March 11, 1969 A. E. WHITECAR 3,431,992

LIFT TRUCK SCALE

Filed Dec. 16, 1966

Sheet 1 of 4

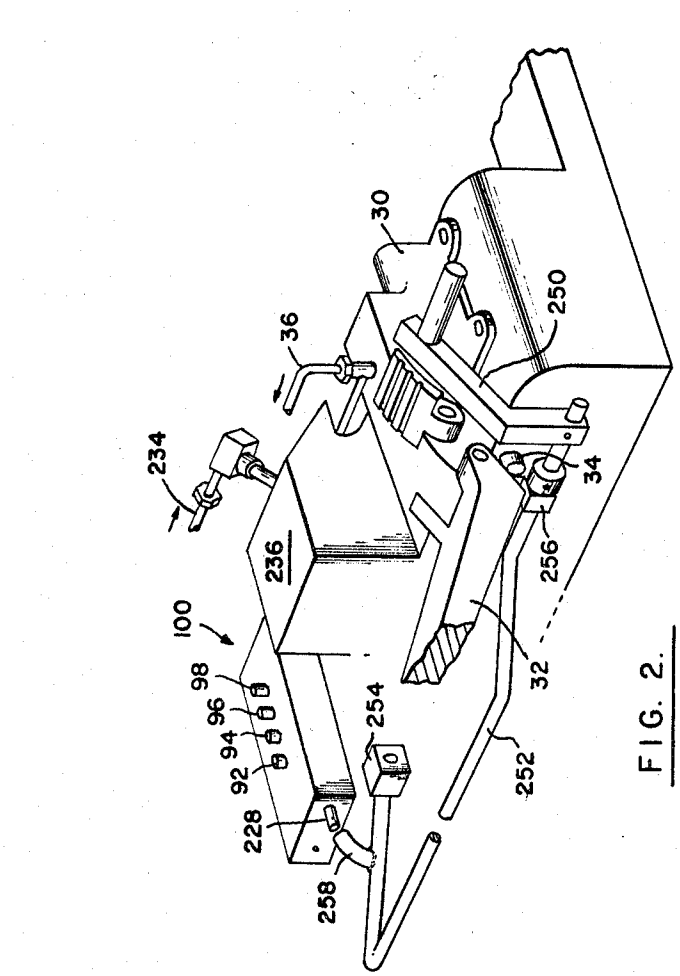


FIG. 2.

FIG. 1.

INVENTOR

ALTEN E. WHITECAR

BY Brose Smith & Heidy

ATTORNEYS

March 11, 1969

A. E. WHITECAR

3,431,992

LIFT TRUCK SCALE

Filed Dec. 16, 1966

Sheet 2 of 4

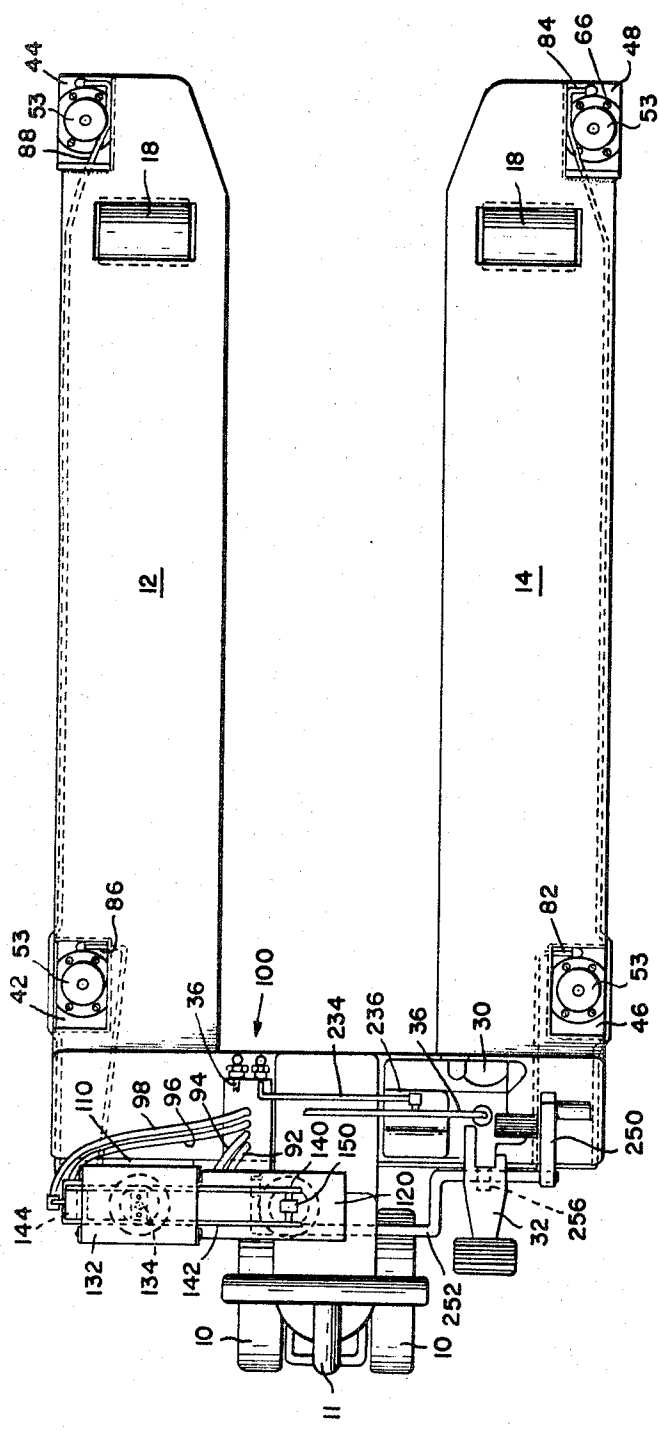


FIG. 3.

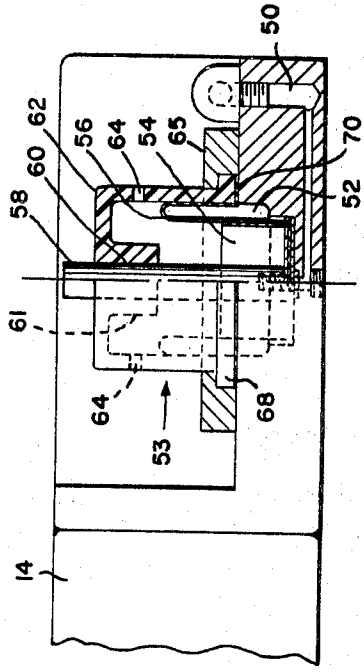


FIG. 4.

INVENTOR

ALTEN E. WHITECAR

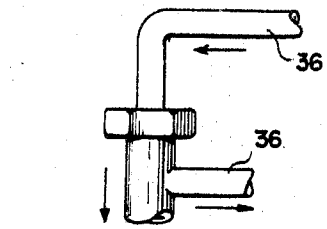
BY Brown, Smith & Hardy

ATTORNEYS

March 11, 1969 A. E. WHITECAR 3,431,992

LIFT TRUCK SCALE

Filed Dec. 16, 1966 Sheet 3 of 4



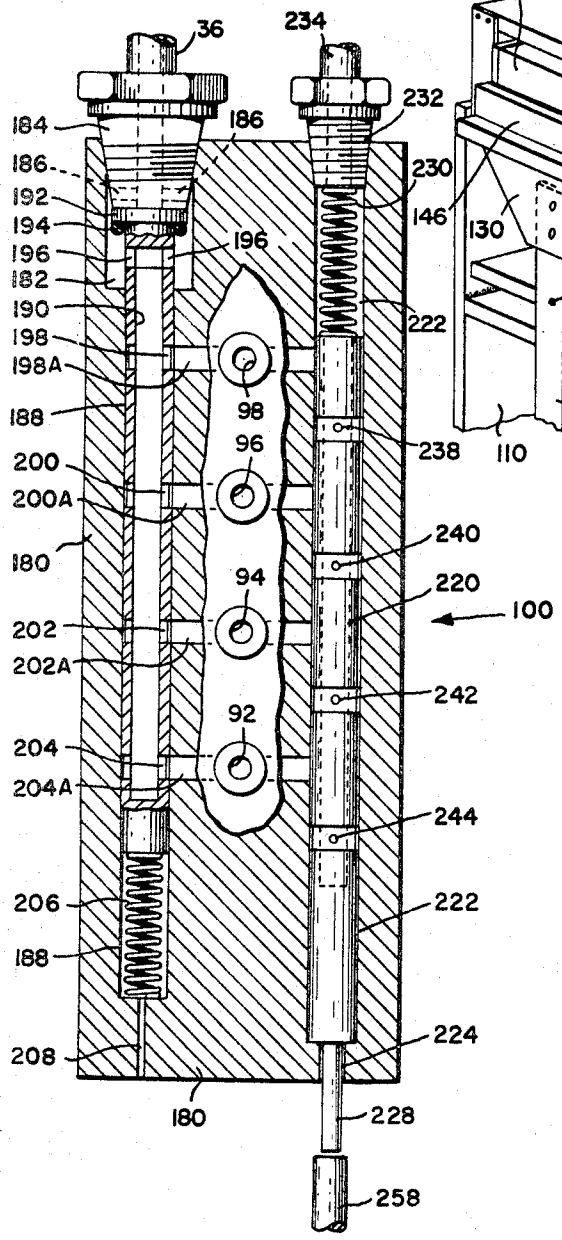


FIG. 5.

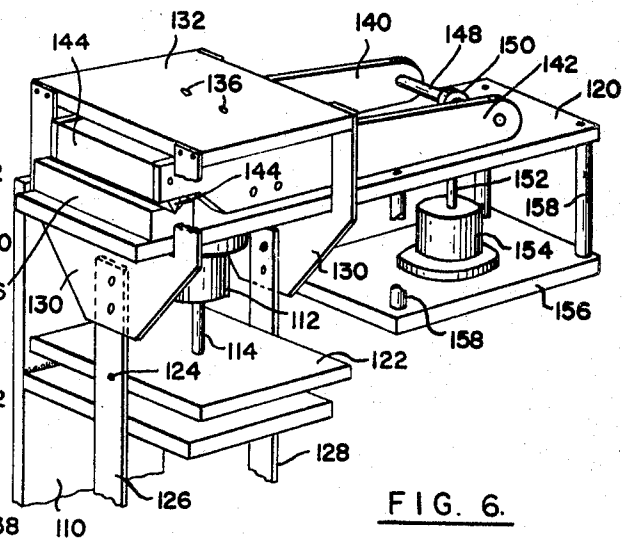


FIG. 6.

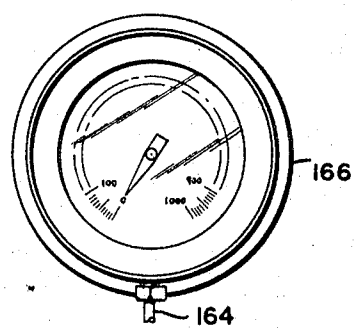


FIG. 7.

INVENTOR
ALTEN E. WHITECAR
BY Bosse Smith & Harding

ATTORNEYS

March 11, 1969 A. E. WHITECAR 3,431,992

LIFT TRUCK SCALE

Filed Dec. 16, 1966 Sheet 4 of 4

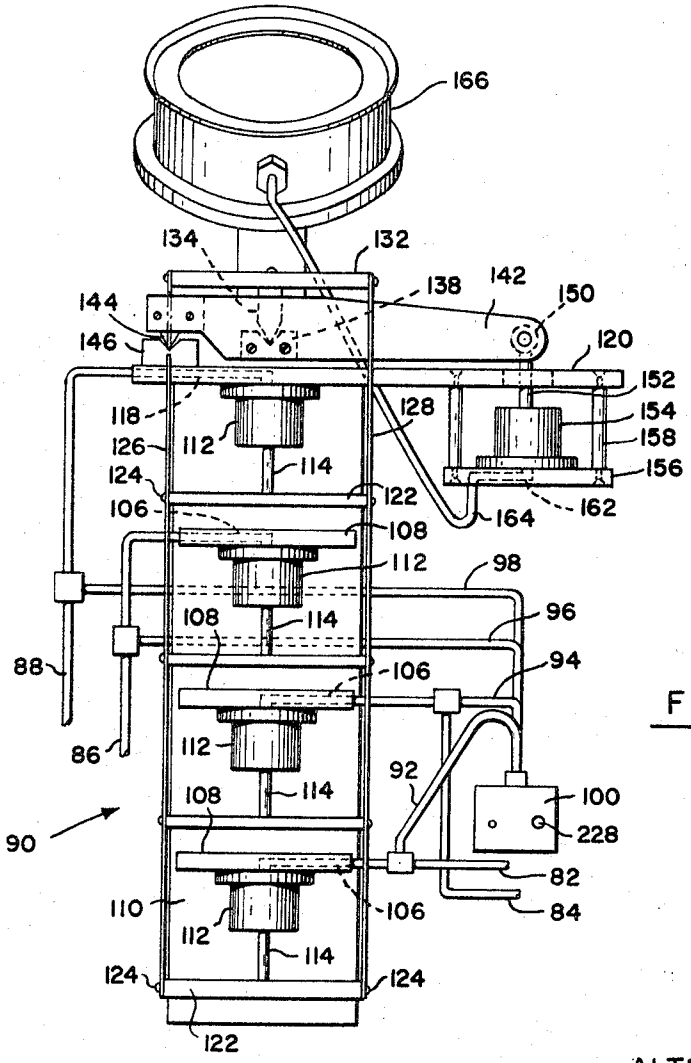


FIG. 8.

INVENTOR

ALTEN E. WHITECAR

BY Bissell Smith & Hardy

ATTORNEYS

United States Patent Office 3,431,992 Patented Mar. 11, 1969

3,431,992

LIFT TRUCK SCALE

Alten E. Whitecar, Westville, N.J., assignor to Smith Kline & French Laboratories, Philadelphia, Pa., a corporation of Pennsylvania

Filed Dec. 16, 1966, Ser. No. 602,368
U.S. Cl. 177—140 10 Claims
Int. Cl. G01g 19/08

ABSTRACT OF THE DISCLOSURE

A scale on a lift truck for handling palletized loads, the scale comprising four hydraulic units depressible by an undersurface of the pallet and transmitting pressure to a weight indicator.

This invention relates to a lift truck scale and more particularly relates to such a scale of particular utility with a lift truck for handling loaded pallets.

In handling palletized material it is frequently necessary to check the weight of the material on each pallet. This is generally accomplished by placing the loaded pallet on a scale which is a time consuming operation. Alternatively and rarely used due to the expense, the lift truck carrying the loaded pallet can be weighed on a floor scale. In accordance with this invention, the loaded pallet is weighed when it is elevated off the ground by the lift truck by a scale incorporated in the lift truck. This is accomplished employing inexpensive mechanism and results in a substantial time saving.

The device of this invention is suitable for use with any of the well known lift trucks. Briefly, the invention employs a plurality of load bearing rods which project upwardly above the top of the supporting surface of the truck in a manner to support the loaded pallet when the lift truck supporting surface is elevated to lift the pallet off the ground. A force transmission system transmits the force exerted on the rods to a force accumulating device which totals the received forces. The force accumulating device is connected to a readout device which can, if desired, give a direct reading of the weight of the load on the pallet. When the lift truck is of the hydraulic type, it is advantageous to incorporate the scale of the invention in the hydraulic system of the lift truck.

The invention will be further clarified by reading the following description in conjunction with the drawings, in which:

FIGURE 1 is a side elevational of a typical hydraulic fork lift truck;

FIGURE 2 is a front perspective view partially broken away of a portion of the hydraulic actuating means of the truck of FIGURE 1;

FIGURE 3 is a plan view of the truck of FIGURE 1;

FIGURE 4 is an enlarged elevation partially broken away, of one of the force transmitting devices of the scale incorporated in the truck of FIGURE 1;

FIGURE 5 is a horizontal sectional view of the valve employed with the scale incorporated in the truck of FIGURE 1;

FIGURE 6 is a perspective view of a force reducing mechanism employed in the scale in the truck of FIGURE 1;

FIGURE 7 is a plan view of a gauge employed with the scale in the truck of FIGURE 1; and

FIGURE 8 is a front elevation of the force accumulating device employed in the scale of the truck of FIGURE 1.

Referring first to FIGURE 1 a fork lift truck 2 of conventional construction has a frame 4 to which is secured a hydraulic ram 6 which in turn is secured to the

axle 8 of wheels 10 so as to provide for the elevation of frame 4. A tow member 11 is secured to axle 8 by means not shown.

A pair of forks 12 and 14 are fixedly secured to frame 4 (FIGURE 3) and are adapted to pass below a pallet and then support it when elevated. Wheels 18, 18 are provided for the elevation of forks 12 and 14. Each wheel 18 is mounted on a bell crank 20 pivoted at 22 and pivotally connected at 24 to a linking system 26 (only part of which is shown) which is connected to hydraulic ram 6 in a manner so that the actuation of the ram causes bell crank 20 to rotate clockwise as viewed in FIGURE 1 resulting in the elevation of the fork to which it is connected.

A hydraulic pump indicated at 30 (FIGURE 2) is actuated by a camming foot lever 32 which actuates pump plunger 34. A pump discharge line 36 connects pump 30 to ram 6.

The thus described structure is old in the art, having been in substantial commercial use for many years, and hence will not be described in further detail. Any of the known trucks wherein the forks or pallet lifting platform are elevated hydraulically is satisfactory for use with the invention.

Platforms 42 and 44 recessed in fork 12 and platforms 46 and 48 recessed in fork 14 substantially below the top surfaces thereof (FIGURE 3) each have a drilled passage 50 communicating with a recess 52 in the platform (see FIGURE 4) forming part of a ram 53. Each ram 53 has a cup-shaped piston 54 received in recess 52 and has attached thereto a diaphragm skirt 56 of rubber or the like. A load bearing piston rod 58 is secured to piston 54 and passes through an opening 60 in a boss 61 extending downwardly from the interior of a cap 62 which is provided with vent openings 64. A clamping ring 65 is secured to each platform by means of machine screws 66 (FIGURE 3) and engages a flanged portion 68 of cap 62 under which is secured the peripheral portion 70 of diaphragm skirt 56 (FIGURE 4).

The passages 50 in the platforms 42, 44, 46 and 48 are respectively connected to hydraulic lines 86, 88, 82 and 84 which in turn are connected to the force accumulator 90 (FIGURE 8). Lines 82, 84, 86 and 88 are respectively connected by lines 92, 94, 96 and 98 to double valve 100.

Each of lines 82, 84 and 86 communicates with a passage 106 in a plate 108 which is fixedly secured as by welding to a vertical plate 110 mounted on frame 4. Each passage 106 communicates with a hydraulic ram 112 mounted on plate 108 and having a rod 114. Each hydraulic ram 112 and its associated plate 108 is of the same construction as the rams 53. Line 88 communicates with a drilled passage 118 in a plate 120 fixedly secured to plate 110. Passage 118 communicates with a ram 112. Each rod 114 bears against a plate 122 which in turn has secured thereto by machine screws 124 a pair of vertical straps 126 and 128. The upper end of each of straps 126 and 128 is secured to a yoke member 130 which in turn is secured to a plate 132 (FIGURE 6). A knife edge member 134 is secured to plate 132 by machine screws indicated at 136 (FIGURE 6) and extends downwardly into engagement with a V-shaped bearing member 138 which is secured to multiplier arms 140 and 142. A knife edge member 144 is secured to arms 140 and 142 and engages a V-shaped bearing member 146 which is secured to plate 120. The other ends of arms 140 and 142 are connected by a rod 148 carrying a roller 150 which bears against the end of rod 152 of hydraulic ram 154 which is mounted on a plate 156 secured to plate 120 by means of posts 158. Hydraulic ram 154 and plate 156 are structurally the same as hydraulic rams 53. As

best seen in FIGURE 8, plate **156** has a passage **162** which communicates with a hydraulic line **164** which in turn communicates with a conventional pressure gauge shown at **166**. As shown in FIGURE 7, gauge **166** can be calibrated to show the weight in any desired unit of weight, for example, pounds as illustrated.

Double valve **100** (FIGURE 5) has a body portion **180** with an enlarged bore **182** to which is secured line **36** from pump **30** by a threaded fitting **184** having discharge openings **186, 186** which discharge into bore **182**. A smaller bore **188** in communication with bore **182** contains a hollow spool valve member **190** having a headed portion **192** which is adapted to abut against fitting **184** and adjacent which is mounted an O-ring **194**. Openings **196, 196** in member **190** are adapted to communicate with bore **182**. Valve member **190** is also provided with openings **198, 200, 202** and **204** in grooved portions thereof which are respectively in communication with passages **198A, 200A, 202A** and **204A**. A compression coil spring **206** biases valve member **190** towards fitting **184**. A vent opening **208** provides communication between bore **188** and the atmosphere. Lines **92, 94, 96** and **98** are in communication with passages **204A, 202A, 200A** and **198A** respectively as shown in FIGURE 5.

Valve **100** has a hollow valve member **220** slidably mounted in a bore **222** which has a reduced portion **224** through which passes a rod **228** secured to member **220**. A compression coil spring **230** biases valve member **220** away from a threaded fitting **232** by means of which a return line **234** is connected to bore **222**. Line **234** is connected to the hydraulic system reservoir **236** as shown in FIGURE 2. Member **220** is provided with openings **238, 240, 242** and **244** in grooved portions thereof which are adapted to communicate with passages **198A, 200A, 202A** and **204A** as best seen in FIGURE 5. A foot crank member **250** (FIGURE 2) is fixedly secured to a link **252** pivotally mounted in bearings **254** and **256** to which is secured a pusher member **258** adapted to engage and urge inwardly rod **228** of valve member **220**.

Operation

In operation, the fork lift truck **2** is moved under a pallet indicated in phantom at **260** in FIGURE 1 with the load bearing rods **58** in the lowered position. Pump **30** is now actuated by foot lever **32** to increase the pressure in line **36** and hence in lines **82, 84, 86** and **88** through communication with double valve **100** through lines **92, 94, 96** and **98** respectively. This causes the four pistons **54** and load bearing rods **58** to be elevated immediately from their recessed positions to the position shown in FIGURE 1 where rods **58** project upwardly above forks **12** and **14** to bear against crossboards **262** of pallet **260** shown in phantom before the forks **12** and **14** are elevated. When the pressure in this system reaches a predetermined figure insufficient to elevate the forks and pallet, for example, 45 p.s.i., the pressure exerted on spool valve member **190** causes it to move downwardly as viewed in FIGURE 5 against spring **206** until O-ring **194** seals against the lower face as viewed in FIGURE 5 of bore **182** thus sealing off the weighing system from pump **30** and moving openings **198, 200, 202** and **204** out of alignment with the corresponding passages **198A, 200A, 202A** and **204A**. If desired, the gauge may be calibrated to register zero when an empty pallet is lifted in order to show the true weight of the load on a loaded pallet.

Continued operation of pump **30** provides sufficient pressure to actuate ram **6** in the conventional manner to elevate frame **4** and pivot bell cranks **20** to elevate forks **12** and **14**. This results in the truck lifting pallet **260** off the surface on which it rests at which time the entire weight of the pallet and any load thereon is carried by the four load bearing rods **58**. The downward force exerted on the four pistons **54** produces a corresponding increase in the weighing system pressure in each of lines **82, 84, 86** and **88** and the correspondingly increased pressure in the four rams **112** of accumulator **90** causes a corresponding increase in the accumulated force exerted by the knife edge member **134** on multiplier arms **140** and **142** through the bearing member **138**. Arms **140** and **142** in turn cause a proprotionally smaller force to be exerted on ram **154** with an increase in the pressure in gauge **166** which will be reflected on the weight scale to give, for example, the weight of the load on the pallet.

Since it saves wear and tear on the rods **58**, it is preferred to retract them after the weighing operation and permit the pallet to rest directly on forks **12** and **14**. In the retracted position rods **58** are ready to pass under the next pallet which is to be handled. This can readily be accomplished by actuation of foot crank **250** which pivots link **252** to cause pusher member **258** to urge rod **228** and valve member **220** against the action of spring **230** until the grooves associated with spool openings **238, 240, 242** and **244** are in registry with passages **198A, 200A, 202A** and **204A** which permits the hydraulic fluid in lines **98, 96, 94** and **92** and hence in lines **88, 86, 84** and **82** respectively to pass into the center of valve member **220**, thence into bore **222** and thence through line **234** to the reservoir **236**. This permits the loaded pallet to force rods downwardly into their retracted position.

It will be obvious that the accumulated forces produced by the four rams **112** of acumulator **90** could be applied directly to a ram capable of withstanding the pressures involved.

It will be understood that the above described embodiment is by way of illustration and is not intended to be limiting.

What is claimed is:

1. In a lift truck for pallets having pallet supporting means and means for elevating the pallet supporting means to lift a pallet off the ground the improvement comprising:

a weighing system having a plurality of cylinders secured to the pallet supporting means below the top of the pallet supporting means,

a piston in each cylinder,

load bearing means attached to each piston and adapted to project above the top of the pallet supporting means,

pressure totaling means connected to each of said cylinders,

output indicating means connected to the pressure totaling means, and

means to supply a fluid at a predetermined pressure to said weighing system to project the load bearing means above the top of the pallet supporting means.

2. The apparatus of claim **1** in which the fluid is a hydraulic fluid.

3. The apparatus of claim **1** in which the pressure totaling means includes a means to accumulate the pressures to be totaled, an output ram and divider means connecting the output ram to the accumulating means.

4. The apparatus of claim **2** in which a fluid supply line is connected to each cylinder,

each fluid supply line is connected to a valve which in turn is connected to the supply means, and

means is provided to shut the valve at a predetermined pressure.

5. The apparatus of claim **4** having a line connecting the supply line to a reservoir and valve means controlling said last mentioned line.

6. In a lift truck for pallets having pallet supporting means and hydraulic means for elevating the pallet supporting means to lift a pallet off the ground the improvement comprising:

a weighing system having a plurality of cylinders secured to the pallet supporting means below the top of the pallet supporting means,

a piston in each cylinder,

load bearings means attached to each piston and adapted

to project above the top of the pallet supporting means,

pressure totaling means connected to each of said cylinders,

output indicating means connected to the pressure totaling means,

a fluid supply line connected to each cylinder and to a valve,

means connecting the valve to the hydraulic elevating means, and

means to close the valve at a predetermined pressure.

7. The apparatus of claim **6** having a line connecting the supply line to a reservoir and valve means controlling said last mentioned line.

8. In a lift truck for pallets having pallet supporting means and means for elevating the pallet supporting means:

a weighing system having a plurality of cylinders secured to the pallet supporting means,

a piston in each cylinder,

load bearing means attached to each piston and projecting above the top of the pallet supporting means,

pressure totaling means,

means connecting each cylinder with the pressure totaling means,

fluid in said cylinders, pressure totaling means and connecting means, and

output indicating means connected to the pressure totaling means.

9. The apparatus of claim **8** in which the fluid is a hydraulic fluid.

10. The apparatus of claim **8** in which the pressure totaling means includes a means to accumulate the pressures to be totaled, an output ram and divider means connecting the output ram to the accumulating means.

References Cited

UNITED STATES PATENTS

1,147,128	7/1915	Troll	177—208 X
2,020,307	11/1935	Fitch	177—139
2,109,460	3/1938	Brasher	177—139
2,659,592	11/1953	Wetsel	214—2
2,756,983	7/1956	Furcini	177—139

RICHARD B. WILKINSON, *Primary Examiner.*

G. H. MILLER, JR., *Assistant Examiner.*

U.S. Cl. X.R.

177—141, 208; 214—2