United States Patent

[11] **3,550,709**

[72] Inventor **Jennings B. Hottel**
Miami, Fla. (18563 Clark St., Apt. 206, Tarzana, Calif. 91356)

[21] Appl. No. **740,499**
[22] Filed **June 27, 1968**
[45] Patented **Dec. 29, 1970**

[54] **SELF-POWERED CLIMBING HAND TRUCK**
7 Claims, 8 Drawing Figs.

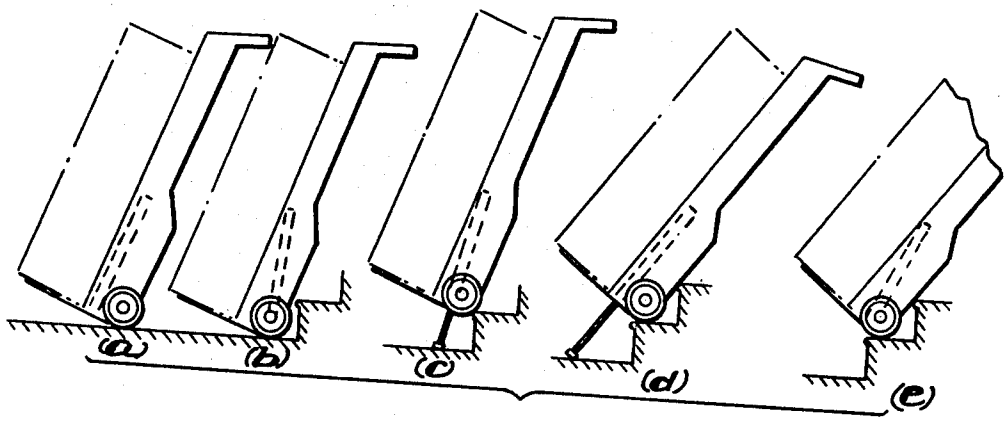
[52] **U.S. Cl.** **180/8, 280/5.3**
[51] **Int. Cl.** **B62b 5/02**
[50] **Field of Search** 180/8.01, 8; 280/5.3

[56] **References Cited**
UNITED STATES PATENTS

3,269,478	8/1966	Joslyn	180/8(.01)
3,417,831	12/1968	Lake	180/8(.01)

Primary Examiner—Leo Friaglia
Attorney—Robert Louis Finkel

ABSTRACT: A self-powered climbing hand truck having an upwardly extending load supporting structure, elongated rigid extensible means hingedly attached at its upper end to the load supporting structure, and means for controllably positioning the lower end of the extensible means with respect to the load supporting structure.



PATENTED DEC 29 1970

3,550,709

SHEET 1 OF 3

Fig. 1

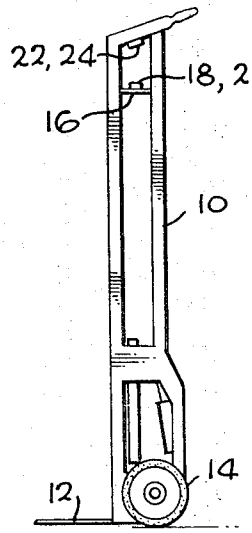
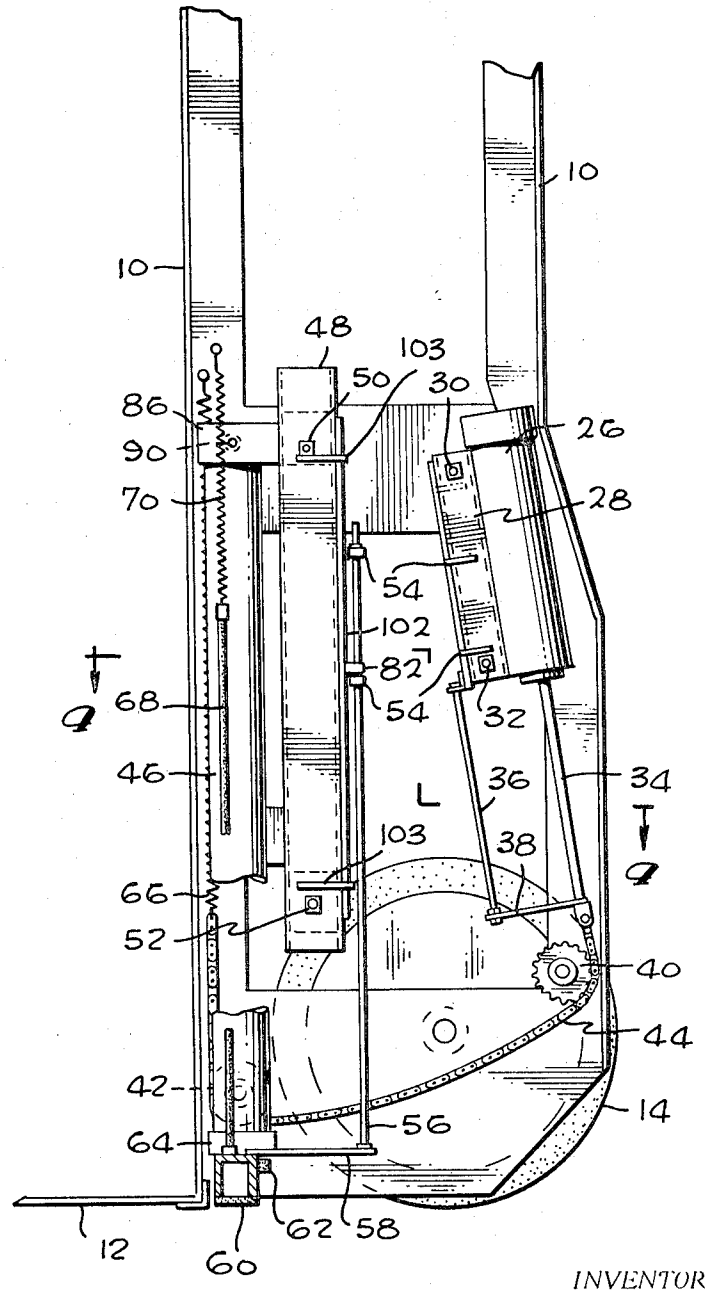


Fig. 3



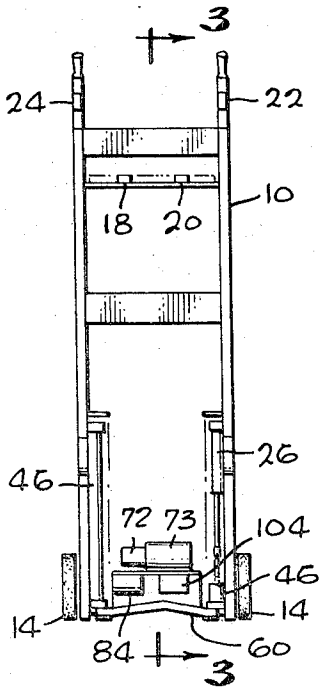


Fig. 2

INVENTOR.
JENNINGS B. HOTTEL
BY
ATTORNEY

Fig. 4

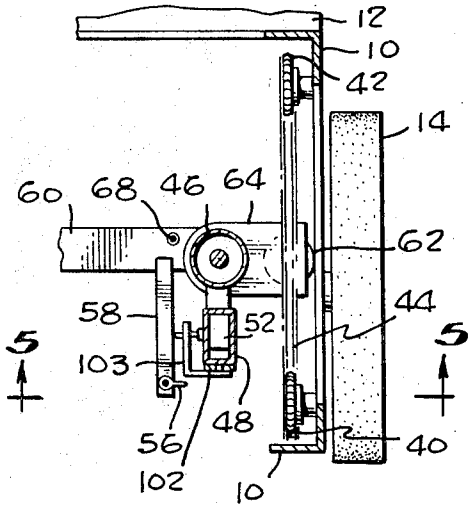


Fig. 5

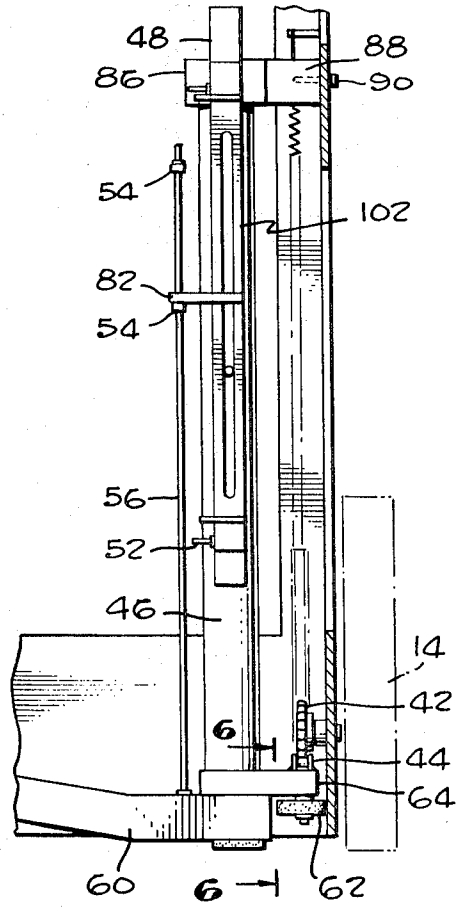
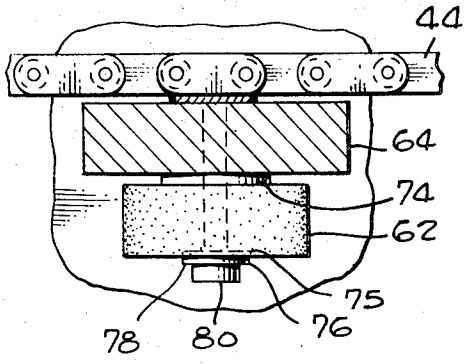


Fig. 6



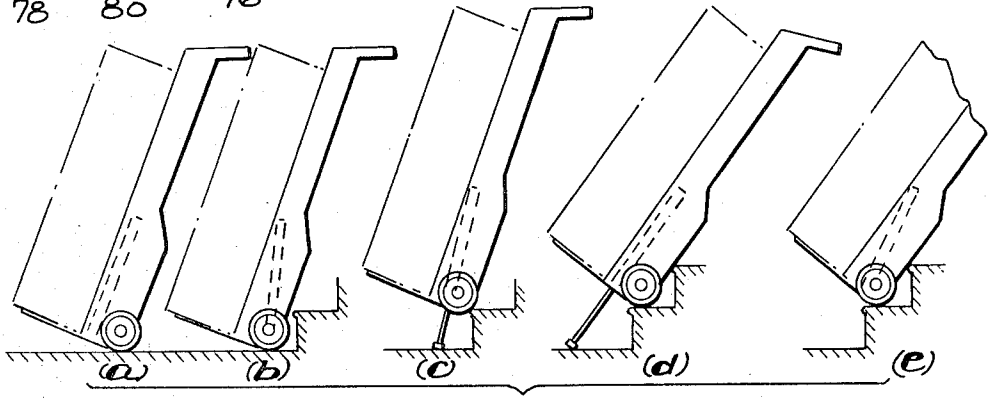
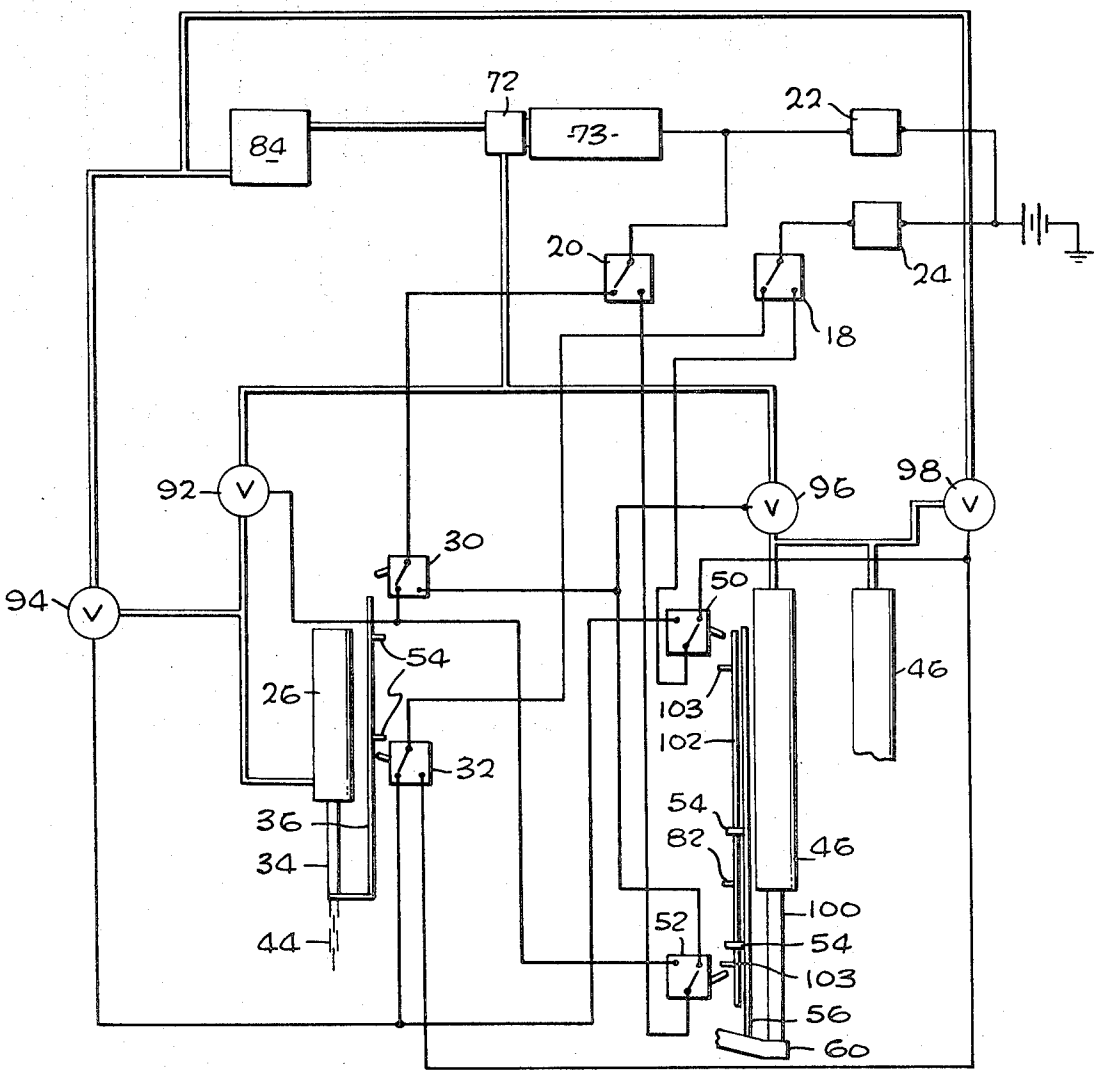


Fig. 7

INVENTOR.
JENNINGS B. HOTTEL
BY
ATTORNEY

Fig. 8



INVENTOR.
JENNINGS B. HOTTEL
BY
ATTORNEY

SELF-POWERED CLIMBING HAND TRUCK

This invention relates to hand trucks and particularly to hand trucks capable of climbing and descending stairs or the like under their own power.

The use of the hand trucks in handling and moving heavy loads such as household appliances, furniture and industrial equipment and especially in the movement of such loads up and down stairs heretofore has been a difficult and sometimes hazardous task, usually requiring the efforts of at least two men. Various lifting and lowering mechanisms attached to hand trucks have been suggested.

Generally these prior art devices fall into one of three basic classes. The first, as illustrated by U.S. Pat. No. 2,823,921, utilizes the traction of the hand truck's own wheels, augmented by means for driving and braking the wheels, for climbing and descending stairs.

The second class employs stair lifts mounted on rotating arms or chain drives to raise or lower the truck. U.S. Pat. Nos. 2,641,325 and 2,740,484 are examples of such devices.

The third class uses some form of extensible lift to raise and lower the load. U.S. Pat. Nos. 2,192,396 3,053,546, 3,269,478, and 3,417,831 are typical of this class. U.S. Pat. No. 1,885,112 illustrates a truck of this class in which a single universally mounted lift is actuated by a hand-operated lever arm.

For a variety of reasons none of the prior art lift trucks has proved fully satisfactory in operation. Accordingly, it is an object of the subject invention to provide a load-supporting platform enabling heavy loads to be moved easily and safely over irregular surfaces by a single unaided operator.

It is a further object to provide a system with a positive positioning elevating device which in its preferred embodiment, a self-powered climbing hand truck, eliminates the previously hazardous and exhausting handling of heavy loads while ascending and descending stairs, curbs or other obstacles.

Still another object is to provide a positive coupling of positioning and elevating mechanisms for use with a load-supporting platform such as a hand truck.

These and other objects of the invention, together with the mechanical features and advantages thereof, will become more apparent from the following detailed specification taken in conjunction with the accompanying drawings.

FIG. 1 is a side elevation of a self-powered climbing hand truck made in accordance with the invention;

FIG. 2 is a front elevation of the hand truck;

FIG. 3 is a sectional view taken along line 3–3 in FIG. 2 showing the physical arrangement of its components;

FIG. 4 is a sectional view taken along line 4–4 in FIG. 3;

FIG. 5 is a sectional view taken along line 5–5 in FIG. 4;

FIG. 6 is a sectional view taken along line 6–6 in FIG. 5;

FIG. 7*a*—*e* is a series of views showing the relative positions of the truck and its elevating components when the truck is moved up or down stairs; and

FIG. 8 is a schematic showing the hydraulic and electrical systems employed in this preferred embodiment of the invention.

Essentially the subject invention utilizes a self-powered controllably extensible elevating member hingedly attached at its upper end to load supporting structure and self-powered means, such as a chain drive, to positively control the position of the lower end of the elevating member with respect to the load supporting structure. For illustrative purposes the construction and operation of the invention will be described herein as embodied in a hand truck. It will be understood, however, that the invention may readily be adapted to be used with a variety of other load supporting platforms.

The self-powered climbing hand truck, as shown in FIGS. 1 and 2, consists of a welded, single unit frame 10 with a rigid lifting plate 12 and two mounted wheels 14. If desired these wheels may be driven by conventional means, or provided with braking means, or both. A switch housing 16 serves as a cross member between the sides of said frame and is placed so as to be readily accessible to the operator. Two sequence switches 18 and 20 are mounted within said housing. A trigger switch 24 is mounted in the left handle of the hand truck and trigger switch 22 is mounted in the right handle. These four switches control the operation of the hand truck when climbing stairs, curbs or other obstructions.

The hydraulic positioning cylinder 26 is rigidly mounted to frame 10 in the attitude shown in FIG. 3. Attached to said cylinder is a limiting switch mounting bracket 28. Limiting switches 30 and 32 are mounted to said bracket.

The positioning actuator rod 36 has two adjustable trippers 54 which can be set to activate limiting switches 30 and 32 to fit the particular conditions for the mode of operations desired.

Extending from positioning cylinder 26 is the positioning cylinder piston rod 34 which is joined to the positioning chain 44. Positioning chain 44 is led around two frame-mounted idling sprockets, the rear sprocket 40 and the front sprocket 42. The positioning chain 44 is joined to the positioning tension spring 66 which is anchored to frame 10.

Positioning actuator rod 36 is joined to position cylinder piston rod 34 by the actuator coupler 38. As the position cylinder is activated and piston rod 34 is extended or retracted the trippers 54 on positioning actuator rod 36 activate limit switches 30 and 32.

The elevating cylinder 46 has an upper cylinder mount 86 that attaches said elevating cylinder by way of a pivot shaft or bolt 90 to frame 10. This arrangement allows said elevating cylinder 46 to pivot at this point. On the opposite end of said elevating cylinder the elevating cylinder piston rod 100 is mounted to end plate 64 and this end plate is attached to positioning chain 44 as shown in FIGS. 4, 5 and 6. End plate 64 is welded to tie-bar 60 which connects the two elevating cylinder piston rods 100.

FIG. 6 illustrates the mounting stud 80 which protrudes below end plate 64 and to which is assembled washer 74, guide roller 62 which rides against frame 10 during the climbing or descending operation of the hand truck, another washer 75, lock washer 76 and a locknut 78.

Mounted to the elevating cylinder 46 is the elevation switch limiting bracket 48 containing the DOWN elevation limiting switch 50 and the UP elevation limiting switch 52. A slide bar actuator 102 having switch engaging arms 103 is slidably attached to bracket 48, and the elevation actuator rod 56 with two adjustable trippers 54 is attached to tie-bar 60 by actuator mount bracket 58 and rides through actuator guide 82 on slide bar actuator 102. The adjustability of trippers 54 on rod 56 permits the truck to be preset to climb or descend any flight of stairs with a minimum of effort on the part of the operator, regardless of the tread height and width.

The elevating cylinder retracting cable 68 is attached to tie-bar 60 and joins tension spring 70 which is attached to frame 10.

In the automatically sequenced operating mode for the ascension of stairs the sequence switches 18 and 20 are placed in an UP position and the hand truck is maneuvered into a load-carrying position, as illustrated in FIG. 7*a*. The right-hand trigger switch 22 is placed in the ON position which activates the pump/motor unit 72,73 powered by battery 104. This opens the positioning pressurizing solenoid valve 92 which activates the positioning cylinder 26 and moves the positioning chain 44 with the attached elevating cylinder 46 to a rearward position, as shown in FIG. 7*b*. When positioning cylinder piston rod 34 has retracted to a preset position, the adjustable trippers 54 on positioning actuator rod 36 engages the BACK limiting switch 30. This closes positioning pressurizing solenoid valve 92 and opens the elevating pressurizing solenoid valve 96. The elevating cylinders 46 are then pressurized, extending the elevating cylinder piston rods 100 until tripper 54 on elevation actuator rod 56 engages actuator guide 82 moving slide bar actuator 102 downward until arm 103 engages the UP elevation limiting switch 52 in the position shown in FIG. 7*c*.

At this time the right-hand trigger switch 22 is placed in an OFF position and the left-hand trigger switch 24 is placed in

an ON position. This opens the positioning release solenoid valve **94** allowing the positioning tension spring **66** to return positioning chain **44** with attached elevating cylinder **46** to a forward position, as shown in FIG. *7d*. This action effectively swings the hand truck unto the next higher step. When the positioning rod **34** has extended to its present limit, limiting switch **32** is activated, which closes the positioning release solenoid valve **94** and opens the elevating release solenoid valve **98**. This results in the elevating cylinder piston rods **100** retracting into a preset position in the elevating cylinder **46** as shown in FIG. *7e*. This operation sequence is then repeated for each stair to be climbed. For descending stairs the sequence is simply reversed. The sequence switches **18** and **20** are placed in a DOWN position. The right-hand trigger switch **22** is placed in an ON position which opens elevating pressurizing solenoid valve **96**, extending elevating cylinder piston rods **100** which, at the preset extension limit shown in FIG. *7d*, activates the UP elevation limiting switch **52**, closing elevating pressurizing solenoid valve **96** and opening positioning pressurizing solenoid valve **92** which retracts positioning chain **44**, pivoting elevating cylinders **46** to their rearwardmost position thereby swinging the hand truck to the position shown in FIG. *7c*. Right-hand trigger switch **22** is placed in OFF position and left-hand trigger switch **24** in ON position, resulting in elevating release solenoid valve **98** being opened, retracting elevating piston rods **100**, as shown in FIG. *7(b)*. This in turn activates limiting switch **30**, closing elevation release solenoid valve **98** and opening positioning release solenoid valve **94** which allows positioning chain **44** with attached elevating cylinder **46** to return to its forward position as shown in FIG. *7a*.

Reservoir **84** is provided to receive the return flow of excess hydraulic fluid from cylinders **26** and **46** and to deliver fluid to pump **72** to maintain pressurization of the hydraulic system.

Although the automatic sequencing arrangement just described has proved highly successful for most moving chores, particularly those involving the climbing and descending of flights of stairs, in some situations it may be advantageous to provide means for selectively controlling the operation of elevating cylinders **46** and positioning cylinder **26**. If desired this can easily be accomplished by modifying the described system or by adding a selector switch bypassing the automatic sequencing features shown and described.

I claim:

1. A self-powered climbing platform comprising:

a load-supporting structure;

extensible elevating means hingedly attached at its upper end to said structure, including a first cylinder having a piston rod extensible therefrom and means for controllably retracting said piston rod;

means for controllably positioning the lower end of said elevating means with respect to said structure, including a second cylinder having a piston, an inelastic linkage connected at one of its ends to the piston of said second cylinder, at its opposite end to resilient means opposing the movement of said piston, and intermediate its ends to said elevating means; and

means to facilitate balancing said load-supporting structure when said elevating means is in its extended position.

2. The device of claim **1** in which:

said inelastic linkage is a flexible chain;

said positioning means includes a sprocket rotatably mounted on said elevating means; and

said chain passes over and engages said sprocket.

3. The device of claim **1** in which:

said climbing platform is a wheeled hand truck;

said load-supporting structure includes a lifting plate having a framework rigidly attached at its lower end thereto and extending upwardly therefrom;

said balance-facilitating means comprises at least one handle attached to said framework; and said elevating means is hingedly attached at its upper end to said framework intermediate the ends thereof.

4. The device of claim **3** in which:

said elevating means comprises a pair of cylinders having piston rods extensible therefrom, said piston rods being connected to a rigid crossmember and

said resilient means is attached to said framework.

5. The device of claim **4** further comprising:

a source of fluid under pressure;

pressure fluid conduits delivering said fluid to each of said cylinders;

valve means in said conduits controlling the flow of fluid to the cylinders of said elevating means and cylinder of said positioning means and bleeding said cylinders; and

valve actuating means for selectively opening and closing said valve means.

6. The device of claim **5** in which, said fluid source includes a pump and a source of power therefor.

7. The device of claim **5** in which:

said valve actuating means comprises solenoids effectively opening and closing each of said valve means;

a source of electrical power;

electrical circuits connecting said solenoids with said electrical power source; and switches opening and closing said circuits and thereby activating said solenoids.