United States Patent

[11] **3,570,695**

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[22] Filed **Jan. 21, 1969**
[45] Patented **Mar. 16, 1971**

[54] **VEHICLE FOR CARRYING AND STACKING CONTAINERS**
7 Claims, 14 Drawing Figs.

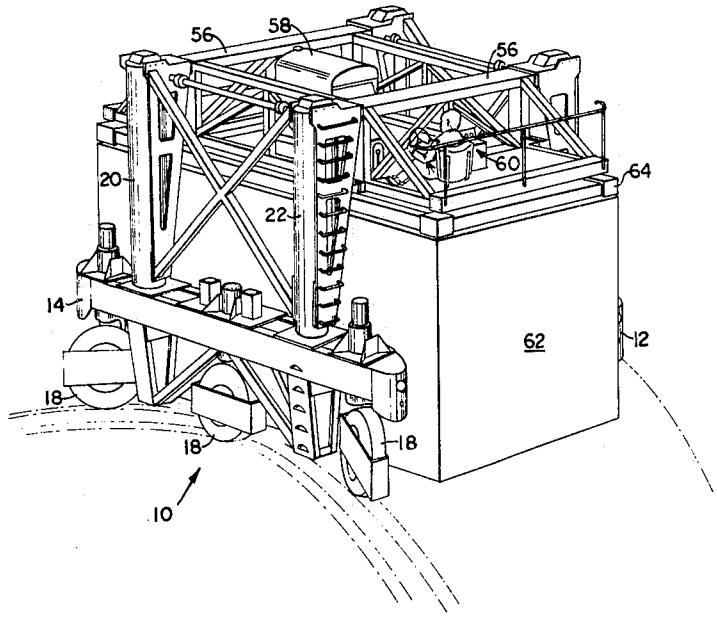
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[51] **Int. Cl.** **B66c 5/02**
[50] **Field of Search** ..... 214/390-—396; 294/67.4 (A); 187/17; 212/14

[56] **References Cited**
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Primary Examiner—Albert J. Makay
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ABSTRACT: A vehicle having a main frame of inverted substantially U-shaped configuration adapted to straddle a container, legs which are extendable and retractable, and a lifting frame which moves generally along with the extension and retraction of the legs. The container may be locked to the lifting frame when the legs are retracted, and may be lifted to a height at least as great as the height of another container on the ground when the legs are extended, so that one container may be stacked on another.



PATENTED MAR 16 1971 3,570,695

SHEET 1 OF 9

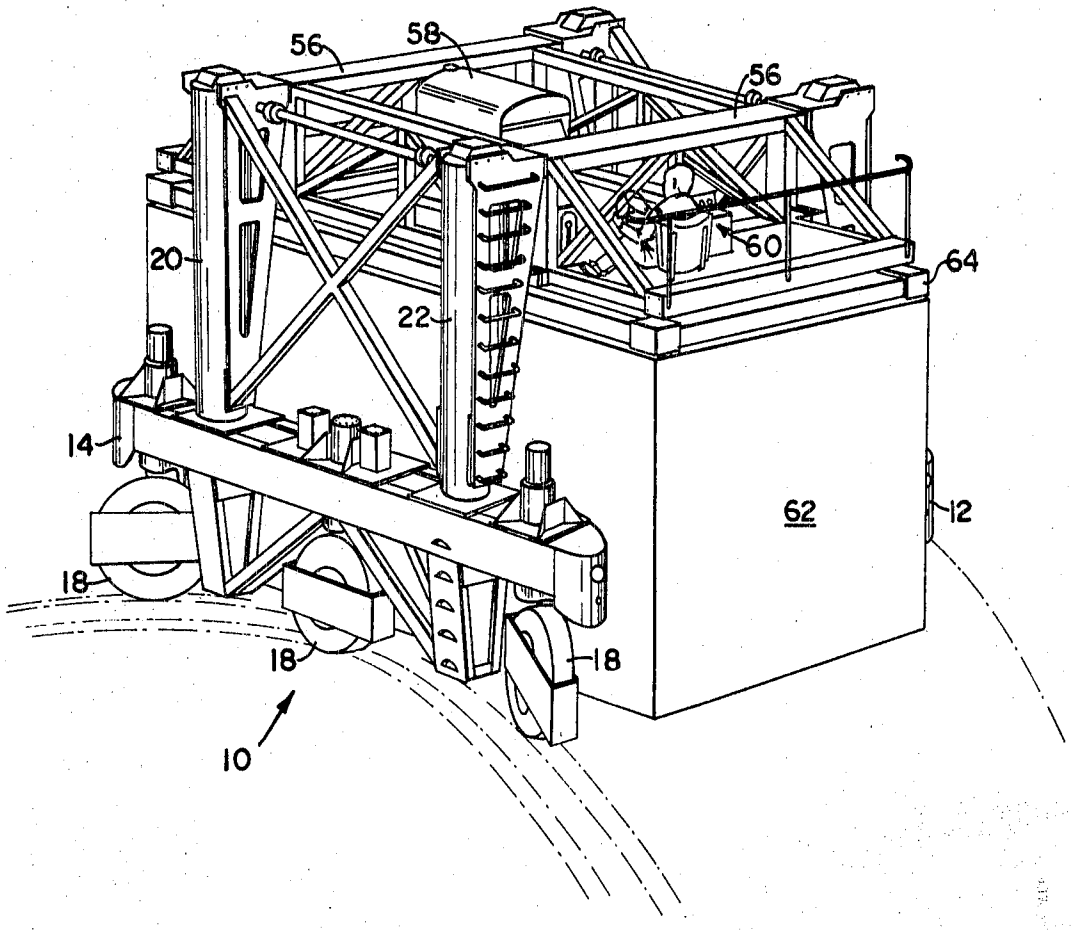


FIG_1

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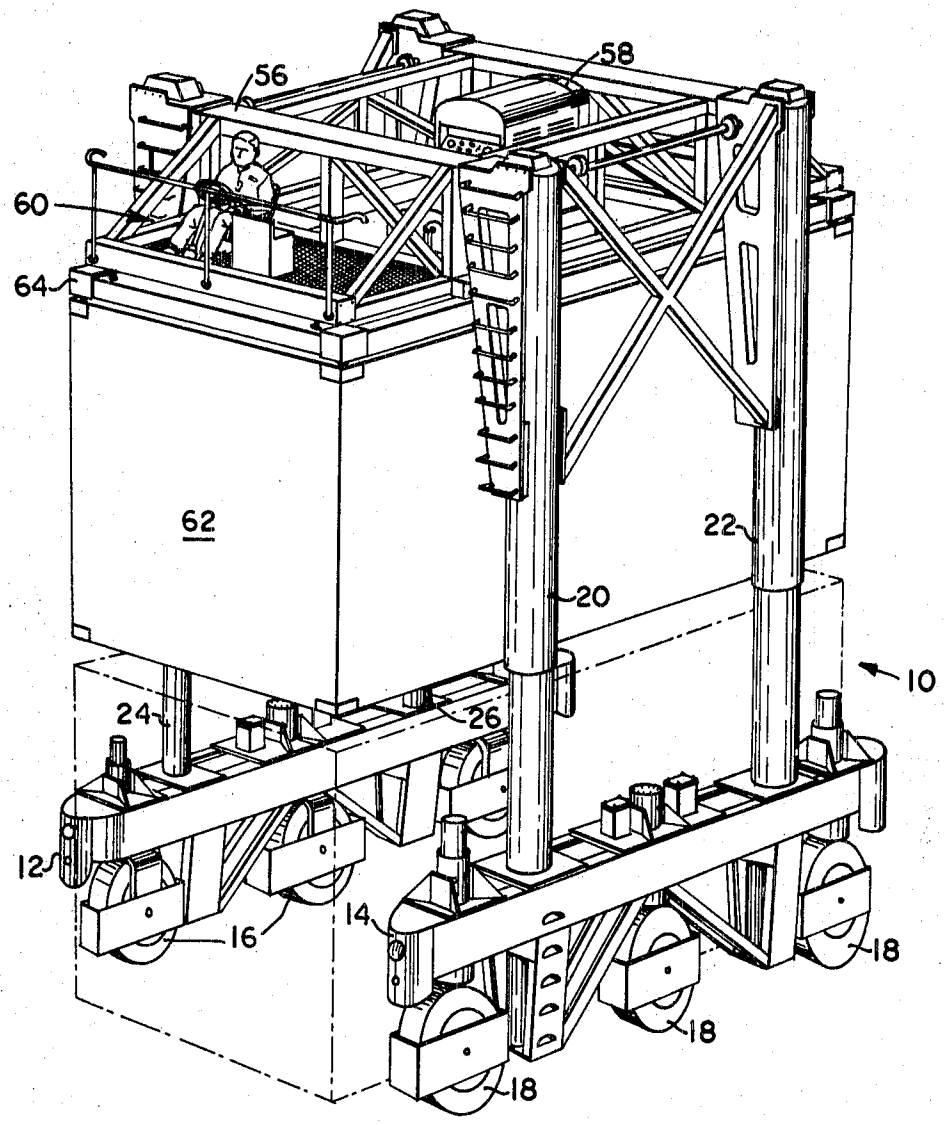


FIG_2

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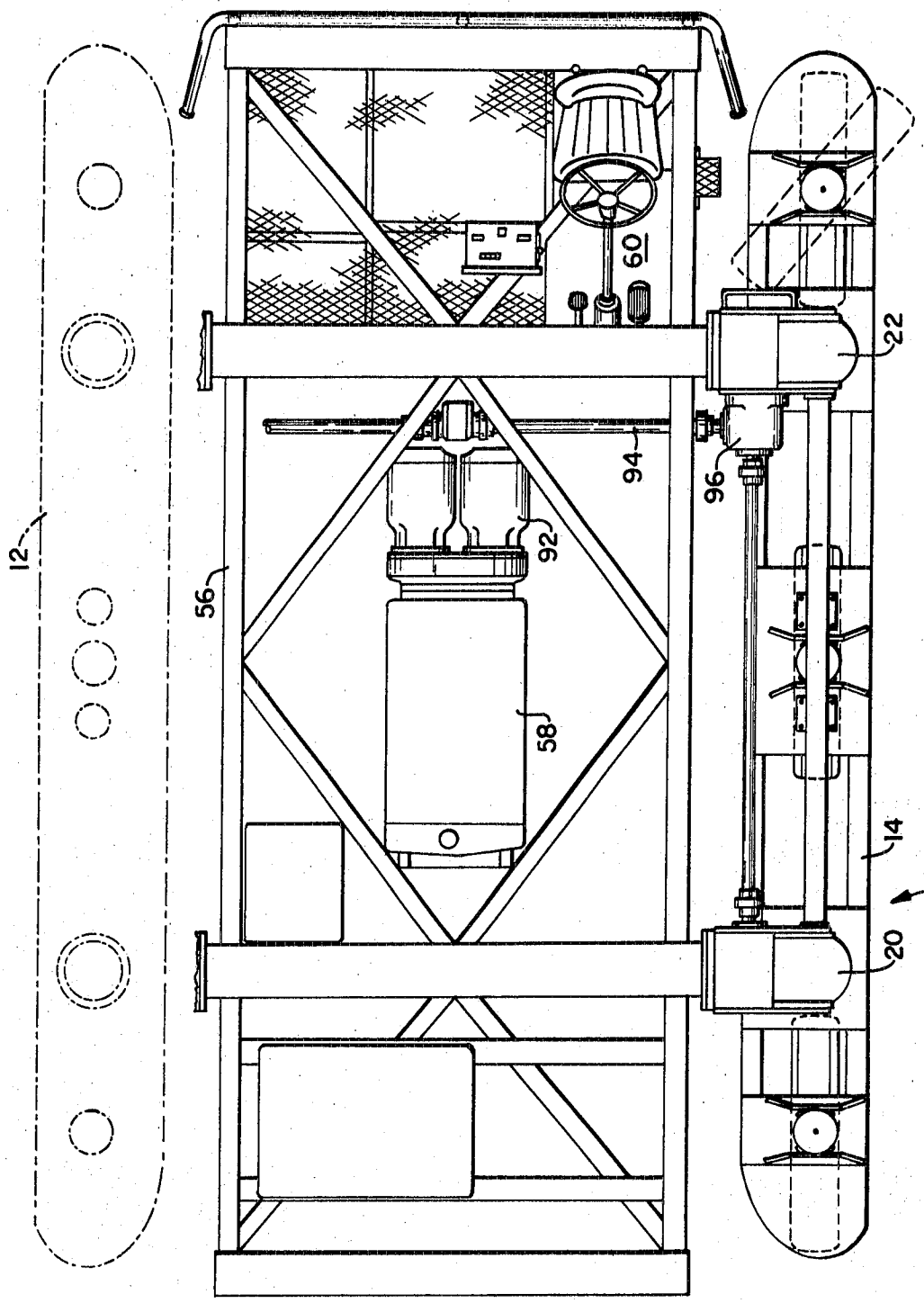


FIG_3

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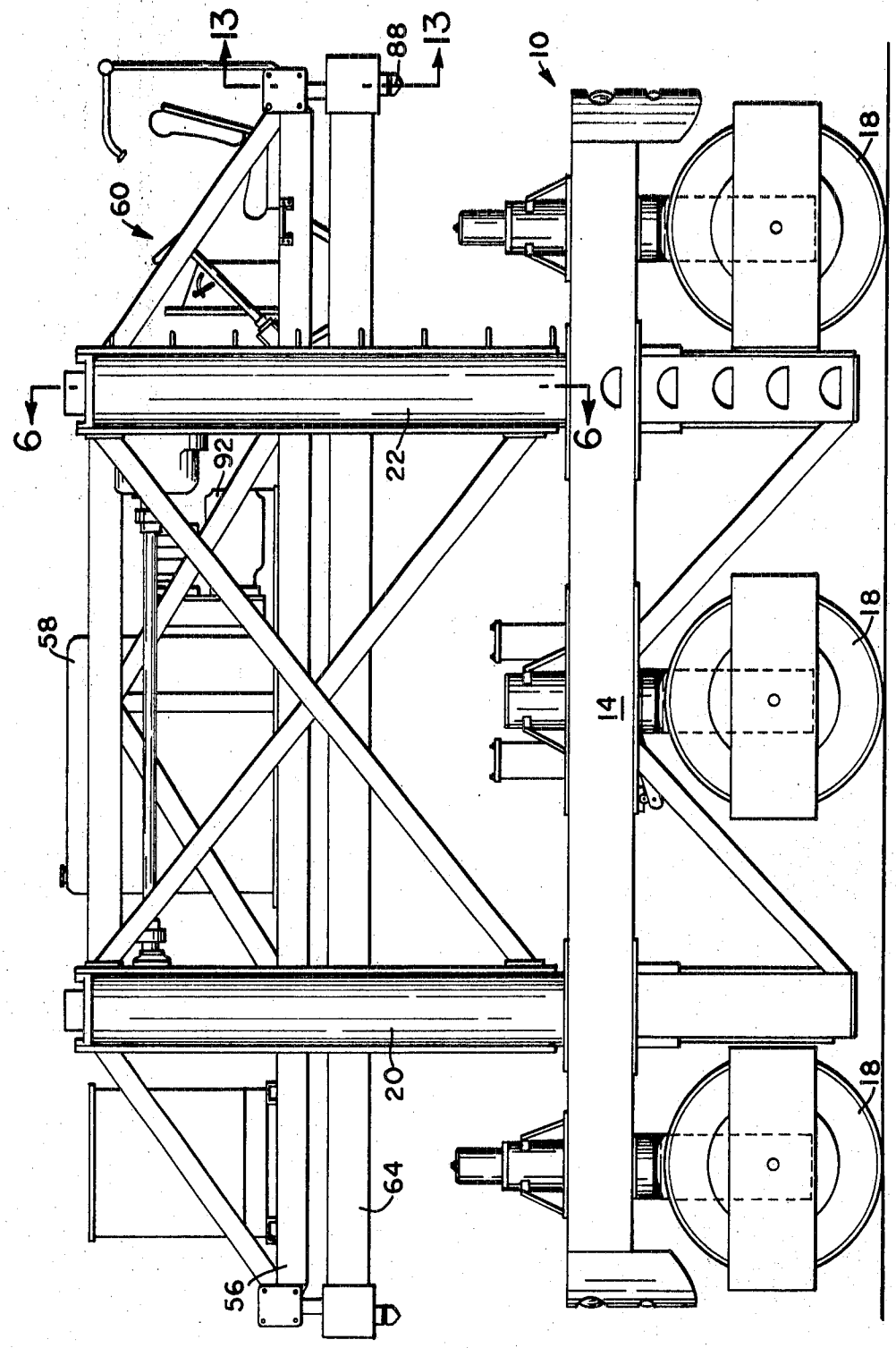


FIG_4

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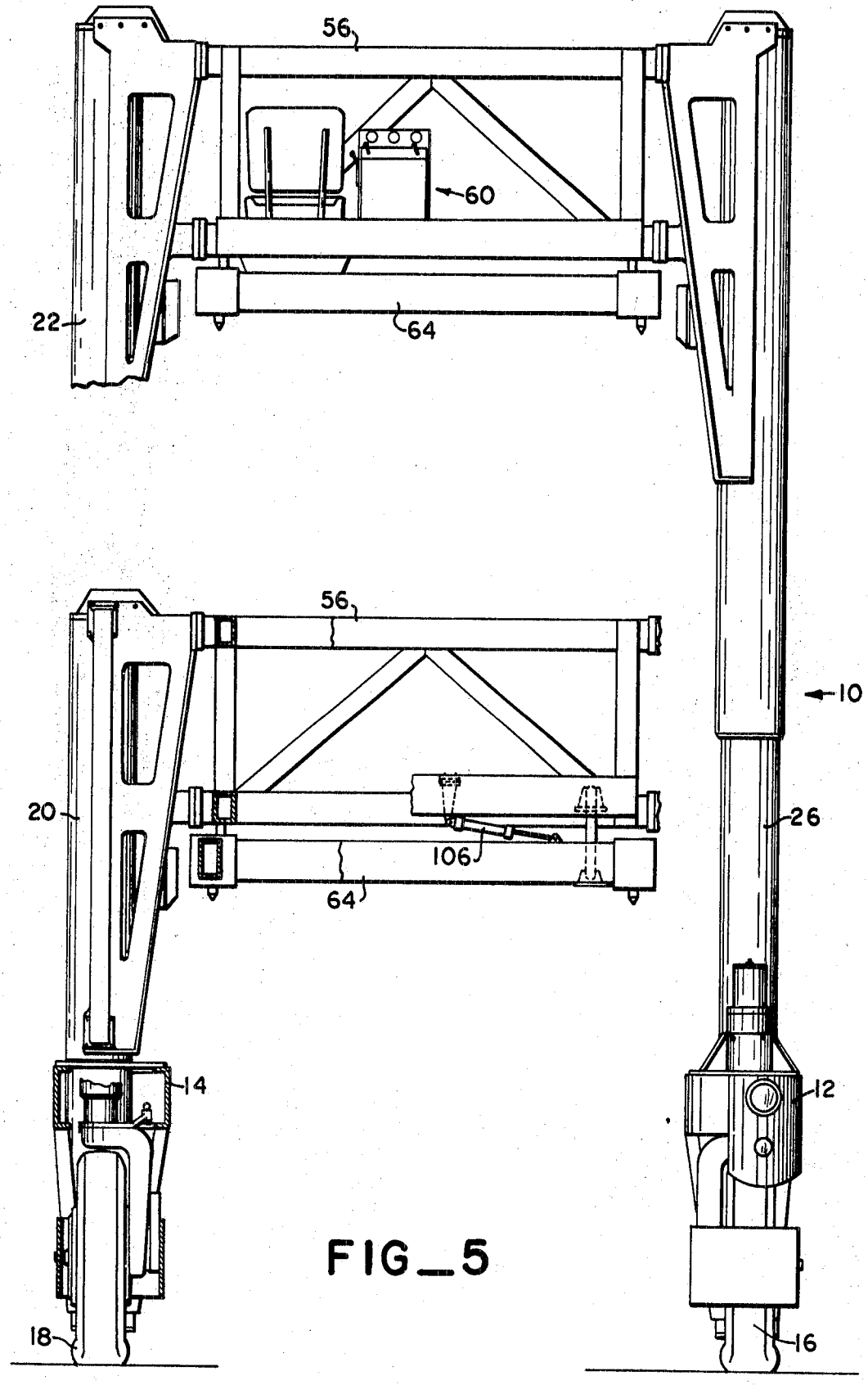


FIG_5

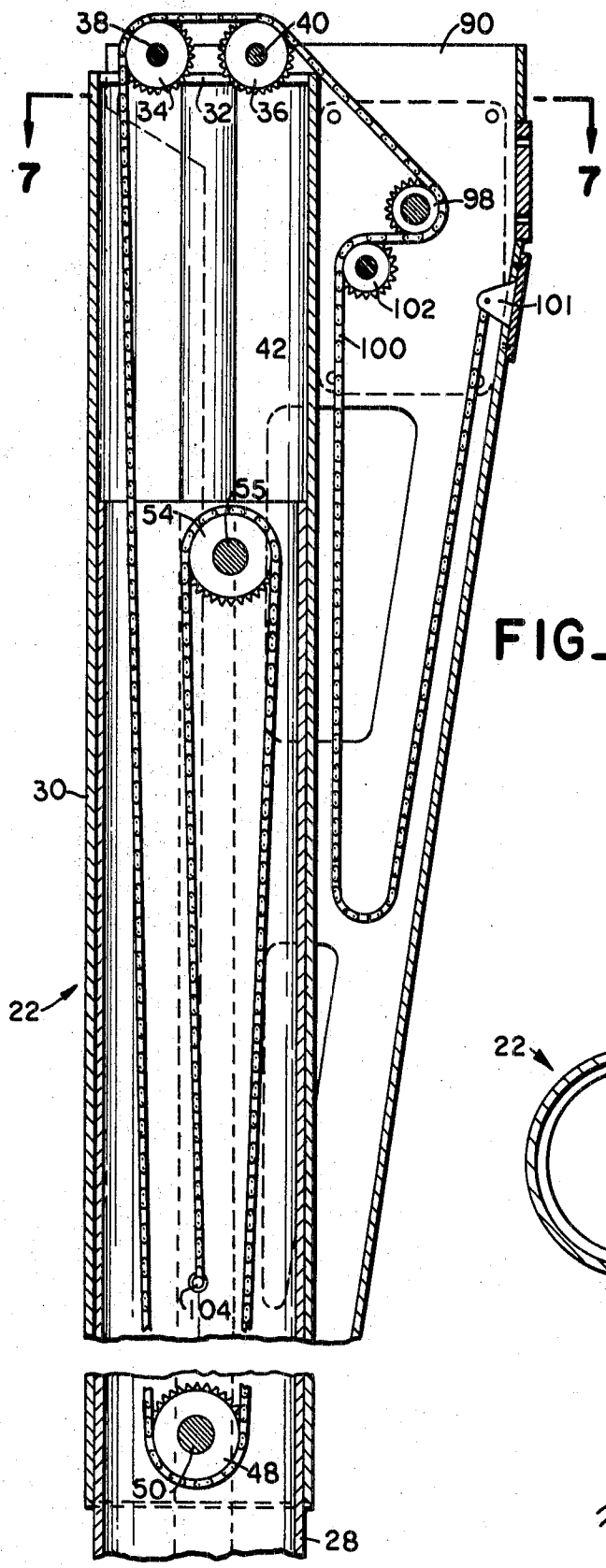


FIG_6

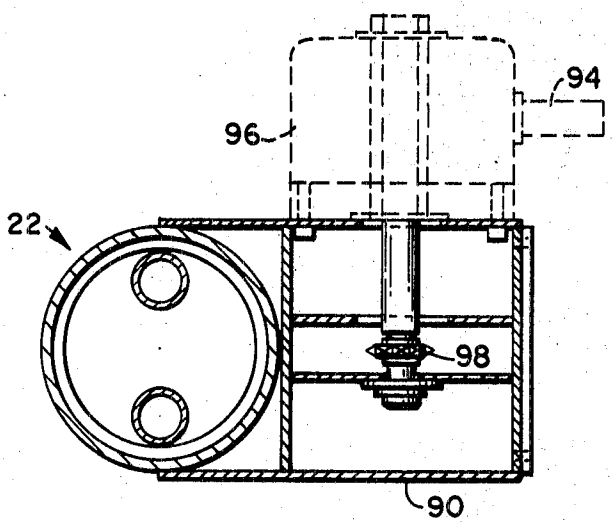


FIG_7

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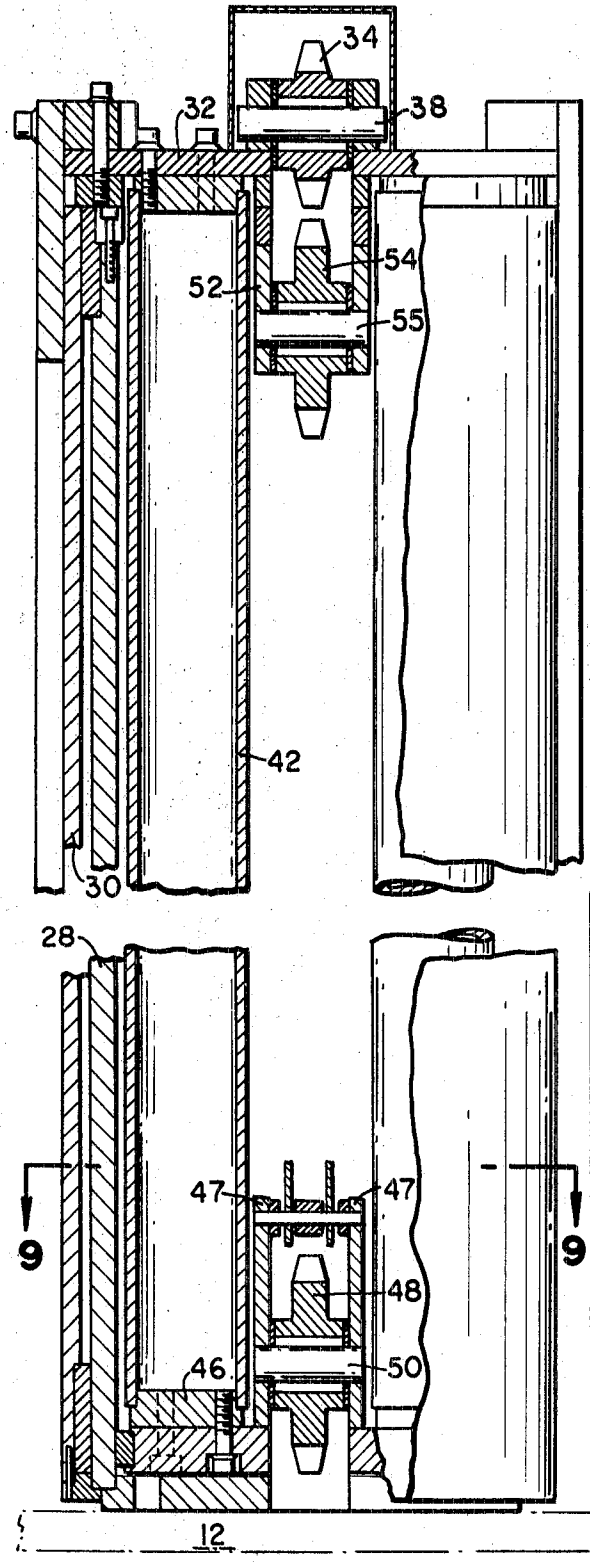


FIG_8

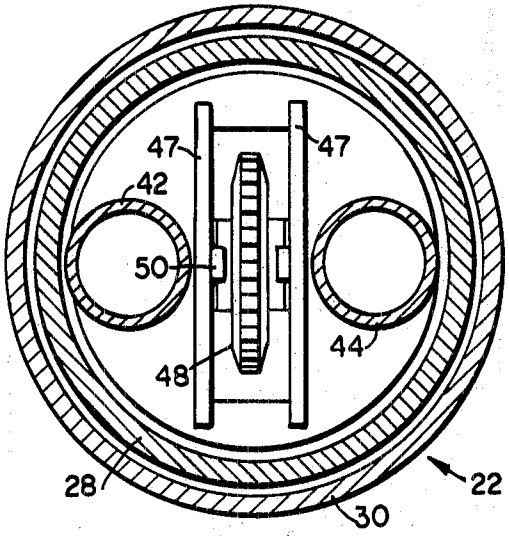


FIG_9

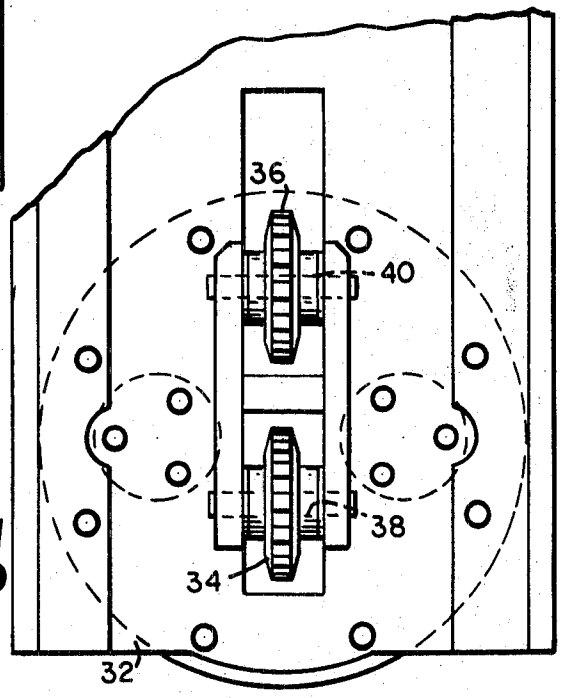
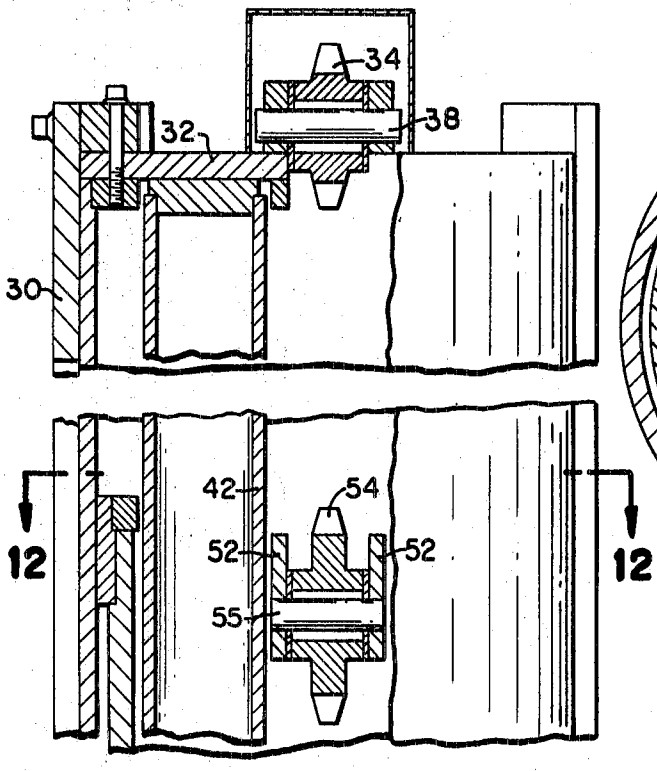


FIG_10

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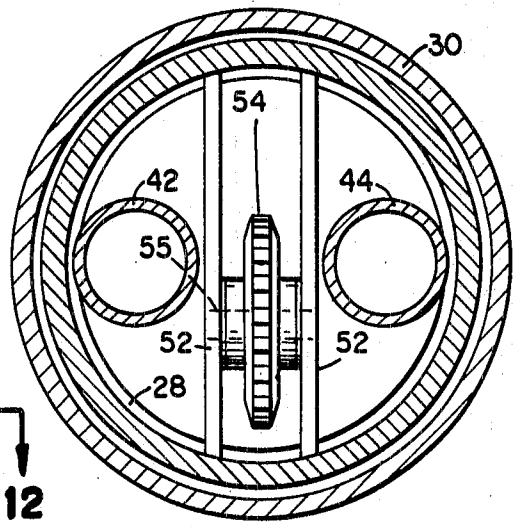


FIG_12

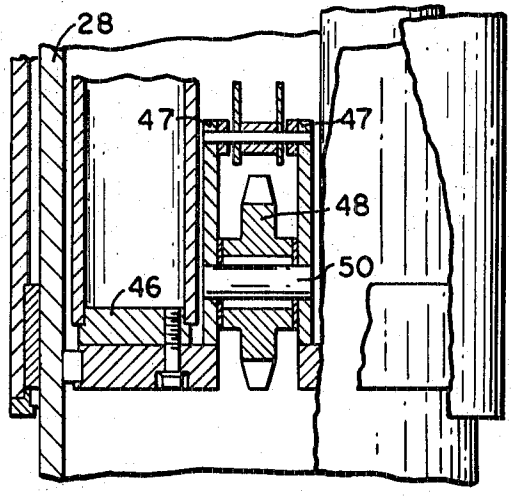
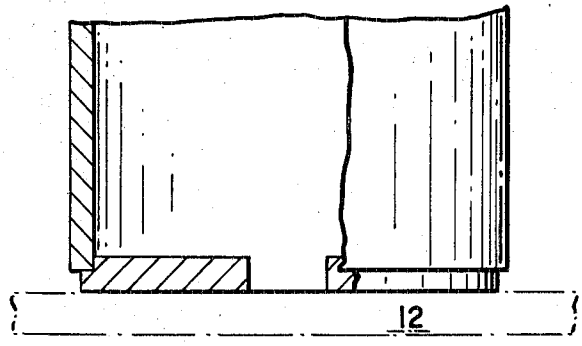


FIG_11



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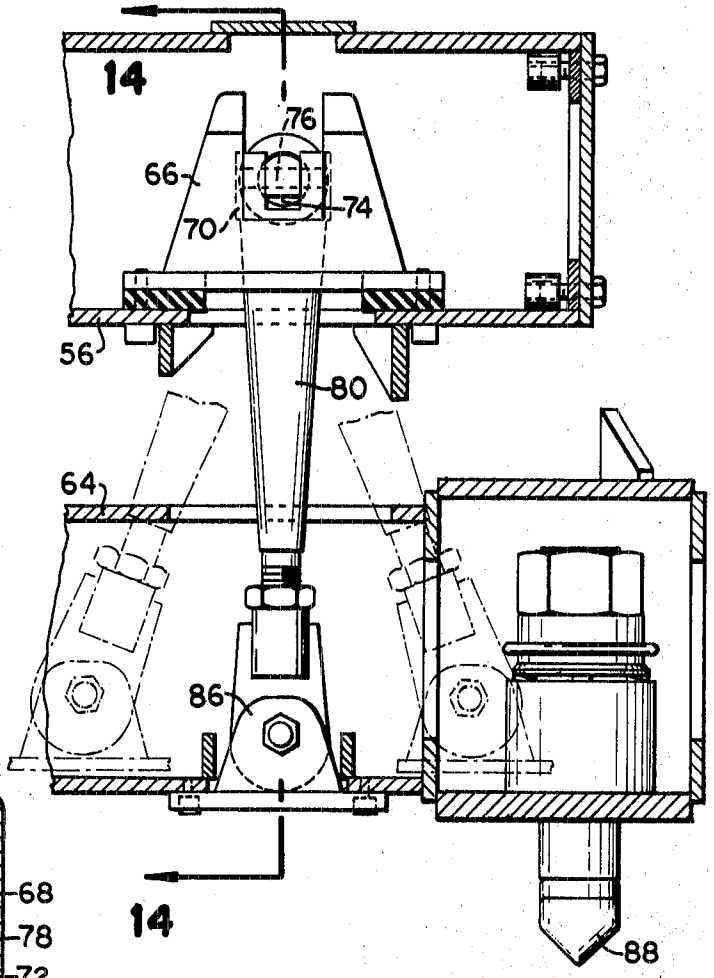


FIG_13

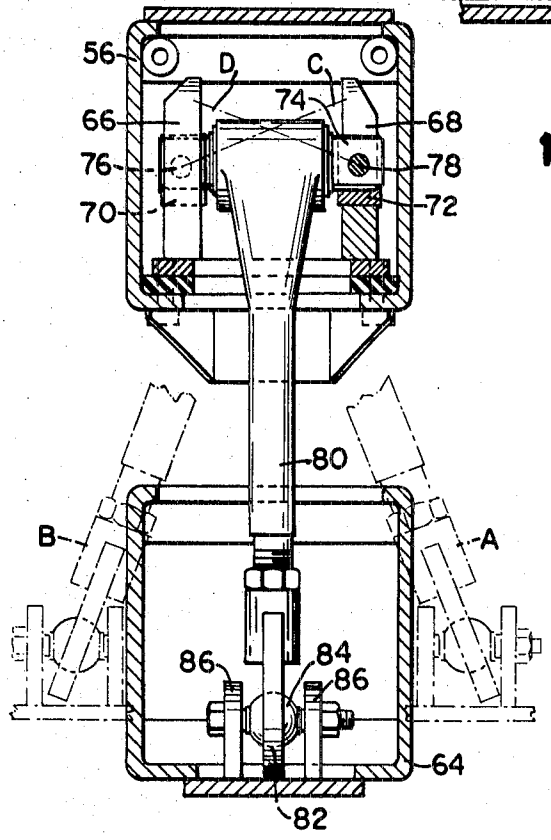


FIG_14

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VEHICLE FOR CARRYING AND STACKING CONTAINERS

BACKGROUND OF THE INVENTION

This invention relates to carrying vehicles, and, more particularly, to a carrying vehicle which is adapted to straddle a container and lift it to a substantial height.

As it has become common to use large containers of substantially identical size in shipping, it has been found desirable to construct a vehicle which is specially adapted to lift and carry such a standard size container. Such a vehicle is generally of inverted, U-shaped cross section so that it can straddle the container, and has a lifting frame to which the container is lockable and which may be raised and lowered so that the container may be lifted from the ground and carried by the vehicle.

A further refinement of such a vehicle as described above has been to construct it so that it is not only capable of lifting and carrying a container, but also lifting it to a sufficient height so that it may be stacked on another container resting on the ground, or other surface. An example of such a vehicle is disclosed in U.S. Pat. No. 3,146,903 to Bjorklund.

However, prior vehicles which fulfill the above objects generally have a number of drawbacks. First, while they are generally capable of being lowered to reduce the overall height thereof, they are not capable of entering or exiting from existing dock warehouses, since the doors thereof are usually not cut high enough to allow such passage. Secondly, the prior vehicles, again because they cannot be reduced in height sufficiently, cannot legally be driven on the highways. This is obviously a major drawback, since it seriously limits the ability to move the vehicle to another job or dock, or to a shop for maintenance or repairs. Thirdly, the prior vehicles are generally quite heavy, in some cases too heavy for existing dock and road surfaces. Fourthly, such vehicles are quite complicated and costly and are expensive to maintain.

It is an object of this invention to provide a vehicle which is capable of effectively lifting and carrying one of a series of uniform containers.

It is a further object of this invention to provide a vehicle which is capable of effectively stacking one such uniform container on another.

It is a further object of this invention to provide a vehicle which fulfills the above objects, meanwhile being capable of having its overall height reduced so that it (a) can pass through existing dock warehouse passageways, and (b) be driven legally on the streets and highways.

It is a still further object of this invention to provide a vehicle which fulfills the above objects, meanwhile being of relatively light and simple construction, enabling construction and repair costs to be kept to a minimum.

SUMMARY OF THE INVENTION

Broadly stated, applicants' vehicle for carrying substantially similarly configured containers comprises first and second suspension frames, said frames including a plurality of wheels and having a height less than the height of such container. At least one leg is disposed upwardly from the first suspension frame and is extendable and retractable relative thereto. At least one leg is disposed upwardly from the second suspension frame and is extendable and retractable relative thereto. An upper frame portion is fixed relative to the upper portions of the legs adjacent the upper ends thereof, the first and second suspension frames, legs, and upper frame portion forming a main frame of inverted, substantially U-shaped cross section adapted to straddle a container. Means are included for simultaneously extending the legs and simultaneously retracting the legs, whereby the upper frame portion may be raised and lowered. A lifting frame is supported by the upper frame portion and has a portion extending below the upper surface of the straddled container only when the legs are fully retracted. The lifting frame is movable generally along with the upper frame portion, whereby the lifting frame may be raised and lowered with the upper frame portion as the legs are extended and retracted. Means are included for selectively locking the lifting frame to the top of the container, so that the container may be raised and lowered with the lifting frame.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects of the invention will become apparent from a study of the following description and drawings, in which:

FIG. 1 is a perspective view of the vehicle, showing the legs fully retracted;

FIG. 2 is a perspective view of the vehicle, showing the legs fully extended;

FIG. 3 is a plan view of the vehicle, with portions removed;

FIG. 4 is a side elevation of the vehicle;

FIG. 5 is an end elevation of the vehicle, with portions removed, showing the legs fully extended and fully retracted;

FIG. 6 is a sectional view taken along the line 6–6 of FIG. 4;

FIG. 7 is a sectional view taken along the line 7–7 of FIG. 6;

FIG. 8 is a side elevation of a leg of the vehicle, partially in section, and with the leg fully retracted;

FIG. 9 is a sectional view taken along the line 9–9 of FIG. 8;

FIG. 10 is a plan view of the leg of FIG. 8;

FIG. 11 is a view similar to that of FIG. 8 but with the leg partially extended;

FIG. 12 is a sectional view taken along the line 12–12 of FIG. 11;

FIG. 13 is a sectional view taken along the line 13–13 of FIG. 4;

FIG. 14 is a sectional view taken along the line 14–14 of FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1—5, there is shown generally at 10 a vehicle. The vehicle 10 includes a pair of substantially parallelly disposed suspension frames 12 and 14. The suspension frame 12 has a plurality of wheels 16, and the suspension frame 14 has a similar plurality of wheels 18. A suitable wheel suspension system (not shown) is housed in each suspension frame 12, 14. Upwardly disposed from suspension frame 14 are legs 20, 22. Upwardly disposed from the suspension frame 12 are legs 24, 26. Each of these legs is of similar construction, and so only one will be described in detail.

Referring to FIGS. 6—12, there is shown in detail leg 22. As shown therein, leg 22 is made up of an inner tube 28 fixed to the suspension frame 12, and an outer tube 30 disposed about the inner tube 28 and slidable therealong. The leg 22 is thus telescopic and may be extended or retracted by such sliding movement. Fixed to the top of the outer tube 30 but free from the inner tube 28 is a plate assembly 32. Supported by the plate assembly 32 are a pair of gears 34, 36 which are freely rotatable about their respective shafts 38, 40. Fixed to and extending downward from the plate assembly 32 within the inner tube 28 are a pair of smaller tubes 42, 44. A second plate assembly 46 is fixed to these tubes 42, 44 at their lowermost portions. Supported by the plate assembly 46 by means of upright brackets 47 is a gear 48 freely rotatable about its shaft 50. It will be seen that outer tube 30, plate assembly 32, gears 34—36 and shafts 38 and 40, smaller tubes 42, 44, plate assembly 46, and gear 48 and shaft 50 are movable together as a unit.

Fixed within the inner tube 28 by means of a pair of cross brackets 52 is a gear 54 freely turnable on a shaft 55. It will be seen that as the outer tube 30 slides along the inner tube 28, the unit described above (i.e., the outer tube 30, plate assembly 32, gear and shaft 34 and 38, smaller tubes 42, 44, plate assembly 46, and gear and shaft 48 and 50) moves relative to the inner tube 28 and gear 54. Such movement is shown by noting FIG. 8 along with FIG. 11.

Since each leg is constructed in a similar manner, it will be seen that each leg is retractable and extendable by sliding the outer tube thereof along the inner tube thereof.

Referring again to FIGS. 1—5, fixed relative to the outer tube of each leg 20, 22, 24, 26 adjacent the top thereof is an upper frame portion 56 which, it will be seen, is movable upward or downward with the outer tubes of legs 20, 22, 24, 26 as the legs 20, 22, 24, 26 are retracted or extended. The upper frame portion 56 supports an engine 58 used to drive the vehicle 10, and controls 60 for the driver of the vehicle 10. It will be seen that the driver's controls 60 could be placed at the rear of the vehicle 10 (FIG. 1) or at the front thereof (FIG. 2). The suspension frames 12 and 14, legs 20, 22, 24, 26, and upper frame portion 56 form a main frame of inverted, substantially U-shaped cross section which can be driven to a position straddling a container 62 (FIG. 1) which may be one of a plurality of containers of substantially similar configuration.

Suspended from the upper frame portion 56 by means best shown in FIGS. 13 and 14, is a rectangular lifting frame 64. As shown thereon, a pair of upright U-shaped members 66, 68 are fixed to the upper frame portion 56. Resting in these U-shaped members 66, 68 are a pair of small slide members 70, 72. A cylindrical shaft 74 is disposed with its longitudinal axis parallel to the longitudinal axis of the vehicle 10, and is supported at its opposite ends by pins 76, 78 passing therethrough and into the small slide members 70, 72 respectively. The shaft 74 passes through one end of an arm 80, and pivotally mounts such arm 80. Arm 80 hangs downwardly from upper frame portion 56. It will be seen that, because of such structure, the arm 80 is freely pivotable about the longitudinal axis of the shaft 74, as shown in FIG. 13. However, the arm 80 is pivotable forwardly of the vehicle 10 (A of FIG. 14) only by tipping the axis of the shaft 74 (C of FIG. 14) about the pin 76 by raising the slide member 72 in U-shaped member 68 and is pivotable rearwardly of the vehicle 10 (B of FIG. 14) only by tipping the axis of the shaft 74 (D of FIG. 14) about the pin 78 by raising slide member 70 in U-shaped member 66, i.e., it is not freely pivotable forwardly and rearwardly in the same way as it is sidewardly of the vehicle 10.

The bottom portion of the arm 80 has a socket 82 formed thereon. Fitted into the socket 82 is a ball 84 fixed to plate 86, which in turn is fixed to lifting frame 64. The arm 80 is thus omnidirectionally pivotable relative to the lifting frame 64. Identical linkage means are provided at each corner of the lifting frame 64 for support thereof by the upper frame portion 56.

The lifting frame 64 has locking members, as at 88, at each of its corners. These locking members are of the well-known type which are adapted to fit into apertures and then be turned through 90° for locking. The rectangular top of container 62 has provided therein four such apertures (not shown) at its corners, into which such locking members are receivable when the locking members are properly positioned relative thereto. Thus, when the lifting frame 64 and container 62 are properly positioned relative to each other, the locking members may be fitted into the proper apertures, and, by turning each locking member 90°, the container 62 may be locked to the lifting frame 64.

It will be seen that, if the container 62 is locked to the lifting frame 64, the container 62 may be lifted with the lifting frame 64 and upper frame portion 56 by extension of the legs 20, 22, 24, 26. The means for extending such legs will now be described.

Referring to FIG. 6, it will be seen that gears 34 and 36 are disposed adjacent the top of the outer tube 30 of leg 22. The gear 48, the shaft 50 of which is fixed relative to the outer tube 30, is adjacent the bottom of the outer tube 30. Gear 54, the shaft 55 of which is fixed relative to inner tube 28, is above the gear 48. Outer tube 30 of leg 22 has fixed thereto a tapered compartment 90. Mounted to the upper frame portion 56 is a motor 92 which drives, through a drive shaft 94 and differential 96, a drive gear 98. The tapered compartment 90, motor 92, drive shaft 94, differential 96, and drive gear 98 all move upward and downward with the outer tube 30. One end of a chain 100 is anchored at 101 to the inner wall of the tapered compartment 90, and leads over an idler gear 102, around drive gear 98, over gear 36, over gear 34, around gear 48, upward to and around gear 54, and is anchored relative to outer tube 30 at point 104. It will be seen that, as drive gear 98 is rotated in a clockwise direction (FIG. 6), the chain portion running therefrom to its anchor point 104 will shorten. Since shaft 55 of gear 54 is fixed relative to inner tube 28, the shortening of that portion of chain 100 acts to raise the outer tube 30 of leg 22, along with the structure which moves as a unit with it, as described above. The slack portion of the chain 100 is received in compartment 90 as the leg 22 is extended. The leg 22 may be retracted by rotating drive gear 98 in a counterclockwise direction (FIG. 6), lengthening that portion of the chain between drive gear 98 and anchor point 104. Similar drive structure is provided to the other legs 20, 24, 26, these drive structures being synchronized so that the legs 20, 22, 24, 26 may be simultaneously extended and simultaneously retracted.

The upper frame portion 56, of course, moves upwardly and downwardly with the extension and retraction of the legs 20, 22, 24, 26, and the lifting frame 64 moves generally along with the upper frame portion 56. It will thus be seen that the lifting frame 64 may be raised and lowered as the legs 20, 22, 24, 26 are extended and retracted.

In operation, the vehicle 10 is driven to a point where it straddles a container 62, with the lifting frame 64 disposed above the container 62. The locking members on the lifting frame and the apertures in the top of the container 62 are then aligned. This is done by shifting the position of the vehicle 10 backward and forward, and by shifting the position of the lifting frame 64 by means of cylinders such as 106 (FIG. 5). As explained previously, the linkages allow such lateral movement. The legs 20, 22, 24, 26 are then retracted to an extent sufficient to dispose the locking members in their respective apertures in the top of the container 62, and the locking members are then rotated through 90° to lock the container 62 to the lifting frame 64. The legs 20, 22, 24, 26 are then extended by means described above to lift the container 62 off the ground. The container 62 may then be carried to a desired location and then lowered and unlocked.

It should be noted that the legs 20, 22, 24, 26 are sufficiently extendable to raise a container 62 to a height greater than the height of another container 62 resting on the ground. Thus a container 62 may be stacked on another container by the vehicle 10.

When carrying a container 62, whether carrying it just off the ground or at the maximum height it can be carried, the linkage means shown in FIGS. 13 and 14 and described above and the cylinders as at 106 serve important functions. The cylinders may be locked to prevent lateral swinging of the lifting frame 64 and container 62. The linkage means described above tends to limit the forward and rearward swinging of the lifting frame 64 and container 62. This is so because the pivot points about which any arm pivots are forward and rearward of the arm itself. Thus the linkage means allows movement of the lifting frame 64 and container 62 forwardly or rearwardly of the vehicle 10 only when a substantial force is applied thereto in a forward or rearward direction relative to the vehicle 10. This results in the container 62 being substantially rigidized relative to the vehicle 10 as it is transported thereby.

It will be seen that herein is provided a vehicle which is capable of effectively lifting and carrying one of a series of uniform containers, and is capable of effectively stacking one such container on another. Furthermore, the vehicle, when the legs are in their fully retracted position, is of relatively low overall height (about 13 feet 4 inches in actual practice). This achievement of low overall height in such a vehicle results mainly from applicants' telescoping feature in the legs of the vehicle. The vehicle can, because of its dimensions with the legs retracted, be legally driven on the streets and highways, and can pass through existing dock warehouse passageways. It is also to be noted that the vehicle is relatively light and simple in construction, with applicants' chain drive means for lifting

contributing greatly to the efficiency and simplicity of the device.

Obviously, the invention can be carried out in many different ways, of which the embodiment shown and described is merely illustrative. Therefore, we do not desire to be limited by that embodiment, but only by the following claims.

We claim:

1. A vehicle for straddling and carrying substantially similarly configured containers comprising:

a. first and second suspension frames each including a plurality of wheels and having a height less than the height of said containers;

b. a first pair of legs disposed upwardly from the first suspension frame, each of the first pair of legs comprising an inner tube fixed to the first suspension frame, and an outer tube disposed about that inner tube and slidable therealong;

c. a second pair of legs disposed upwardly from the second suspension frame, each of the second pair of legs comprising an inner tube fixed to the second suspension frame, and an outer tube disposed about that inner tube and slidable therealong;

d. an upper frame portion fixed relative to the outer tubes of the legs, the first and second suspension frames, legs, and upper frame portion forming a main frame of inverted, substantially U-shaped cross section adapted to straddle a container;

e. means associated with each leg for simultaneously extending the legs by sliding the outer tubes upwardly along the inner tubes and simultaneously retracting the legs by sliding the outer tubes downwardly along the inner tubes, whereby the upper frame portion may be raised and lowered;

f. a lifting frame supported by the upper frame portion having portions extending below said height of the upper surface of the straddled container only when the upper frame portion is fully lowered and movable generally along with the upper frame portion, whereby the lifting frame may be raised and lowered with the upper frame portion as the legs are extended and retracted; and

g. means for selectively locking the lifting frame to the top of the container so that the container may be raised and lowered with the upper frame portion.

2. A vehicle according to claim 1 wherein the means for simultaneously extending the legs and simultaneously retracting the legs comprises a motor and chain drive means associated with each leg and driven by the motor.

3. A vehicle according to claim 2 wherein the legs are sufficiently retractable to allow locking of the lifting frame to the top of a container resting on the ground and sufficiently extendable to raise the container to a height greater than the height of another substantially similarly configured container resting on the ground.

4. A vehicle for straddling and carrying a container comprising:

a. a frame of inverted, substantially U-shaped cross section adapted to straddle the container, including suspension frames having wheels, extendable and retractable legs disposed upwards from the suspension frames, and an upper frame portion fixed relative to the upper portions of the legs;

b. a lifting frame disposed under the upper frame portion above the straddled container and adapted to selectively lock to the container; and

c. linkage means interconnecting the upper frame portion and the lifting frame for supporting the lifting frame, the linkage means being mounted for pivotal movement about a first axis extending longitudinally of said frame to allow relatively free movement of the lifting frame sidewardly of said longitudinal first axis, the linkage means being mounted for pivotal movement about a pair of spaced axes perpendicular to said first axis, thereby allowing movement of the lifting frame forwardly or rearwardly of the vehicle only when a substantial force is applied to the lifting frame in a forward or rearward direction relative to the vehicle to cause pivotal movement about one of said pair of axes.

5. A vehicle according to claim 4 wherein the linkage means comprises a plurality of linkages each interconnecting the upper frame portion and the lifting frame, each linkage comprising:

a. an arm;

b. a shaft disposed through one end of the arm and fixed thereto, the longitudinal axis of the shaft being disposed parallel to the longitudinal axis of the vehicle and supported at its opposite ends by the upper frame portion, the arm being freely pivotable about the longitudinal axis of the shaft relative to the upper frame portion, the arm being pivotable forwardly of the vehicle only about the rearward point of support of the shaft, the arm being pivotable rearwardly of the vehicle only about the forward point of support of the shaft, the arm having socket means formed on its other end; and

c. ball means fixed to the lifting frame and adapted to fit in the socket, whereby the arm supports the lifting frame and is omnidirectionally pivotable relative thereto.

6. A vehicle according to claim 5 and further including means for selectively limiting the movement of the lifting frame sidewardly of the longitudinal axis of the vehicle.

7. In a vehicle for straddling and carrying a container comprising a frame of inverted, substantially U-shaped cross section adapted to straddle the container, said frame including a pair of wheel suspension frames one on each side of the container, extendable and retractable legs disposed upwards from the suspension frames, and an upper frame portion fixed relative to the upper portion of the legs, the improvement wherein each extendable and retractable leg comprises:

a. an inner cylinder extending upwardly from the suspension frame associated therewith;

b. an outer cylinder telescoped over said inner cylinder and slidable therealong; and

c. chain drive means comprising a drive gear mounted on a drive shaft adapted to be driven by a drive motor, said drive shaft being fixed relative to the outer tube of that leg, a first gear mounted on a first shaft which is fixed relative to the outer tube of that leg, a second gear mounted on a second shaft above said first gear, said second shaft being fixed relative to the inner tube of that leg, and a chain reeved around said drive gear, around said first gear, around said second gear and then anchored relative to said outer tube of that leg between said first said second gears.