March 13, 1962 G. F. QUAYLE 3,024,927

LEVERAGE SYSTEM FOR SECONDARY LIFT

Filed July 30, 1957 2 Sheets-Sheet 1

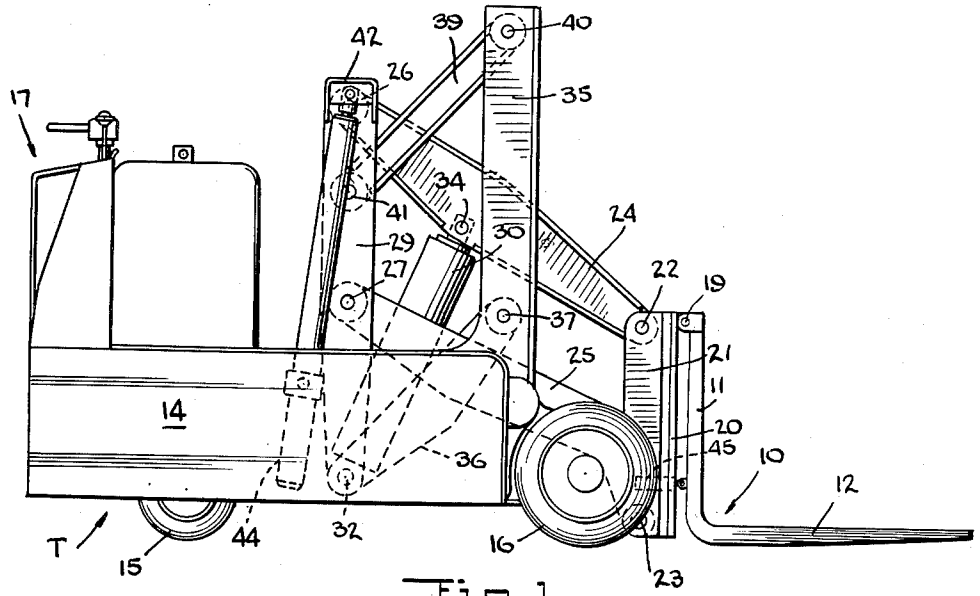

Fig. 1.

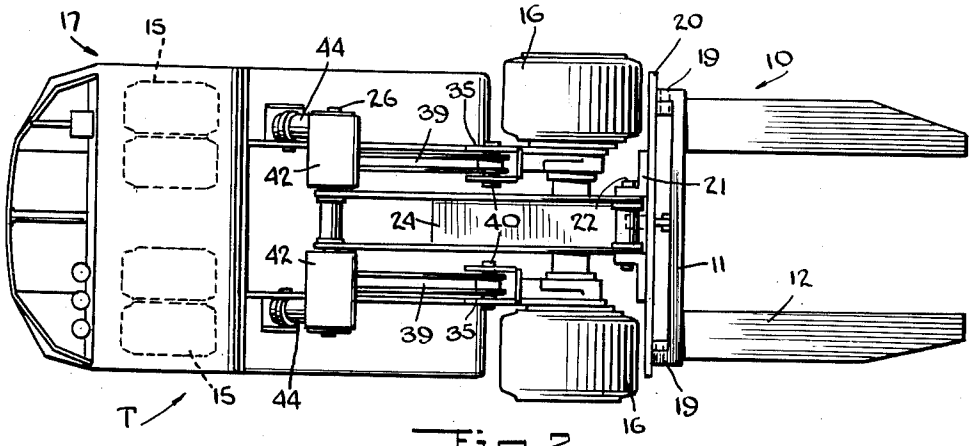

Fig. 2.

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March 13, 1962 G. F. QUAYLE 3,024,927

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Filed July 30, 1957 2 Sheets-Sheet 2

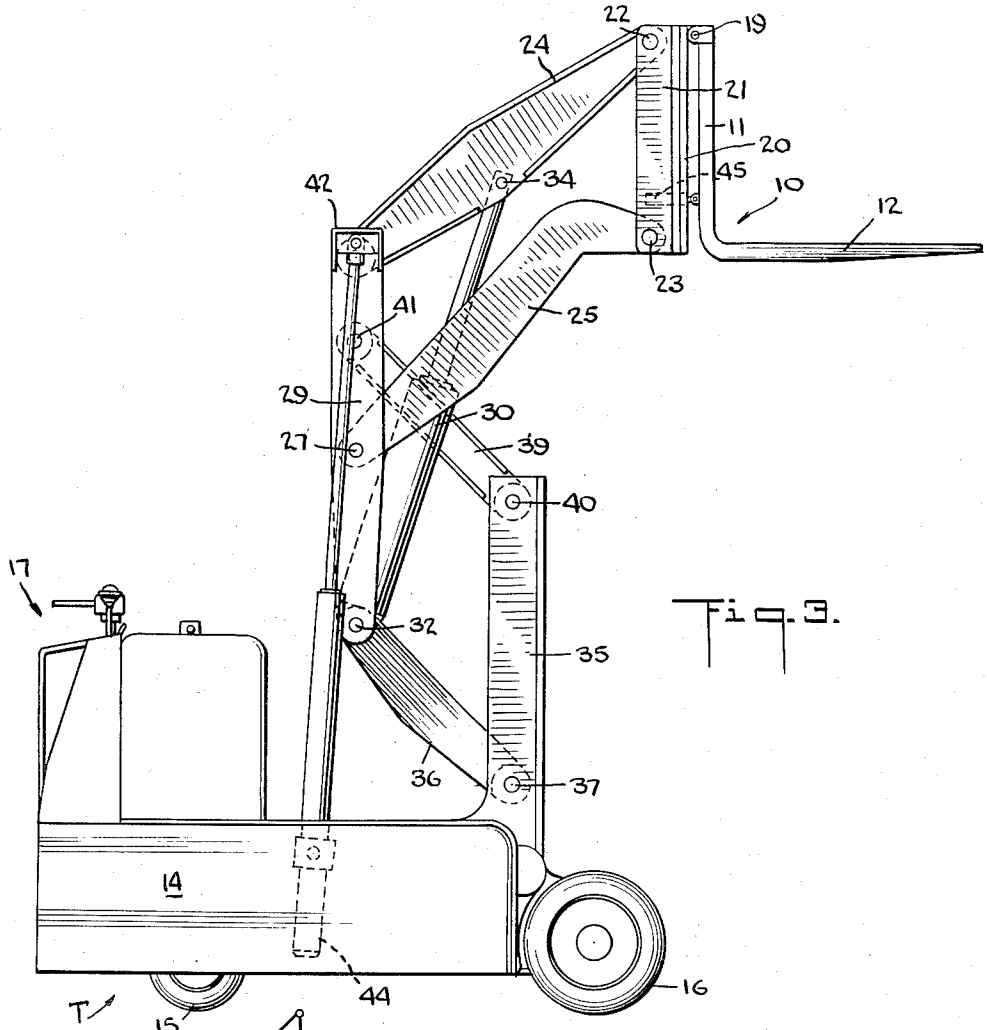

Fig. 3.

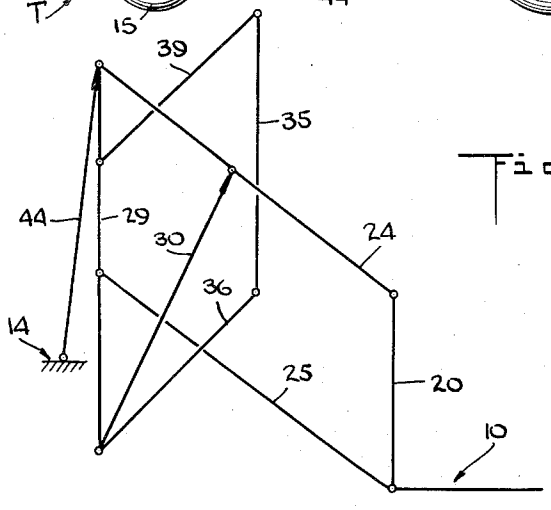

Fig. 4.

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LEVERAGE SYSTEM FOR SECONDARY LIFT

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1 Claim. (Cl. 214—131)

This invention relates to a lifting mechanism for an industrial truck, and, more particularly, to a lifting mechanism for imparting lifting movement to a load platform or fork construction such as found in many industrial trucks.

Heretofore, in industrial trucks, it has been proposed that a load carriage, or other lifting member, be actuated through a leverage system. This leverage system is so mounted on the truck that the load carried by the load carriage is counterbalanced without unduly lengthening the truck. Systems of this class eliminate the need for conventional uprights and thereby also provide improved visibility for the operator as well as other advantages. In a truck of this class, it is important to maintain at a minimum the size of the leverage system so that the trucks may also be minimum in size for use in confined spaces.

My invention contemplates a construction wherein a leverage system of the foregoing class is provided with means for imparting high, over-all lift to a load, while, at the same time, retaining all of the advantages inherent in such as system.

As a feature of my invention, I use a leverage system on which is mounted a load carriage or other lifting member. Instead of being mounted on a part of the truck for upward and downward movement relatively to the truck, this leverage system is mounted on support means that are in turn mounted on the truck for lifting movement relatively thereto.

As a further feature of my invention, the support means are mounted on the truck for upward and downward movement relatively thereto by a second leverage system, and, in the preferred form of the invention, both systems take the form of parallelogram leverage systems and the support means constitutes a side of both systems. By using parallelogram, or parallel motion systems, it will be seen that the load carriage may be elevated about the support means while being held in a particular angular position relatively to the support means. In like manner, the support means may be lifted relatively to the truck while maintaining its angularity constant.

As still further features of the invention, I use a hydraulic ram bearing between the support means and a part of the remainder of the first leverage system to effect elevation of the load carriage relatively to the support means, and I use a second hydraulic ram extending between the truck and the support means to effect upward swinging movement of the support means relatively to the truck.

This novel concept contributes an exceedingly simple and effective construction that provides, in a leverage system, all of the advantages found in lift trucks of the type mentioned heretofore, while providing for considerably greater over-all lift than has been achieved thus far wherever such systems have been employed.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claim appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important,

therefore, that the claim be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in order to prevent the appropriation of my invention by those skilled in the art.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

FIG. 1 is a side view of a lift truck illustrating a leverage system in accordance with the present invention;

FIG. 2 is a plan view of the apparatus illustrated in FIG. 1;

FIG. 3 is a side view similar to FIG. 1 but illustrating the position of the various members of the system when the load carriage is in elevated position; and

FIG. 4 is a diagrammatic view of the parts in the position illustrated in FIG. 1.

Referring to the drawings, and more particularly to FIGS. 1 to 3 thereof, the present invention is shown utilized to mount a load carriage 10 for lifting movement relatively to an industrial truck T. The load carriage chosen for illustration comprises a front plate 11 arranged to support a pair of load forks 12, although it should be understood that any suitable load carrying or manipulating apparatus may be employed.

The truck T has a main frame 14, steering wheels 15 and traction wheels 16, as well as a control station 17 from which an operator may control both the truck and the lifting mechanism.

Front plate 11 is pivotally mounted at its upper corners by pinned brackets 19 upon a transverse plate 20 which is integrally connected to a vertically extending, centrally disposed arm 21. This arm 21 constitutes a part of a parallelogram leverage system and is connected at its ends through pivots 22 and 23 to the forward ends of upper and lower longitudinally extending arm 24 and 25, respectively. The rearward ends of these arms 24 and 25, are in turn connected through pivots 26 and 27, respectively, to a pair of upstanding arms 29. Since these arms 29 are parallel and always act in unison, they may be considered as a single, integral member constituting one side of the parallelogram. In order to assure parallel motion of the respective arms, the pivots 26 and 27 have the same spacing as do pivots 22 and 23 while the pivots 22 and 26 also have the same spacing as do pivots 23 and 27.

It will be seen from the description thus far that the arms 29 serve to support the arms 24 and 25, as well as the arm 21 and the load carriage 10. In order to impart swinging movement to the load carriage to elevate the same relatively to the supporting arms 29, those arms are extended downwardly a suitable distance beyond the pivot 27. At their extended ends, the arms 29 support a hydraulic ram 30 through a pivot 32. The piston of this ram is suitably connected through a conventional piston rod to the arm 24, intermediate its ends, by a pivot 34.

As has been mentioned heretofore, the side of the parallelogram which supports the lifting carriage, and which now has been defined as consisting of the arms 29, is preferably itself a part of a further parallelogram or parallel motion system. In this system, the frame 14 of the truck T is provided with a pair of upstanding structural beams 35 straddling both the longitudinal axis of the truck and the arms 24 and 25. A first pair of links 36 is connected at its forward ends to the lower portions of the beam 35 by pivots 37, and at its rearward ends to the supporting arms 29 through the pivot 32. A second pair of links 39 is connected at its forward ends to the upper portions of the beams 35 by pivots 40, and at its rearward ends to the supporting arms 29 through the pivots 41. As is the case with the arms 29, it will

be seen that each pair of links 36 and 39 may be considered as an integral unit.

In order to assure parallel motion of opposite parts in this second parallelogram system, the pivots 40 and 41, and 32 and 37, are similarly spaced, as are the pivots 32 and 41, and 37 and 40.

In order to impart swinging movement to the supporting arms 29, those arms are provided at their uppermost ends with outwardly extending, downwardly facing U-shaped brackets 42. A pair of hydraulic rams 44 extend between the truck frame 14 and the brackets 42, one ram being pivoted to each bracket.

To elevate the load carriage from its normal position illustrated in FIG. 1 to its raised position illustrated in FIG. 3, reference is had to the diagrammatic FIG. 4 wherein the rams 30 and 44 are shown as arrows. At this point, attention is invited to the fact that the rams may be operated individually, and in sequence. In this way, the load carriage may be elevated to a certain degree without increasing the over-all height of the truck so that the truck may be employed advantageously in low headroom areas. Nevertheless, it will generally be preferred that the rams be simultaneously actuated through a suitable metering or proportioning valve, but, as such an arrangement is not essential to the present invention, it is not shown here.

As fluid under pressure is simultaneously applied to the rams 30 and 44, it will be seen that the first ram 30, bearing between the supporting arms 29 and longitudinal arm 24, will cause the arms 24 and 25 to swing upwardly about their respective pivots 26 and 27 in the arms 29, thus elevating the arm 21 and the load carriage 10 in an arcuate path relatively to the arms 29. Simultaneously, the application of fluid under pressure to the rams 44 bearing between the upper portions of arms 29 through brackets 42 and the truck frame 14, will cause the arms 29 to swing upwardly about the beams 35 through the links 36 and 39. The load carriage may be returned to its normal position by relieving the pressure on the rams. Because of the arrangement of parts shown and described herein, wherein the beams 35 are disposed between the arms 29 and the load carriage, it will be seen that the arcuate paths of the arms 29 and the load carriage 10 are concave with respect to each other, thus effecting at least partial equalization thereof and elevation of the load carriage in a substantially vertical path.

If it is desired that the load carriage 10 be tilted, any suitable means may be provided for that purpose, such as an additional ram 45, for example, bearing between the lower end of the arm 21 and the forward plate 11, and a stop lug may be welded to the rear of the forward plate to assure vertical positioning thereof when the carriage is not tilted.

From the foregoing description it will be seen that the present invention provides a leverage system for an industrial truck wherein lifting movement of the load carriage is contributed by the first hydraulic ram, with a further or secondary lift obtained through elevation of the supporting arms 29 by additional rams. While providing these advantageous characteristics, the novel features of this construction also retain the desirable advantages of the single lift leverage systems heretofore proposed.

I now claim:

In combination with a truck having a frame and ground engaging wheels secured to said frame for supporting said frame, an upstanding member secured to said frame adjacent one end of said frame, an intermediate link member, a pair of rearwardly extending arms pivotally secured at their forward ends to said upstanding member at vertically spaced points and pivotally secured at their rearward ends to said intermediate link member at vertically spaced points to form a first parallelogram leverage system for supporting said intermediate link member for swinging vertical movement relatively to said frame, a load carriage, a pair of forwardly extending arms pivotally secured at their rearward ends to said intermediate link member at vertically spaced points and pivotally secured at their forward ends to said load carriage at vertically spaced points to form a second parallelogram leverage system for supporting said load carriage for swinging vertical movement relative to said intermediate link member, said forwardly extending pair of arms having lateral clearance with respect to said rearwardly extending arms and said upstanding member whereby said load carriage may be moved vertically between a position vertically above and a position vertically below the points of pivotal attachment of said rearwardly extending arms to said upstanding member to position said load carriage adjacent the ground forwardly of said upstanding member, ram means secured to and extending between said frame and said intermediate link member for vertically swinging said intermediate link member relatively to said frame, and ram means secured to and extending between said intermediate link member and one of said forwardly extending arms for vertically swinging said load carriage relatively to said intermediate link member.

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