connected by a link 118 to a clevis 119 on the forward end of an inboard operating rod 120.

The guide block 116 is provided with an off set arranged to engage a roller 116A which in turn operates an electric switch 116B. As the crosshead 116 moves under the influence of power rod 113, switch arm 116A is moved and switch 116B is closed, to connect the electric control for moving the platform when the locks are unlocked and to disconnect it when the lock bolts are moved to their locking position. This arrangement provides a means for preventing the motor 40 from causing operation of the hoisting engine and platform while the platform is locked against the flight deck.

The aft end of the operating rod 120 is pivotally connected by a link 121 with the upper end of a lever arm 122, the lower end of which is fixed on the inner end of the lock shaft 73. The lever arm 122 is so fixed on the lock shaft 73 that a reciprocating motion of the operating rod 120 in the aft direction will rotate or rock the lock shaft 73 and thereby operate its levers 72 and 88 to move the lock bolts 64 and 80 out of their locking position.

The means for rotatably moving the lock shaft 75 by means of the air engine, comprises a lever 125, a link 126, and a lever arm 127. The lever 125 has its upper end pivotally connected to the link 118 attached to the rod 120 and its lower end pivotally connected to a support 128 mounted on the ship frame. The link 126 has one end pivotally connected to the middle portion of the lever 125 and its central portion pivotally connected to the outer end of the lever arm 127, the other end of which is fixed on the inner end of the lock shaft 75. With this construction, it will be observed that a reciprocating movement of the link 118 by the piston rod 113 toward the aft end of the ship will move the top of the lever 125 in the aft direction thereby pulling on the link 126 and turning the crank arm 127 to rock the shaft 75 and thus operate the lever arms 77 and 92 to move the locking bolts 74 and 90

out of their locking position and into their unlocked position.

A manual means 130 is provided for operating the locking apparatus at any time when the air engine fails in operation by reason of failure in the air supply for it or for any other reason. The manual means 130 includes a hand lever 131 having its base end rotatably mounted on one end of a shaft 132 which is rotatably mounted in the framework underneath the overhanging deck 15. A rest hook 133 is provided for supporting the hand lever when it is not in use. A two-way pawl 134 (Fig. 11) is pivotally mounted by a bolt 135 on the base end of the hand lever 131 in position to engage either side of a ratchet wheel 136 fixed on the outer end of the shaft 132, so that the lever may be used for operating the pawl to rotate the shaft 132 in either direction. A spring biased pin 137 is disposed in the free end of the pawl for holding it out of use when the lever 131 is not being used. A pinion 139 is fixed on the inner end of the shaft 132 in position to mesh with a segmental gear 140 which is firmly fixed on the locking shaft 75, so that operation of the hand lever 131 when the pawl 134 is in one of its locking positions will rotate the pinion 139 and thereby move the segmental gear to rock the shaft 75 to move the lock bolts into or out of locking position, it being obvious that the rotation of the shaft 75 to move the lock bolts 74 and 80 will also operate the arm 127, the link 126, the lever 125 and the operating rod 120 to rock the shaft 73 for moving the lock bolts 64 and 80.

In order to prevent the lock bolts from being moved into locking position when the elevator platform is not at the flight deck, a safety cam 142 (Figs. 3, 5 and 10) is pivotally mounted by a bolt 144 on a depending support 145 and provided with a locking member 143 disposed to cooperate with a lock block 147 on the rod 120. The block 147 is fastened to the rod 120 by a bolt 148 and it may be adjusted to its correct position on the rod by loosening the bolt sliding the block along the rod until it is in the correct position and then tightening the bolt. The depending support 145 is also provided with a hole which receives the operating rod 120 and provides a slidable bearing for it.

A compression spring 142*a* is mounted between a lip 142*b* on the safety cam arm and a nut and washer 142*c* on the outer end of a rod 142*d*, the inner end of which is pivotally mounted by a bolt 142*e* on the depending safety cam support 145. The spring 142*a* will bias the safety cam 142 outwardly into the path of the elevator platform so that the locking member 143 of the safety cam device will always be in locking position except when the elevator platform is at the flight deck.

When the lock bolts are withdrawn from their locking position by movement of the rod 120 in the aft direction, that movement of the rod moves the locking block 147 aftward beyond the end of the locking member 143. When the platform leaves the flight deck, it releases the cam lever 142. Thereupon, the spring 142*a* forces the locking member 143 against the rod 120 back of the block 147 where it will prevent forward movement of the rod and the block until the platform is again moved to the flight deck. Thus the rod 120 cannot be operated to move the lock bolts into locking until the movement of the platform to the flight deck operates the cam lever 142 to move the locking member 143 outwardly to its unlocking position.



When the elevator platform is locked in position at its flight deck, the locking bolts must not be removed from their locking position unless the oil pressure in the hydraulic engine cylinder 34 is sufficient to maintain the hoisting cables with full power to support the platform at the flight deck. Therefore, we have provided an engine interlock mechanism 150 for preventing movement of the locking bolts to their unlocking position unless the oil pressure in the engine is sufficient to support the elevator platform at the flight deck.

The interlock mechanism 150 comprises a hydraulic cylinder 151 (Figs. 5, 8 and 9), a piston 152 operatively disposed in the cylinder and a rectangular head 153 on the upper end of the piston. The cylinder 151 is mounted by a pair of supporting members 154 on the lower part of the engine frame with the piston head 153 slidably disposed between a pair of guide blocks 154*a* and 154*b* on the underside of a portion of the frame 117 of the air engine 110. The piston head 153 is disposed to engage, when in its lowermost position, a pair of locking hooks 155 and 155*a* on the free end of the link yoke 126 which is pivotally connected with the lever 125 and the lever arm 127 so that the levers and the operating rod 120 cannot be moved to withdraw the locking bolts from their locking position unless the piston head 153 is in its uppermost position.

The means for raising the piston and piston head into their uppermost position to permit unlocking operation of the rod 120 when the engine is ready to support the platform is a plunger 156 seated in a cavity 157 in the lower part of the cylinder 151 which is connected by an oil pipe line 158 to the high pressure side of the hydraulic engine. When the hydraulic fluid in the high pressure side of the hydraulic engine is at its normal high pressure, that pressure will raise the plunger 156 upwardly and cause it to push upwardly on the bottom of the piston 152 and thus raise the piston to move its piston head 153 to its uppermost position out of engagement with the locking hooks 155 and 155*a* on the operating link 126.

A compression spring 160 is mounted in the interior of the cylinder 152 between a plug 161 slidably disposed in the upper end of the cylinder and a bottom plate 162 which is welded into the bottom of the cylinder. The upper end of the plug rests against a bottom section of the air engine frame 117. When the piston is moved upwardly under the action of the plunger 156, the spring 160 is compressed and stores up energy to bias the piston 152 downwardly against the pressure of the oil in the engine cylinder. The strength of the compression spring 160 should be so selected that it will counterbalance the pressure of the plunger 156 operated by the pressure of the oil in the engine in such manner that the piston will be forced upwardly to unlock the bars 155 and 155*a* only when the oil pressure in the engine cylinder is sufficient to support the elevator platform.

At times it may happen that the oil line 158 leading to the cylinder 151 is shot away or otherwise damaged while the oil pressure in the engine cylinder 34 is still capable of supporting the elevator platform. If the oil line 158 is seriously damaged but the oil pressure in the engine cylinder is still capable of supporting the platform, the piston 152 may be moved upwardly by the hand lever 165 which is pivotally mounted on the cyl-

inder 151 and connected by a push rod 166 with the underside of the power head 153 on the upper end of the piston. As indicated in the drawings, if the handle 165 is raised it will push upwardly on the rod 166 and thus raise the power head 153 out of its locking engagement with the locking hooks 155 and 155a so that the locking apparatus may be operated to withdraw the lock bolts from their locking position.

*Assumed operation of the apparatus*

It will be assumed now that the elevator platform is locked at the flight deck in the position shown in Fig. 3, that the hand operating means is disconnected by moving the pawl 134 into its non-engaging position and resting the hand lever against the rest hook 133, and that the oil pressure in the engine cylinder is sufficient to support the platform and, therefore, sufficient to maintain the piston head 153 above the interlock hooks 155 and 155a. It will be assumed now that the attendant desires to unlock the platform to move it downwardly and, therefore, operates the air engine 110 to move the lock bolts to their unlocked position. The operation of the air engine 110 causes its piston 111 to move in the aft direction (Fig. 3) and thereby push its piston rod 113 outwardly.

The outward movement of the piston rod carries with it the guide 116, the link 118, the lever 125, the clevis 119, the operating rod 120, and the link 121 and thereby rocks the lever arm 122 in anticlockwise direction to rock the lock shaft 73 into open locking position. This rotative movement of the shaft 73 causes its lever arms 72 and 88 to pull on their links 71 and 87 and thus pull the aft inboard locking bolt 64 and the aft outboard locking bolt 80 out of their locking position into their unlocked position. This motion also engages guide block 116 with roller 116A to close switch 116B to close the electric circuit to the platform control.

The aft movement of the link 118 carries with it the upper end of the operating lever 125 thus pulling the link 126 in the aft direction and thereby operating the lever arm 127 to cause a corresponding rotative movement of the shaft 73. The rotative movement of the shaft 75 causes its lever arms 77 and 92 to pull on their links 76 and 81 and thus move the forward inboard lock bolt 74 and the forward outboard lock bolt 90 out of their locking position and into their unlocked position. The lock bolts are now in their unlocked position and the platform is supported on the hoisting cables by the hydraulic engine.

The rotative movement of the lock shaft 75 also rotates a gear segment 140 and this in turn rotates the pinion 139 of the hand operating mechanism but this results in no effect because the pawl 134 has been disconnected from the ratchet wheel 136.

It will be assumed now that the platform is lowered from the flight deck to the main deck. As it leaves the flight deck, it moves out of the way of the safety cam 142 which falls downwardly under the effect of the spring 142a and thereby moves its locking member 143 inwardly against the operating rod 120. The unlocking movement of the locking rod moves the locking block 147 in the aft direction until it is beyond the locking member 143 so that the present movement of the locking member 143 brings it up against the operating rod back of the locking member where it will prevent any locking movement of the operating rod as long as the safety cam is not held in "safe" position by the elevator platform being at the flight deck.



It will be assumed now that the platform is again raised to the flight deck and that it will be locked in position thereat.

As the elevator platform approaches closely to the flight deck it strikes the safety cam 142 and moves it inwardly, thus moving the locking member 143 away from the rod 120 and out of the way of the locking block 147 so that the operating rod 120 may be moved in the forward direction for operating the locking apparatus to lock the platform at the flight deck.

In this operation of the locks it will be assumed that the air pressure for the air engine is insufficient to operate that engine and that the attendants must operate the manual means 130 to effect the desired locking action. In order to use the hand means the pawl 134 is thrown into engagement with the ratchet wheel 136, then the lever 131 is operated back and forth to rotate the ratchet wheel 136. The rotation of the wheel 136 rotates the pinion 139 on the segmental gear 140 and thus rocks the lock shaft 75 to move its links 76 and 91 in the aft direction and thereby push the locking bolts 74 and 90 into their locking position.

The rotative movement of the lock shaft 75 (Fig. 5) also moves the lever arm 127 to pull the link 126 on the lever 125 and thereby pull the operating rod 120 on the lever arm 122 to cause a rotative movement of the shaft 73. The rotative movement of the shaft 73 causes its lever arms 72 and 88 to push on the links 71 and 87 and thereby move the locking bolts 64 and 80 into their locking position. Inasmuch as the wedge shaped faces 86 and 93 of the outboard locking bolts 80 and 90 are disposed in engagement with cooperating wedge faces on the stop castings on the elevator platform, they will wedge the platform tightly against the flight deck and maintain it in that position regardless of the action of the elements or any changes in the size of the elevator notch.

From the foregoing description it will be apparent that we have provided an efficient locking apparatus for locking and wedging a deck edge elevator platform in a parking position at the flight deck in such manner as to prevent any looseness between the platform and the ship so that no battering ram effect can take place between the platform and the ship when the ship rolls and pitches to such an extent that the outboard portion of the platform dips into the water.

It will also be apparent that we have provided a locking and wedging apparatus for holding a deck edge elevator platform at its flight deck; that such apparatus may be operated either by hand or a power means; that we have provided means for interlocking the locking apparatus with the hoisting engine in such manner that it cannot be unlocked unless the oil pressure in the hoisting engine is sufficient to support the platform; and that the lock bolts cannot be moved to their locking position until the platform is in the position in which it is to be locked.

It will also be apparent that, with the described arrangement of the locks, that the inboard locks will carry only vertical forces which will result in a low reaction at the aft lock due to water drag; that we have provided a wedge shaped locking means with a power follow-up which will tie the elevator platform securely to the ship under all adverse conditions; and that the tog-

gle arrangement of the operating devices behind the lock bolts will exert a high force on the bolts and will prevent any forces exerted by the platform from moving the bolts out of their engaged position.

Although we have illustrated and described only one specific embodiment of our invention, many changes therein and modifications thereof may be made without departing from the spirit and scope of the invention.

We claim as our invention:

1. In an elevator, a platform for serving a parking floor, a hoisting engine for operating the platform, a stop device on the floor for each end of the platform, to limit its upward movement, a wedging lock at each end of the platform for wedging and locking the platform tightly against the stopping devices on the parking floor, a locking engine for locking and unlocking the locks, and means for causing the locking engine to exert a continuous pressure on the wedging locks while they are in their locking position and thereby constantly maintain the platform tightly against the parking floor.

2. In an elevator, a platform for serving a parking floor, a hoisting engine for operating the platform, a plurality of stopping devices on the parking floor for each end of the platform, a pair of guide members for preventing lateral movement of the platform, a lock at each end of the platform for locking it against the adjacent stopping devices on the parking floor and preventing more than a limited vertical movement of the platform, a wedging lock at each end of the platform for wedging the platform tightly against the adjacent stopping devices on the parking floor, and means for locking and unlocking the locks.

3. In an elevator, a platform for serving a parking floor, a hoisting engine for operating the platform, a plurality of locks for locking the platform at the parking floor, means for locking and unlocking the locks, a means responsive to movement of the platform from the parking floor for preventing locking operation of the locks while the platform is away from the parking floor, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing unlocking of the locks while the hoisting engine is not in condition to operate the platform.

4. In an elevator, a platform for serving a parking floor, a hoisting engine for operating the platform, a pair of guide members for preventing lateral movement of the platform, a lock at each end of the platform for locking it at the parking floor and preventing more than a limited vertical movement, of the platform, a wedging lock at each end of the platform for wedging the platform tightly against the parking floor, means for locking and unlocking the locks, a means responsive to movement of the platform from the parking floor for preventing locking operation of the locks while the platform is away from the parking floor, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing unlocking of the locks while the hoisting engine is not in condition to support the platform.

5. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, a lock housing mounted in the flight deck at each end of the platform, a stop mounted on each end of the platform opposite the housing thereat, a lock bolt slidably disposed in each housing for engaging the stop associated therewith, a lock shaft rotatably mounted on the ship at each end of the platform for moving the bolts into and out of locking position, an operating rod for operating the lock shafts, a means for operating the operating rod, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.

6. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, a lock housing mounted in the flight deck at each end of the platform, a stop mounted on each end of the platform opposite the housing thereat, a lock bolt slidably disposed in each housing for engaging the stop associated therewith, a lock shaft rotatably mounted on the ship at each end of the platform for moving the bolts into and out of locking position, an operating rod for operating the lock shafts, a locking engine for operating the operating rod, a means responsive to movement of the platform from the flight deck for preventing locking operation of the lock bolts until the platform is positioned at the flight deck, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.

7. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, a lock housing mounted in the flight deck at each end of the platform, a stop mounted on each end of the platform opposite the housing thereat, a lock bolt slidably disposed in each housing for engaging the stop associated therewith, said housings, stops and lock bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, and a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position.

8. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a lock housing mounted in the flight deck at each end of the platform, a stop mounted on each end of the platform opposite the housing thereat, a lock bolt slidably disposed in each housing for engaging the stop associated therewith, said housings, stops and lock bolts having beveled faces disposed to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, and

a means responsive to movement of the platform from the flight deck for preventing locking operation of the locking bolts until the platform is positioned at the flight deck.

9. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, a lock housing mounted in the flight deck at each end of the platform, a stop mounted on each end of the platform opposite the housing thereat, a lock bolt slidably disposed in each housing for engaging the stop associated therewith, said housings, stops and lock bolts having beveled faces disposed to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.

10. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing having a stopping member mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith and locking it against the stopping member on the housing, an outboard lock housing having a stopping member mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith and locking it against the stopping member on that outboard housing, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, and a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position.

11. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, said inboard housings, inboard stops and inboard bolts having horizontal flat cooperating faces for preventing vertical movement but permitting a limited horizontal movement of the platform, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, said outboard housings, outboard stops and outboard lock bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connecting to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position.

12. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, said inboard housing, inboard stops and inboard bolts having horizontal flat cooperating faces for preventing vertical movement but permitting a limited horizontal movement of the platform, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, said outboard housings, outboard stops and outboard lock bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, and manual means for operating the operating rod to move the bolts into and out of locking position upon failure of the locking engine.

13. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, said inboard housings, inboard stops and inboard bolts having horizontal flat cooperating faces for preventing vertical movement but permitting a limited horizontal movement of the platform, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, said outboard housings, outboard stops and outboard lock

bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a toggle like link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, and means for supplying a constant power to the locking engine to maintain the outboard lock bolts in tight wedging position while they lock the platform at the flight deck.

14. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, a lock shaft rotatably mounted on the ship at each end of the platform, a toggle like link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, means for supplying a constant power to the locking engine to maintain the outboard lock bolts in tight wedging position while they lock the platform at the flight deck, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.

15. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, said outboard housings, outboard stops and outboard lock bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a toggle like link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, means for supplying a constant power to the locking engine to maintain the outboard lock bolts in tight wedging position while they lock the platform at the flight deck, and a means responsive to movement of the platform from the flight deck for preventing locking operation of the locking bolts until the platform is positioned at the flight deck, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.



16. In a deck edge elevator for an airplane carrier ship, an elevator platform for serving a main deck and a flight deck, a hoisting engine for supporting and raising and lowering the platform, an inboard lock housing mounted in the flight deck at each end of the platform, an inboard stop mounted at each end of the platform opposite the inboard housing thereat, a lock bolt slidably disposed in each inboard housing for engaging the inboard stop associated therewith, said inboard housings, inboard stops and inboard lock bolts having flat horizontal cooperating faces for preventing vertical movement of the platform, an outboard lock housing mounted in the flight deck at each end of the platform, an outboard stop mounted on each end of the platform opposite the outboard housing thereat, a lock bolt slidably disposed in each outboard housing for engaging the outboard stop associated therewith, said outboard housings, outboard stops and outboard lock bolts having beveled faces to wedge and lock the platform tightly against the flight deck when the bolts are in their locking position, a lock shaft rotatably mounted on the ship at each end of the platform, a toggle like link and lever arm connecting each lock bolt to the lock shaft at its end of the platform, an operating rod, a plurality of links and lever arms connecting the operating rod to the lock shafts, a locking engine connected to the operating rod for moving it to rock the lock shafts and thereby move the lock bolts into and out of their locking position, means for supplying a constant power to the locking engine to maintain the outboard lock bolts in tight wedging position while they lock the platform at the flight deck, a safety cam responsive to movement of the platform from the flight deck for preventing a locking operation of the locking bolts until the platform is positioned at the flight deck, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing withdrawal of the locking bolts from their locking position while the hoisting engine is not in condition to support the platform.

17. In an elevator, a platform for serving a parking floor, a plurality of stopping devices on the parking floor, a hoisting engine for operating the platform, a lock at each end of the platform for locking the platform against the stopping devices on the parking floor, and a locking engine for locking and unlocking the locks, means responsive to operating of the locks to lock the platform at the parking floor for preventing operation of the hoisting engine while the locks are in locked condition.

18. In an elevator, a platform for serving a parking floor, a hoisting engine for operating the platform, a lock at each end of the platform for locking the platform against the parking floor,

means responsive to operating of the locks to lock the platform at the parking floor for preventing operation of the hoisting engine while the locks are in locked condition, and an interlocking mechanism responsive to the condition of the hoisting engine for preventing the locks from being unlocked while the hoisting engine is not in condition to support the platform.

19. In an elevator, a platform for serving a parking floor, a plurality of stopping devices on the parking floor, a hoisting engine for operating the platform, a lock at each end of the platform for locking the platform against the stopping devices on the parking floor, means responsive to operation of the locks to lock the platform at the parking floor for preventing operation of the hoisting engine while the locks are in locked condition, and a means responsive to the absence of the platform from the parking floor for preventing a locking operation of the locking bolts until the platform is positioned at the parking floor.

20. In an elevator, a platform for serving a parking floor, a plurality of stopping devices on the parking floor, a hoisting engine for operating the platform, a lock at each end of the platform for locking the platform against the stopping device on the parking floor, a locking engine for locking and unlocking the locks, and a means responsive to the absence of the platform from the parking floor for preventing a locking operation of the locks until the platform is positioned at the parking floor.

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