

April 18, 1961

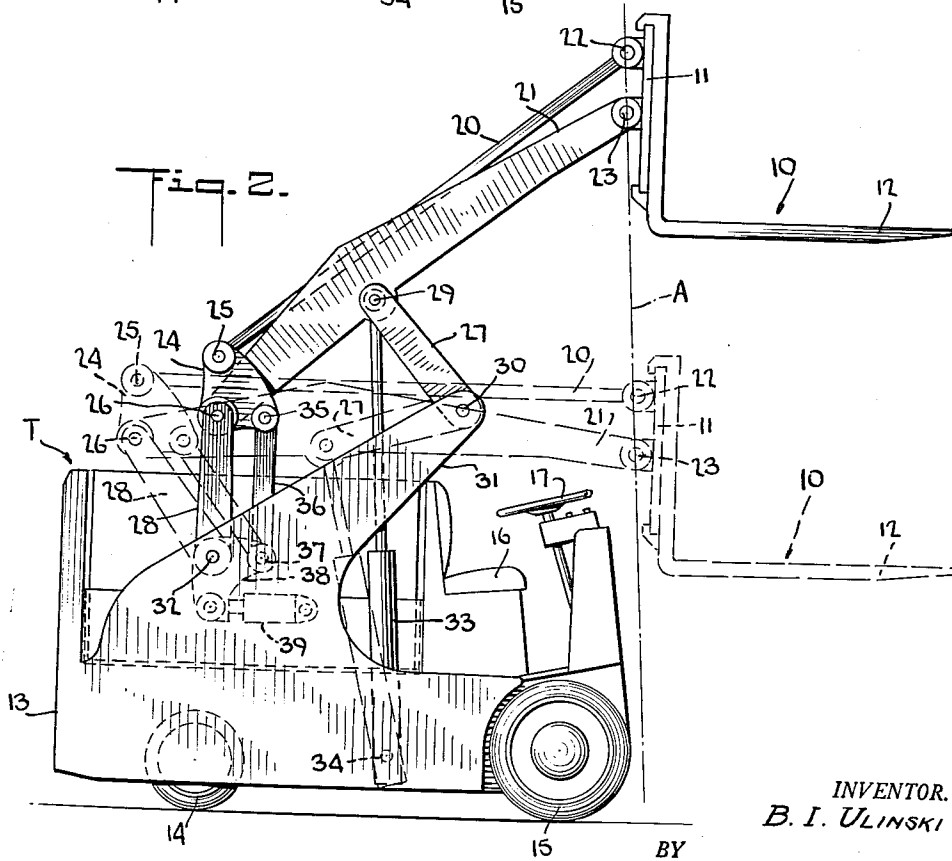
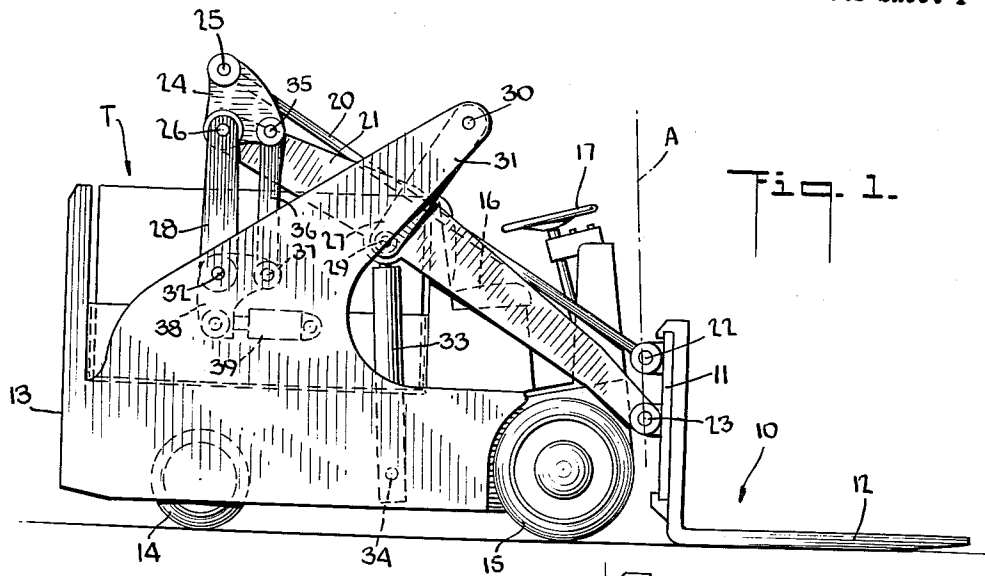
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LIFTING MECHANISM FOR INDUSTRIAL TRUCK

Filed Feb. 11, 1957

3 Sheets-Sheet 1



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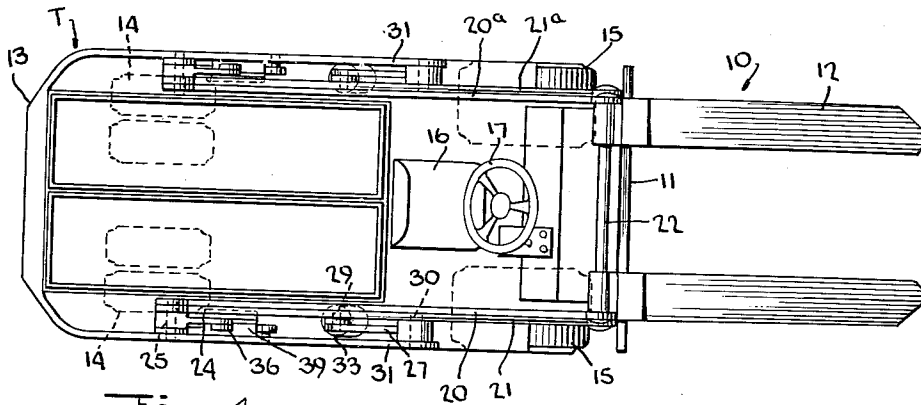


Fig. 4.

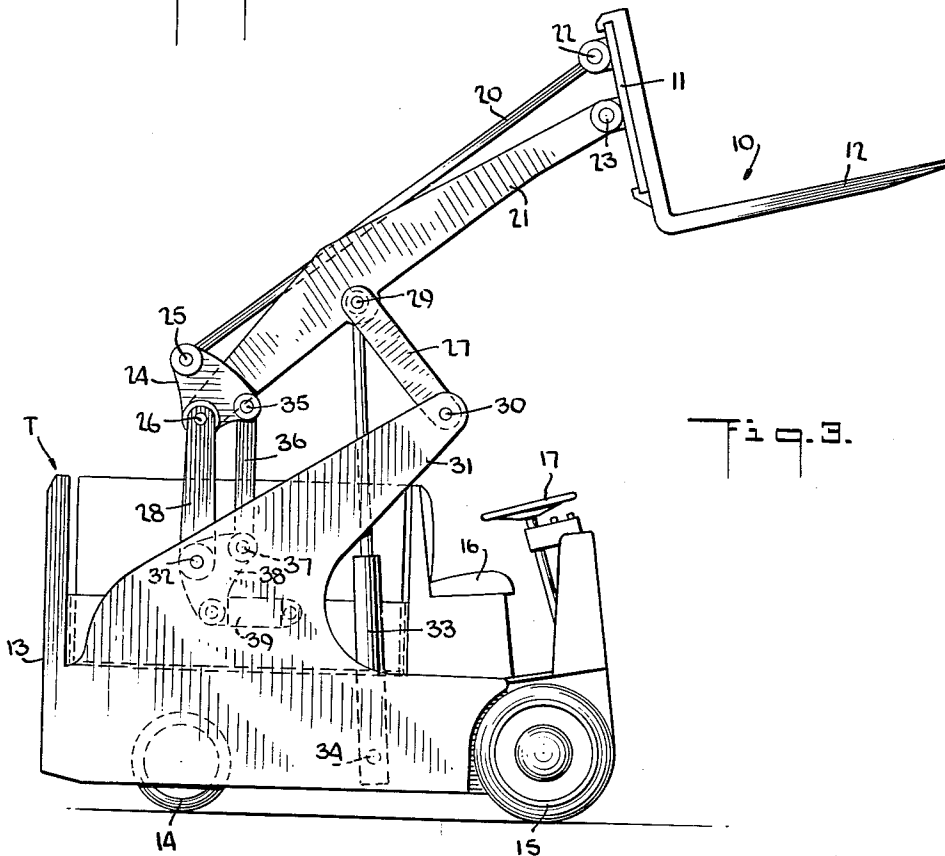


Fig. 5.

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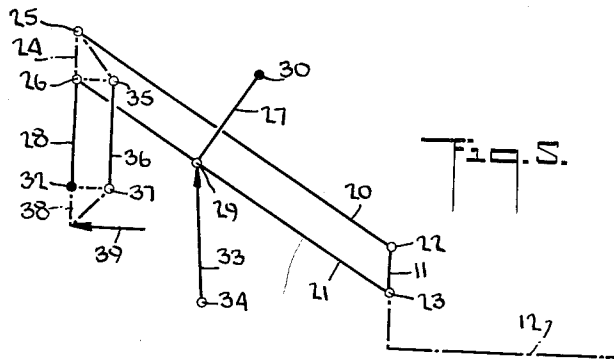
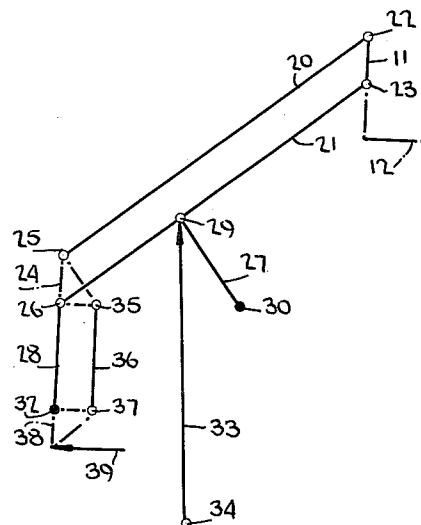
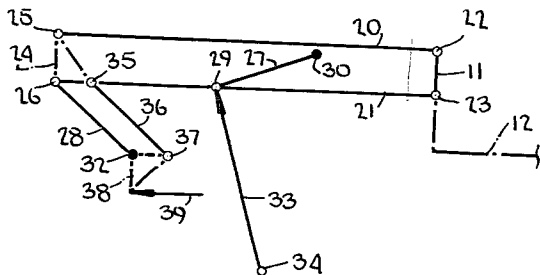
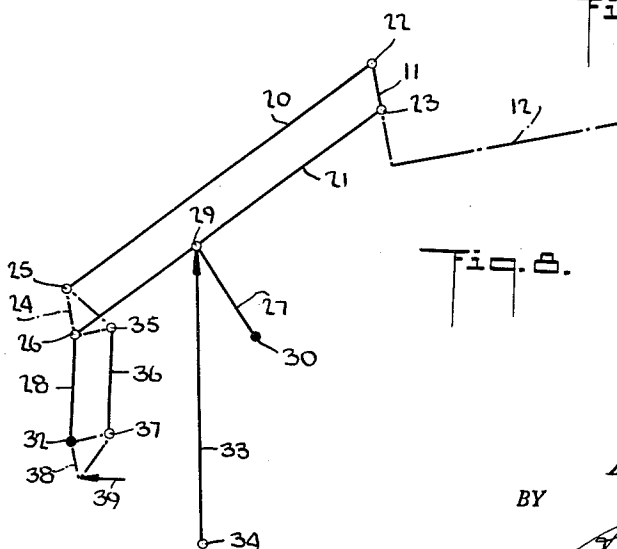


Fig. 6.



Fi 7.



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LIFTING MECHANISM FOR INDUSTRIAL TRUCK

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9 Claims. (Cl. 214-140)

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.

It is customary, in most industrial trucks, to mount the load lifting platform or forks for movement on channeled uprights. In this way, the load is elevated through movement on the uprights, while the load can be tilted through tilting movement of the uprights so as to facilitate taking the load off the truck, or to move the load with the truck. For example, it is frequently desired to tilt the load backwardly so as to stabilize the truck and also to stabilize the load on the truck.

It has been proposed that a load platform or other load lifting member be actuated through operation of a lever system. The purpose of a construction of this class is to locate the load lifting mechanism on the truck in a position where it will act to counterbalance the load carried by the platform or the forks. Further, it has been proposed that in a leverage system of the class described, the forks or other load platform move vertically so as to facilitate the handling of a load as it is being stacked or placed in storage. By moving the load vertically in a single plane, the same results are accomplished as when the load platform or forks are moved on vertical uprights.

However, in leverage systems of the class described, so far as I am aware, it has never been possible to effect the tilting of the load platform or forks except through the use of complicated means that are difficult to operate. I have now conceived a construction through which I am able to lift a load platform or lifting forks so that the platform or forks move substantially in a particular vertical plane. At the same time, I am able through the particular manipulation of the lifting means, to effect tilting of the load platform or forks in any lifted position thereof.

As a feature of my invention, I form the load lifting structure, such as forks or the like, as part of a parallelogram and then I arrange to swing this parallelogram so that the load moves substantially vertically at all times. This swinging movement is made possible simply by holding in a particular plane that portion of the parallelogram that is opposite the load platform or forks in the parallelogram system. As a further particular feature of the invention, the parallelogram member that is held in a particular position is adapted to be rotated in any position of the parallelogram; thereby pivoting the forks rearwardly so as to tilt the load. Moreover, the load may be elevated or lowered while in this tilted position.

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As a further particular feature of the invention, the parallelogram member that controls the positioning of the forks is itself a part of a further parallelogram system in which its opposed parallelogram member is controlled by a hydraulic ram or other positioning device. Through this hydraulic ram the parallelogram member may then move that part of the parallelogram leverage system that lifts the load so as to tilt the load in all positions thereof.

This novel concept contributes an exceedingly simple and effective construction that makes possible the utilization of a leverage system for lifting a load platform or forks and for moving the load as effectively as though the load were mounted for movement on the usual channeled uprights. Moreover, since I do not utilize uprights, I enable the operator to have much better vision for driving the truck or for manipulating the load. I believe, therefore, that my truck construction yields all the advantages of a leverage lifting system together with all the further advantages of an upright channel system.

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 claims 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 claims 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.

In the drawings:

Fig. 1 is a side view showing an industrial truck that utilizes my novel lifting mechanism.

Fig. 2 is like Fig. 1 but illustrates the lifting movements of my mechanism.

Fig. 3 illustrates the tilting movement of the load carrier.

Fig. 4 shows a plan view of my invention.

Fig. 5 is a diagrammatic view showing the parts of the lifting mechanism in the position of Fig. 1.

Fig. 6 shows the same parts in the dotted position of Fig. 2.

Fig. 7 shows the parts in the full line position of Fig. 2, and

Fig. 8 shows the parts in the position of Fig. 3.

Referring now more particularly to the drawings, I show my invention utilized to mount a load carrier 10 for lifting movement relatively to an industrial truck T. I have chosen to show the load carrier 10 constructed with a front plate 11 that is somewhat like the front plate used on a conventional load lifting carriage, and that is adapted to accept load forks 12. It is to be understood, however, that the particular construction of the load carrier 10 is not important to an understanding of my invention, and it is necessary to realize merely that the carrier 10 is adapted to support a load that is to be handled. The truck T has a main frame 13 with steering and driving wheels 14, 15, and has also a seat 16 for the operator and controls 17 through which the operator

controls the truck and lifting mechanism, as will be understood by those skilled in the art.

In the extremely novel lifting mechanism that I contribute by my invention, I support the load carrier 10 through a parallelogram arrangement that includes upper and lower parallel arms 20, 21, well shown in Figs. 1 to 3. Those arms 20, 21 are pivoted at their forward ends to the load carrier 10 through pivots 22, 23 that are vertically spaced, while the rearward ends of arms 20, 21 are attached to a lever 24 through pivots 25, 26 that have the same spacing as do that pivots 22, 23. Actually, I utilize corresponding parallel arms at opposed sides of the truck, those on the left-hand side being indicated in Fig. 4 by the numerals 20a, 21a. However, since the parts of my mechanism are alike at both sides of the truck, I believe it will suffice if I describe merely the right-hand side, shown in Figs. 1, 2 and 3.

In order to understand the movements of the parallelogram that includes the arms 20, 21, it is necessary first to realize that I swing the parallelogram relatively to the truck T through first and second swing links 27, 28. Thus, one end of the first swing link 27 is pivoted to a medial portion of the arm 21 through a pivot 29, while the opposed end of that link 27 rotates on a pivot 30 on an upper portion 31 of truck frame 13. Opposed ends of the second swing link 28 are pivoted to the rear end of arm 21 through the pivot 26, and to truck frame 13 through a pivot 32.

The arrangement is such that the parallel arms 20, 21 will swing vertically on the links 27, 28 while having a certain longitudinal movement relatively to the truck T. Thus, when the arms 20, 21 swing to lift the load carrier 10 from the lowered position shown in Figs. 1 and 5, the links 27, 28 will cause the arms and carrier to move also in a rearward direction, toward the position shown in dotted lines in Fig. 2, and also shown in Fig. 6. When swinging further to a full elevated position, the arms 20, 21 and carrier 10 will move somewhat in a forward direction whereby to lie in the full line position shown in Fig. 2 and in Fig. 7. I thereby enable the arms 20, 21 to lift the load carrier 10 with the carrier moving in substantially a particular plane. Actually, I prefer to construct the swing links 27, 28 in such a way that the plane in which the load carrier 10 moves is inclined slightly in a rearward direction, as is indicated by the dot and dash line A in Fig. 2. With the carrier 10 moving substantially in one plane, I am able to lift and to carry a load in the same way as in a lift truck that utilizes conventional uprights.

To impart lifting movement to the parallel arms 20, 21 I prefer to utilize a hydraulic ram 33, that ram being pivoted to the truck frame 13 through a pivot 34, and acting at its upper end against the pivot 29 on the medial portion of arm 21. It may be said in effect that ram 33 acts against the lower arm 21, or against link 27. Of course, it is conceivable that the ram 33 may be arranged to act at substantially any point on the arm 21 or link 27.

I shall now describe that part of my invention that enables the load carrier 10 to be tilted when that is desired by the operator of the truck. I shall first call attention to the fact that I equip the lever 24 with a further pivot 35, that pivot in my preferred construction being offset whereby the lever 24 is, in effect, a two-armed lever. Further, I utilize a link 36 that extends between the pivot 35 and a pivot 37 on a link 38. The link 38 is mounted to rotate on the truck frame 13 through the same pivot 32 that is utilized for the swing link 28, and forms with the lever 24, swing link 28, and further link 36, a second parallelogram.

I control that second parallelogram through a hydraulic ram 39 that acts against the link 38, thus enabling me to change the angular position of link 38. Since link 38 is opposite lever 24, the changing of the angular position of link 38 will change the angular position of lever 24. It will be remembered, of course, that lever 24 forms one

end of the first parallelogram that includes the load carrier 10. Therefore, by utilizing the hydraulic ram 39 to control the link 38 and lever 24, I can hold the load carrier 10 in any particular angular position I select. One position is shown for example in Figs. 1, 2, 5 and 7. By rotating link 38 through ram 39 I can tilt the load carrier, as shown in Figs. 3 and 8. Actually, my invention enables me to effect tilting of the load carrier 10 in all positions to which the carrier moves in its vertical plane of lifting movement. Moreover, the lift ram 33 will be effective to move the load carrier 10 vertically whether or not the carrier is tilted. Because I can tilt the load carrier, those persons skilled in the art will appreciate that I facilitate the handling of a load and the stabilizing of the load relatively to the truck.

I have already referred to the fact that I arrange the parts of my novel lifting mechanism at opposed sides of the truck. Thus, it will be seen while considering Fig. 4 that the lifting arms 20, 21 and 20a and 21a extend at opposed sides of the truck controls 17 and operator's seat 16, and that no part of my lifting mechanism, other than the load carrier 10 itself, is in front of the operator's position on the seat 16. Thereby my invention enables the operator to have much better visibility when driving the truck or when manipulating the load carrier 10.

I believe that the construction and operation of my extremely novel load lifting mechanism will now be fully understood. Through my novel concept, it is possible to achieve all the advantages of a leverage lifting system, together with the advantages of a channel upright system. Thus, I am able not only to hold the load carrier in a particular plane during its lifting movement, but also to achieve tilting of the load carrier in all positions thereof. These things I accomplish without truck uprights, yet I do not require in my lever system means that are complicated and difficult to operate. Actually, my novel lifting mechanism is quite simple, despite the fact that it will enable an industrial truck to handle a load with exceedingly good effect. I believe that those skilled in the art will now appreciate the very considerable value of my invention.

I now claim:

1. In a truck of the class described, a load carrier, upper and lower parallel arms each pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being each pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a first parallelogram comprising said arms, said load carrier and said lever, a swing link pivoted at one end to one of said arms and at its other end to the truck, a second swing link pivoted at one end to said lever on the same axis as the pivot of said lower arm and at its other end to the truck, two additional links pivoted to said lever and second swing link and forming therewith a second parallelogram for positioning said lever in a particular angular position predetermined by said second parallelogram while supporting said first parallelogram for swinging movement, means for swinging said first parallelogram on said swing links whereby to raise that parallelogram relatively to the truck and to elevate the load carrier, said lever by its predetermined angular position holding the parts of the first parallelogram during said swinging thereof so as to maintain the load carrier in a particular angular position, and means effective through movement of the second parallelogram for rotating said lever relatively to said second swing link whereby to change the angular position of said load carrier in all elevated positions thereof.

2. In a truck of the class described, a load carrier, upper and lower parallel arms each pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being each pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, a first swing link pivoted

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at one end to one of said arms and at its other end to the truck, a pair of swing links each pivoted at one end to said lever with one of said links pivoted to the lever on the same axis as the pivot of said lower parallel arm, the opposed ends of said pair of swing links being pivoted relatively to the truck, and means for swinging the parallelogram relatively to the truck on said pair of swing links with said first swing link guiding the movement of said parallelogram and its load carrier.

3. In a truck of the class described, a load carrier, upper and lower parallel arms each pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being each pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a first parallelogram comprising said arms, said load carrier and said lever, a swing link pivoted at one end to one of said arms and at its other end to the truck, a second swing link pivoted at one end to said lever and at its other end to the truck, two additional links pivoted to said lever and second link and forming therewith a second parallelogram for positioning said lever in a particular angular position predetermined by said second parallelogram, means for swinging said first parallelogram vertically on said swing links whereby to elevate the load carrier in a particular plane relatively to the truck, said lever effective by its predetermined angular position to hold the parts of the first parallelogram during said swinging thereof so as to maintain the load carrier in a particular angular position, and means effective through the second parallelogram for rotating said lever relatively to said second swing link whereby to change the angular position of said load carrier in any position to which it is elevated in said particular plane.

4. In a truck of the class described, a load carrier, a pair of arms pivoted at one end to said load carrier in predetermined spaced relation, said arms being pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, a second parallelogram including said lever and a pair of parallel links pivoted to said lever, means for swinging the first parallelogram bodily on said parallel links relatively to the truck, a guide link pivoted at one end to an arm of the first parallelogram and at its other end to the truck for controlling the bodily movement of said first parallelogram on said pair of parallel links, and means acting through said pair of parallel links to control the angularity of said lever whereby to control the angular position of the load carrier relatively to the truck.

5. In a truck of the class described, a load carrier, parallelogram links pivoted at one end thereof to said load carrier, further links pivoting the opposed end of said parallelogram links to the truck and acting through the parallelogram links to control the angular position of the carrier, an intermediate link pivoted to the truck and to a point intermediate the ends of one of said parallelogram links, means for swinging said parallelogram links on said further and intermediate links whereby to lift said carrier relatively to the truck, and said intermediate link acting during the lifting movement to move bodily the parallelogram links whereby to hold said load carrier in a predetermined path.

6. In a truck of the class described, a load carrier, a pair of arms each pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, a control link pivoted at one end to a fixed pivot on said truck and at the other end to one of said arms, a pair of vertical links pivoted at their upper ends to said lever and at their lower ends relatively to said truck, a ram for swinging said arms about their pivots on said lever whereby to effect the lifting and lowering of said load

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carrier, said control link guiding said arms so that the load carrier moves in substantially a vertical plane with said arms swinging bodily with said lever on said vertical links as said load carrier swings on said arms relatively to said lever, and a second ram for changing the angular alignment of said lever relatively to said vertical links whereby to change also the vertical alignment of said carrier in all elevated positions thereof and during its elevating and lowering movements.

7. In a truck of the class described, a load carrier, a pair of arms pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, a pair of vertical links pivoted at their upper ends to said lever and at their lower ends relatively to said truck and mounting said lever and thereby said parallelogram for swinging movement relatively to said truck, a ram extending between said truck and said arms for swinging said arms and load carrier relatively to said lever, a control link pivoted at one end to a fixed portion of said truck and at its other end to one of said arms whereby to control the position of said load carrier to hold it always substantially in the same vertical plane through the swinging of said parallelogram of arms, load carrier and lever bodily with said lever on said vertical links, and a second ram for changing the angular alignment of said lever relatively to said vertical links whereby to change also the vertical alignment of said load carrier in all elevated positions thereof and during its elevating or lowering movement.

8. In a truck of the class described, a load carrier, a pair of relatively long arms pivoted at one end thereof to said carrier in predetermined spaced relation, said arms being pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, means for swinging said arms vertically about their pivots on said lever between a position in which said load carrier is substantially above said pivots and a position in which said load carrier is substantially below said pivots, movable means mounting said lever on said truck for longitudinal movement relatively to said truck while maintaining said lever in a particular angular position relatively to said truck during vertical swinging movement of said arms whereby said load carrier may move in a substantially vertical path relatively to said truck, means operatively interconnecting said lever and arms and a portion of said truck for effecting automatically said longitudinal movement of said lever during swinging movement of said arms whereby to restrict bodily movement of said load carrier to said vertical path, and means for selectively effecting angular movement of said lever relatively to said truck and for holding said lever in a particular angular position during swinging movement of said arms whereby the angular position of the load carrier may be adjusted.

9. In a truck of the class described, a load carrier, a pair of relatively long arms pivoted at one end thereof to said load carrier in predetermined spaced relation, said arms being pivoted at their opposed ends to a lever in the same predetermined spaced relation whereby to form a parallelogram comprising said arms, said load carrier and said lever, means for swinging said arms vertically about their pivots on said lever between a position in which said load carrier is substantially above said pivots and a position in which said carrier is substantially below said pivots, a pair of vertical links of a length substantially less than one-half the length of said arms pivoted at their upper ends to said lever and pivoted at their lower ends relatively to said truck so that said lever and arms may move longitudinally of said truck by swinging movement of said links to offset longitudinal movement of said load carrier relatively to said truck during

vertical swinging movement thereof whereby said load carrier may move in a substantially vertical path relatively to said truck, means operatively interconnecting said lever and arms and a portion of said truck for effecting automatically said longitudinal movement of said lever and arms during swinging movement of said arms whereby to restrict bodily movement of said load carrier to said vertical path, means for imparting angular movement to said lever relatively to said links and said truck, and means for selectively effecting said angular movement of said lever and for holding said lever in a particular angular position during swinging movement of said arms whereby the angular position of the load carrier may be adjusted.

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