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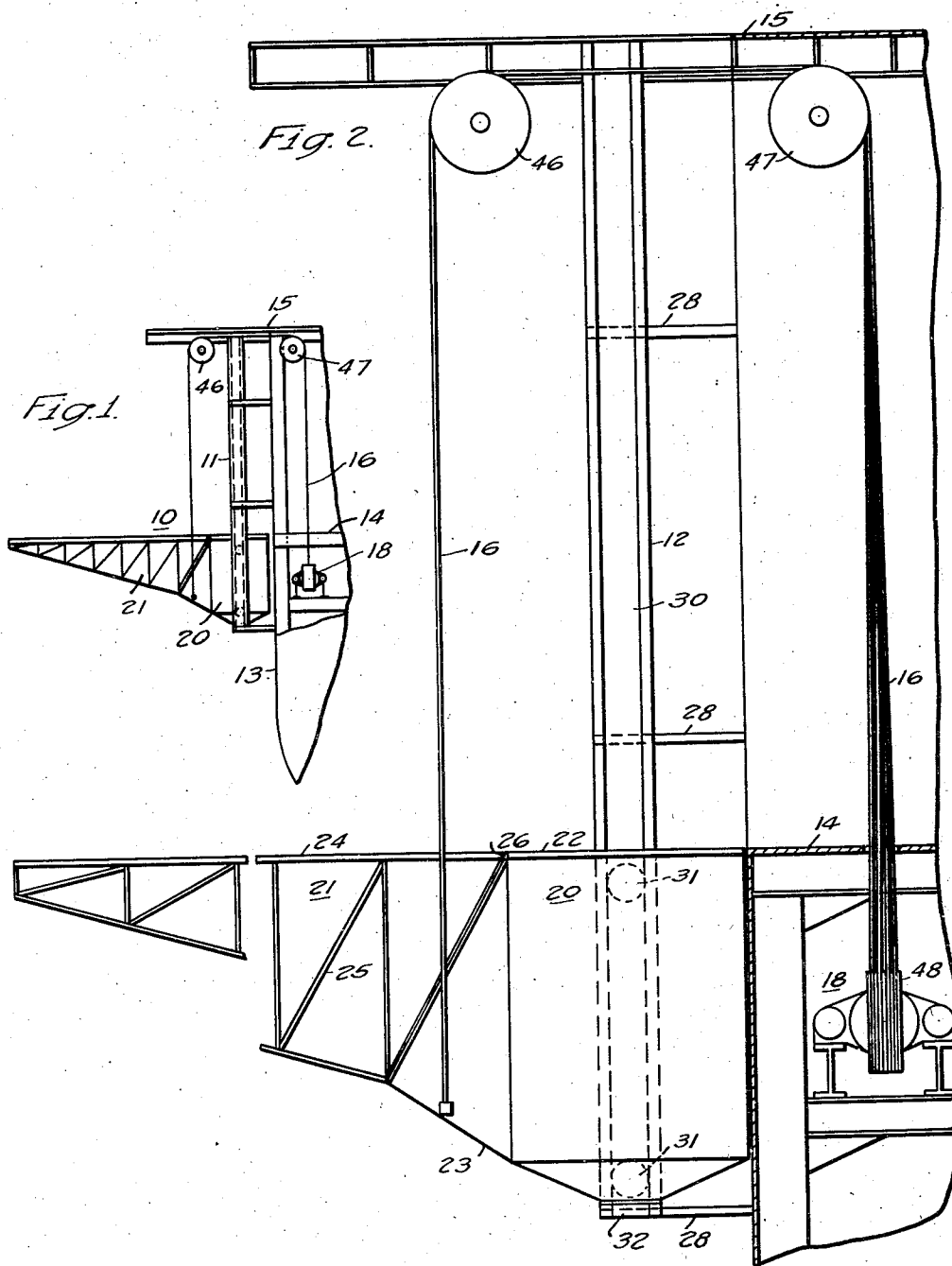
J. DUNLOP

2,408,757

ELEVATOR

Filed Oct. 21, 1943

3 Sheets-Sheet 1



WITNESSES:
E. A. McElroy
Birney Hines

INVENTOR
James Dunlop
BY *[Signature]*
ATTORNEY

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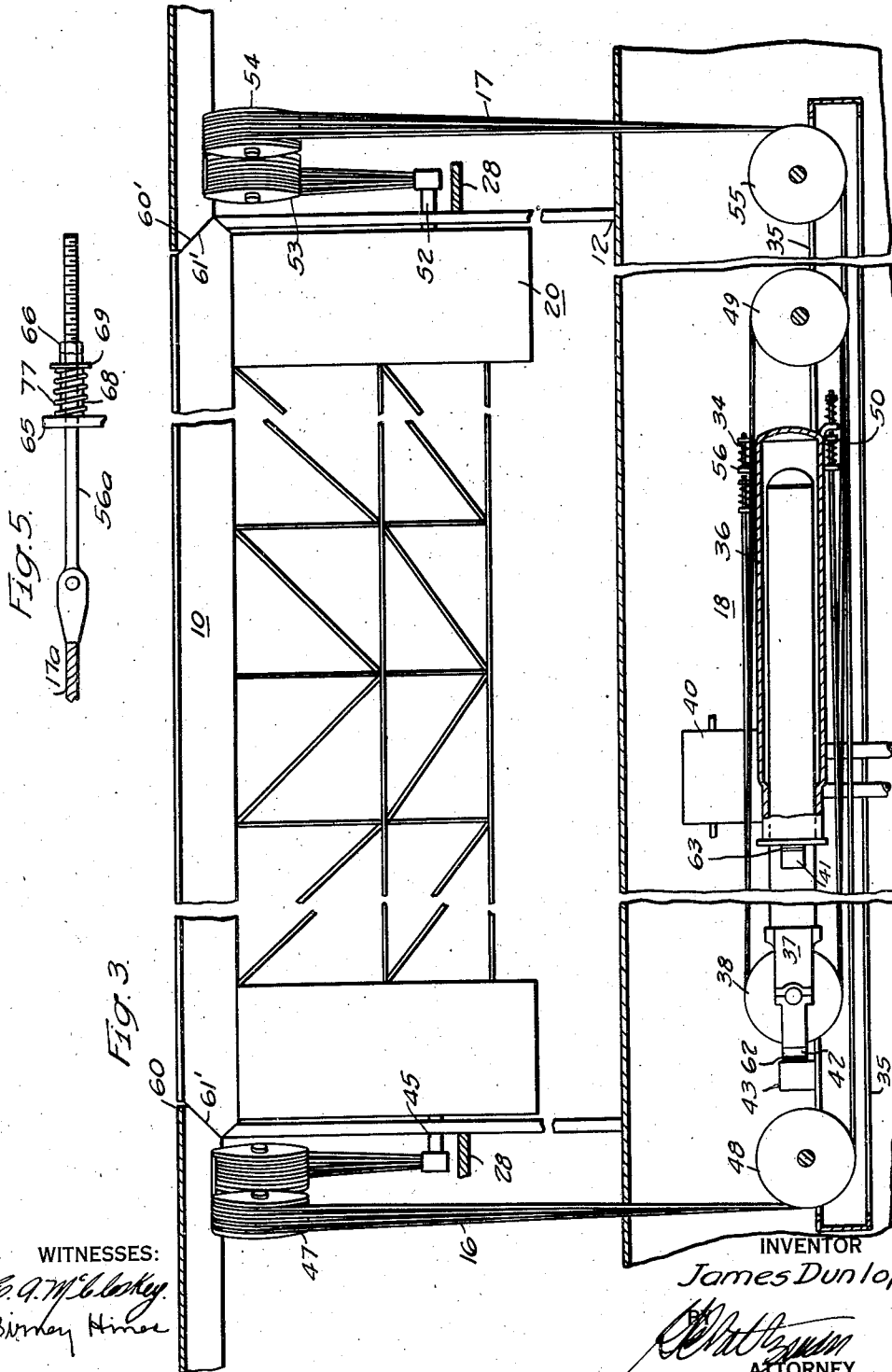
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3 Sheets-Sheet 3

Fig. 6.

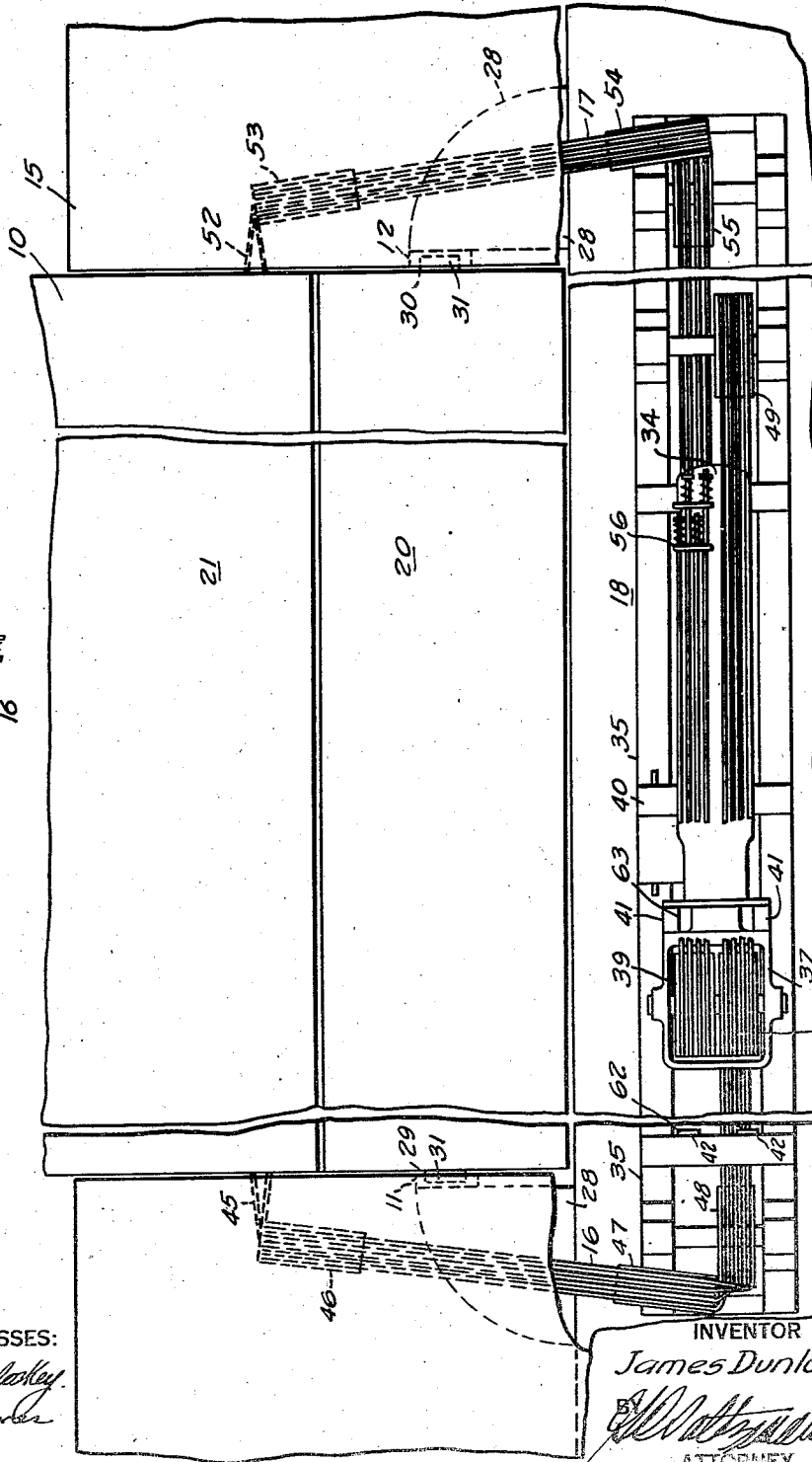
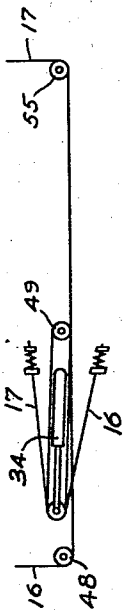


Fig. 4.

WITNESSES:

E. A. M. C. C. C.
Birney Hinder

INVENTOR

James Dunlop

ATTORNEY

UNITED STATES PATENT OFFICE

2,408,757

ELEVATOR

James Dunlop, Ridgewood, N. J., assignor, by
mesne assignments, to Westinghouse Electric
Corporation, East Pittsburgh, Pa., a corpora-
tion of Pennsylvania

Application October 21, 1943, Serial No. 507,132

7 Claims. (Cl. 187-6)

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My invention relates to elevators and, more particularly, to hoisting apparatus for raising and lowering elevators.

One object of my invention is to provide an elevator hoisting apparatus which will maintain the elevator platform in level position regardless of the position of the load upon it while it is being loaded or unloaded and while it is being raised or lowered.

Another object is to eliminate the need for any leveling device to level the elevator platform at floor landings.

A further object is to provide an elevator hoisting apparatus which shall be simple and easy to install, operate and maintain in operation and which may be used for extremely large elevators as well as for small or medium sized elevators.

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

Figure 1 is a diagrammatic representation in end elevation of a deck edge elevator for the side of a ship and provided with my improved hoisting apparatus;

Fig. 2 is an enlarged view in end elevation of the elevator illustrated in Fig. 1, with part of the platform broken away and with the nearest guide rail eliminated;

Fig. 3 is a view taken from the interior of the ship looking toward the elevator and showing the hoisting apparatus and the engine for operating it, part of the engine being shown in cross section and the elevator being shown in its position at the flight deck of the ship;

Fig. 4 is a top plan view of the elevator and hoisting apparatus shown in Fig. 3 but with the elevator lowered into position at the main deck and with the flight deck and the main deck cut away to give a full view of the engine;

Fig. 5 is an enlarged view in side elevation of one of the cable hitches mounted on the engine shown in Fig. 2; and

Fig. 6 is a small view giving the position of the engine with reference to the cable sheaves.

My invention is illustrated in connection with a deck edge elevator, such as is used on airplane carrier ships for transferring airplanes from the main deck to the flight deck or from the flight deck to the main deck. Elevators of this type are mounted on the outside of the hull at one side of the ship in alignment with an opening therein to the main deck and are movable up and down on the side of the ship to serve the main deck and the flight deck. Some of these elevators extend along the side of the ship for a

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distance of over sixty feet and outwardly over thirty feet. However, it is to be understood that the invention may be used in connection with many other forms of elevators.

Referring more particularly to the drawings, I 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 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 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 bridgelike construction to form a relatively light but strong body. 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 bridgelike 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 lock or other narrow opening.

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 and 30 (Fig. 4) 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. Normally, the platform is suspended entirely by the hoisting cables.

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.

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The outer end of the plunger is provided with a power head 37 in which a pair of power sheaves 38 and 39 are rotatably mounted. The plunger in the cylinder slides back and forth horizontally 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 40 is mounted on the cylinder for controlling the operation of the plunger by controlling the admission of the oil to the cylinder.

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 left-hand end of the platform (Fig. 3) are secured to the base 20 by means of a bracket 45 mounted thereon 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 rotatable sheave 38 mounted in the power head 37, and thence to a dead end hitch 50 mounted on the lower part of the rear end of the engine cylinder 34.

The hoisting cables 17 at the right-hand end of the elevator (Fig. 3) are secured to the base 20 by a bracket 52 mounted thereon 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 the power sheave 39 mounted in the engine plunger head 37, and thence to a dead-end hitch 56 mounted on the upper part of the rear end of the engine cylinder.

The position of the engine 13 on the bed 35 is so arranged in central relation with the ends of the elevator that the length of the cables 16 and the length of the cables 17 will be approximately equal. This arrangement secures a well balanced operation of the cables and also assists in leveling the elevator because, inasmuch as the stretch in the cables is approximately uniform, the use of the same length of the cables at the ends of the elevator will result in the same length of stretch in each set of cables and thus maintain the platform in a level position. Also, this roping arrangement or cable system results in a two-to-one movement of the elevator when the plunger is moved; that is, the plunger stroke is one-half the elevator travel when in operation.

As a further aid to leveling the platform at the flight deck, the flight deck is provided with stops such as the inwardly beveled edges 60 and 60' which cooperate with the upwardly beveled edges 61 and 61' on the ends of the elevator platform to stop the platform level with the flight deck. In order to hold the platform level with the flight deck after it arrives thereat, the cables are connected to the engine a little short of the actual length necessary for raising the platform to

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the flight deck so that the platform arrives at the flight deck before the engine reaches the limits of its forward stroke for the up direction. Thus, the engine continues to exert a raising force on the cables until the power head reaches its up stop block 42. This additional raising action takes up all of the predetermined inherent stretch in the cables so that the tendency of the cables to return to their normal length holds the platform firmly against the flight deck stops 60 and 60'. The limits of movement of the engine plunger may be readily adjusted by the use of suitable shims 62 behind the up stop block and shims 63 behind the down stop block and also by the use of the dead end hitches 50 and 56.

As illustrated in Fig. 5, one end of the hitch 56 is firmly secured to the engine end of one of the hoisting cables 17a and its other end is secured to and passes through a bracket 65 on the cylinder head to be held in that position by a pair of nuts 66. A compression spring 77 is concentrically mounted on the hitch rod 56a between the bracket 65 and nuts 66 to provide means for storing energy to operate a broken-cable switch (not shown). A collar 68 is mounted under the spring and on the hitch rod between the bracket 65 and the spring washer 69 so that the nuts 66 may be tightened until the washer is firmly against the collar and the collar is firmly against the bracket, thereby making a dead-end hitch for the hoisting cable but permitting the spring to use its stored energy to pull the washer and rod forward upon failure of the cable. Usually for convenience the collar and the washer are constructed in one integral piece. The broken cable switch and spring construction are illustrated, described and claimed in my copending application filed October 29, 1943, Serial No. 508,191. Each of the hitches is constructed and used in the same manner.

By the use of the adjusting shims 62 and 63 behind the stopping blocks and the nuts on the cable hitches, the cables and the stroke of the plunger may be adjusted to any desired length to take advantage of the predetermined stretch in the cables so that, when the platform reaches the flight deck and the engine moves the power head just a little farther, that movement will be sufficient to take up the predetermined stretch in the cables to such extent that even a fully loaded platform will be firmly held against the flight deck stops without the need of any special leveling device.

In the case of an off-center load on the platform 10 causing an unequal load on the opposite cables, the pressure exerted on either stop 60 or 60' will vary in relation to the stretch of the sets of cables at the ends and the position of the load on the platform. The pressure of either end of the platform on the stop 60 or 60', however, will be kept above zero and governed by the predetermined stretch in the cables for maximum load and the adjustment provided for each cable at the hitches to equalize this stretch of the cables will cause the platform to always lie flush with the flight deck line regardless of the position of the load on the platform.

The travel of the platform for leveling at the main deck may also be adjusted by adjusting the number of shims 63 behind the down stop blocks. The shims used for both the up stopping blocks and the down stopping blocks may be of the same size so that they may be interchanged as suits the occasion.

In view of the fact that no stopping means is

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provided for the platform at the lower or main deck level, its position with respect to the main deck with different loads will be determined by the stretch in the cables produced by each load. This is found in practice to have a variation of approximately $\frac{3}{8}$ inch between no load on the platform and fully loaded platform. The number of shims placed behind the down stopping blocks of the hydraulic motor should be such that this variation is spread equally above and below the lower deck level. Thus the platform will never be more than $\frac{1}{8}$ inch from true level and, for practical purposes, this is an excellent "level."

Fixed compression stops are provided only at the flight deck. No compression stops are provided for the main deck because the cables are always in tension and the platform stops level with the main deck when the power head on the engine reaches the down stopping blocks on the engine. If required, the down stopping blocks on the engine may be adjusted by taking out or putting in the shims 63 to cause the platform to level with the main deck.

In an assumed operation of the elevator, with the platform at the lower deck, the valve 40 on the engine 18 is operated to admit oil under pressure to the cylinder. As the oil flows into the cylinder, it forces the plunger forward and thereby moves the power sheaves to the left. As the power sheaves move toward the left, they exert a pull on the portions of the hoisting cables 16 and 17 and thus cause them to raise the platform 10 until it engages the stopping edges 60 and 61 on the flight deck. The stopping edges prevent further upward movement of the platform but the plunger continues its forward stroke a short additional distance until it is stopped by the up stopping blocks 42 on the engine. The movement of the plunger beyond its position corresponding to the position of the platform level with the flight deck increases the tension on the hoisting cables holding the platform against the flight deck until it absorbs all of the predetermined stretch in the cables. Hence the platform will be held tightly against the stopping means on the flight deck regardless of the position of the load on it and it will be prevented from tilting or getting out of level with the flight deck.

As the platform approached the flight deck, the valve 40 was operated to decrease the amount of oil admitted to the engine cylinder until the pressure decreased to a point where the plunger is merely held against the cables with sufficient force to maintain the platform in its upper position.

When the platform is to be lowered to the main deck, the valve 40 is operated to permit the oil in the cylinder 34 to escape and thereby permit the plunger to make its rearward stroke under the pressure exerted by the weight of the elevator. As the plunger nears the end of its rearward stroke, the valve 40 is operated to its closed position and the plunger reaches the down stopping blocks 41 and is stopped to hold the platform at the lower deck. As previously indicated, the down stopping blocks and the cable hitches are so adjusted that the platform will be in position to serve the main deck when the plunger is stopped by its down stopping blocks.

By the foregoing arrangement it will be seen that I have provided a simple and effective roping system for large size elevators which may be quickly and conveniently adjusted to maintain the elevator level with the floors at which it stops and which eliminates the necessity for any level-

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ing devices to maintain the elevator platform level with the floors it serves.

Although I have illustrated and described only one specific embodiment of my invention, it is to be understood that changes therein and modifications thereof may be made without departing from the spirit and scope of the invention.

I claim as my invention:

1. A deck edge elevator for serving an upper deck and a lower deck on a ship comprising, a pair of guide rails, means for mounting the guide rails on the side of the ship, an elevator platform disposed between the guide rails, guiding means mounted on the ends of the platform for engaging the guide rails to guide the movement of the platform, a stopping means disposed at the upper deck for limiting the upward movement of the platform, a deflecting sheave adjacent to each end of the platform, a hydraulic engine including a cylinder and a plunger disposed in the cylinder for operation by hydraulic pressure, a pair of power sheaves on the outer end of the plunger, a stationary sheave mounted in the rear of the engine, an adjustable cable hitch mounted on each side of the rear end of the engine, a plurality of fixed sheaves, a pair of hoisting cables of approximately equal length for operation by the engine to raise and lower the platform, one of said cables having its one end connected to one end of the platform and its other end connected to the cable hitch on one side of the engine with its middle portion passing over one of the power sheaves and around the stationary sheave and under the deflecting sheave at the end of the platform to which the cable is attached and over a number of the fixed sheaves, the other of said cables having its one end connected to the opposite end of the platform and its other end connected to the cable hitch on the opposite side of the engine from the first-mentioned cable hitch with its central portion passing over one of the power sheaves and the deflecting sheave and a number of the fixed sheaves at the end of the platform to which it is attached, an adjustable up stop device for limiting the forward stroke of the plunger to a short distance beyond that necessary to raise the platform to the upper deck, whereby the cables may be so adjusted by their hitches that their normal length is the length required to raise the platform to the upper deck stopping means and the up stop device on the engine may be so adjusted with reference to the upper deck stopping means that the platform will engage the upper deck stopping means before the plunger engages its stopping means so that the full forward movement of the plunger to the limit determined by the up stop device will pull the platform upwardly against the upper deck stopping means and take advantage of the inherent stretch in the cables to hold the platform firmly against the upper deck stopping means, and an adjustable down stopping device for limiting the rear stroke of the plunger to the distance required for leveling the platform with the lower deck.

2. An elevator for serving an upper deck and a lower deck comprising, a platform, a guide rail at each end of the platform for guiding the platform, a platform stopping means on the upper deck; a hydraulic engine having a cylinder and a plunger disposed therein for operation by hydraulic pressure, an adjustable up stop device for limiting the forward stroke of the plunger; a pair of power sheaves on the outer end of the plunger; a stationary sheave mounted at the rear of the

engine; a plurality of fixed sheaves, a deflecting sheave adjacent to each end of the platform, a pair of hoisting cables for operation by the engine to raise or lower the platform, one of said cables having its one end connected to one end of the platform and its other end connected to one side of the engine with its middle portion passing over a number of fixed sheaves and under the deflecting sheave at the end of the platform to which the cable is attached and around the stationary sheave and over one of the power sheaves, the other of said cables having its one end connected to the opposite end of the platform and its other end connected to the opposite side of the engine from the first-mentioned cable and its central portion passing over a number of the fixed sheaves and under the deflecting sheave at its end of the platform and over one of the power sheaves, and adjustable means disposed in the connection of each cable to the engine for increasing or reducing its effective length, whereby the cables may be so adjusted that their normal length is the length required to raise the platform to the upper deck stopping means and the up stop device on the engine may be so adjusted with reference to the upper deck stopping means that the platform will engage the upper deck stopping means before the plunger engages its stopping device so that the full forward movement of the plunger to the limit determined by the up stop device will pull the platform upwardly against the upper deck stopping means, and take advantage of the inherent stretch in the cables to hold the platform firmly against the upper deck stopping means.

3. An elevator for serving an upper deck and a lower deck comprising a platform, a guide rail at each end of the platform for guiding the platform, a platform stopping means on the upper deck; a hydraulic engine having a cylinder and a plunger disposed therein for operation by hydraulic pressure, an adjustable up stop device for limiting the forward stroke of the plunger to a short distance beyond that necessary to raise the platform to the upper deck; an adjustable down stop device for limiting the rearward stroke of the plunger, a pair of power sheaves on the outer end of the plunger; a stationary sheave mounted in the rear of the engine; a deflecting sheave adjacent to each end of the platform, a pair of hoisting cables for operation by the engine to raise and lower the platform, one of said cables having its one end connected to one end of the platform and its other end connected to one side of the engine with its middle portion passing under the deflecting sheave at the end of the platform to which the cable is attached and around the stationary sheave and over one of the power sheaves, and the other of said cables having its one end connected to the opposite end of the platform and its other end connected to the opposite side of the engine from the first-mentioned cable and its central portion passing under the deflecting sheave at its end of the platform and over one of the power sheaves, and adjustable means disposed in the connection of each cable to the engine for increasing or reducing its effective length.

4. A deck edge elevator for serving an upper deck and a lower deck on a ship, a pair of guide rails, means for mounting the guide rails on the outer side of the hull of the ship, an elevator platform disposed between the guide rails, guiding means mounted on the ends of the platform for engaging the guide rails to guide the movement of the platform, a stopping means at the

upper deck for stopping the platform, a hydraulic engine disposed in a horizontal position within the ship hull and below the lower deck for raising and lowering the platform, said engine including a cylinder and a plunger disposed in the cylinder for operation by hydraulic pressure, a pair of power sheaves on the outer end of the plunger, a deflecting sheave disposed at each end of the engine, a stationary sheave mounted between the rear end of the engine and the deflecting sheave at that end of the engine, a plurality of idler sheaves mounted on the outside of the hull of the ship, a hoisting cable having one end connected to one end of the platform and its other end connected to the one side of the engine with its middle portion passing over one of the power sheaves and around the stationary sheave and under one of the deflecting sheaves and over an idler sheave, a second hoisting cable having its one end connected to the other end of the platform and its other end connected to the opposite side of the engine from the first-mentioned cable with its central portion passing over one of the power sheaves and under one of the deflecting sheaves and over one of the idler sheaves to the end of the platform to which it is attached, said cables being of predetermined length sufficient to move the platform from one deck to the other when operated by the plunger, an adjustable up stop device for limiting the forward movement of the plunger to a position slightly beyond its position corresponding to the upper level position of the platform, and an adjustable down stop device for limiting the rearward movement of the plunger whereby the platform levels with the upper deck with the cables under tension when the plunger completes its forward stroke and with the lower deck when the plunger completes its rearward stroke.

5. An elevator operable between an upper level and a lower level comprising a platform movable on guides, a hydraulic engine having a cylinder and a power plunger therein for operation by hydraulic pressure, a plurality of power sheaves mounted on the outer end of the plunger, two sets of hoisting cables fastened to said platform at opposite sides and extending over the sheaves on the plunger to opposite sides of the cylinder of the engine, a stopping device for said platform at its upper level, and an adjustable stop for stopping the plunger when it moves forward to a position slightly beyond its position corresponding to the upper level position of the platform, whereby a predetermined tension is produced in said hoisting cables when said platform is at floor level in its upper level position.

6. In an elevator drive for an elevator platform operable between a top floor and a bottom floor, a hydraulic motor having a cylinder and a plunger therein, a plurality of hoisting cables connecting said plunger with said platform, a stop at the top floor for the platform, an adjustable stop on the engine for stopping said plunger at a position slightly beyond that necessary to raise the platform level with the top floor for tensioning the cables during the stop of the platform thereat, and a plurality of shims for said adjustable stop, whereby the tension in said cables can be adjusted to have a predetermined value when the platform is stopped level with said top floor.

7. In an elevator drive for an elevator platform operable between a top floor and a bottom floor, a cylinder and plunger type hydraulic motor, cables connecting said plunger with said plat-

form, a stop at the top floor level for the platform, an up adjustable stop on the engine for stopping the plunger at a position slightly beyond that necessary to raise the platform level with the top floor for tensioning the cables during the stop of the platform thereat, a plurality of shims for said adjustable stop, whereby the tension in the cables can be adjusted to the necessary value to cause the platform to level with

the top floor when the plunger is stopped by its up stop, a down stop on the engine for stopping the plunger at a position corresponding to the position of the platform level with the bottom floor, and shim means for adjusting the position of the down stop whereby the said platform can be made to stop approximately level with the lower floor regardless of load.

JAMES DUNLOP.