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PIVOTAL FORK UNIT FOR LIFT TRUCKS

Filed Feb. 8, 1950

3 Sheets-Sheet 1

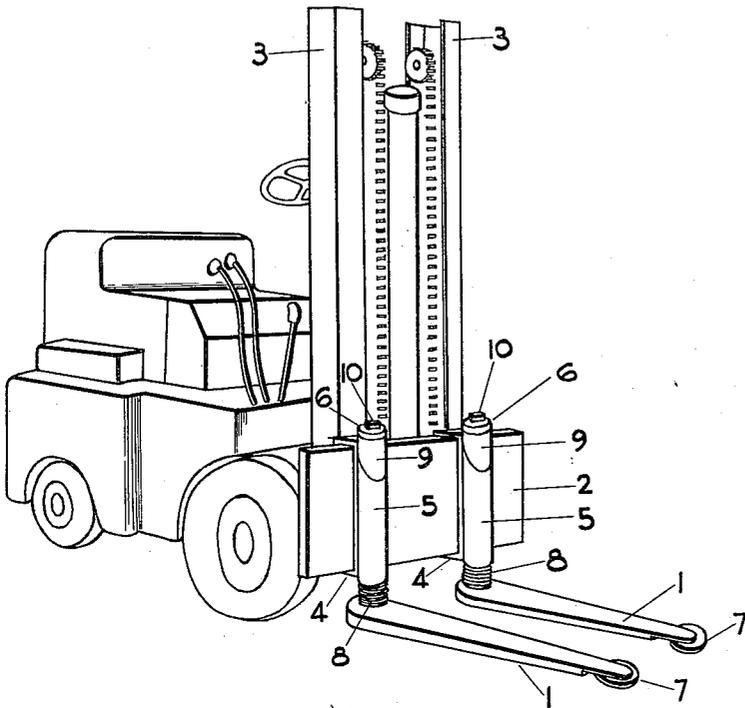


FIGURE 1

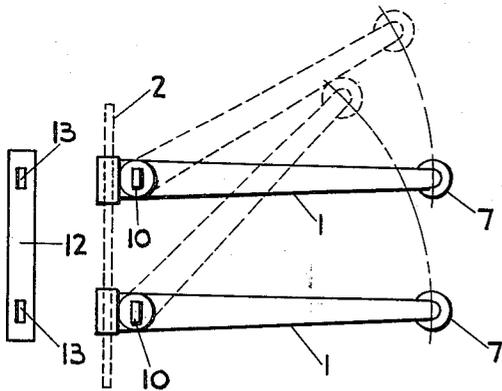


FIGURE 3

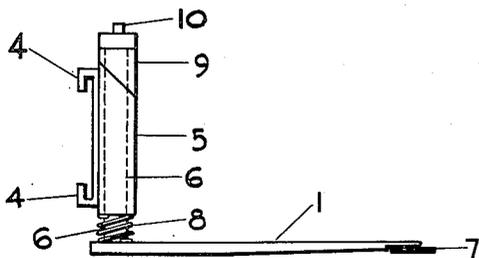


FIGURE 2

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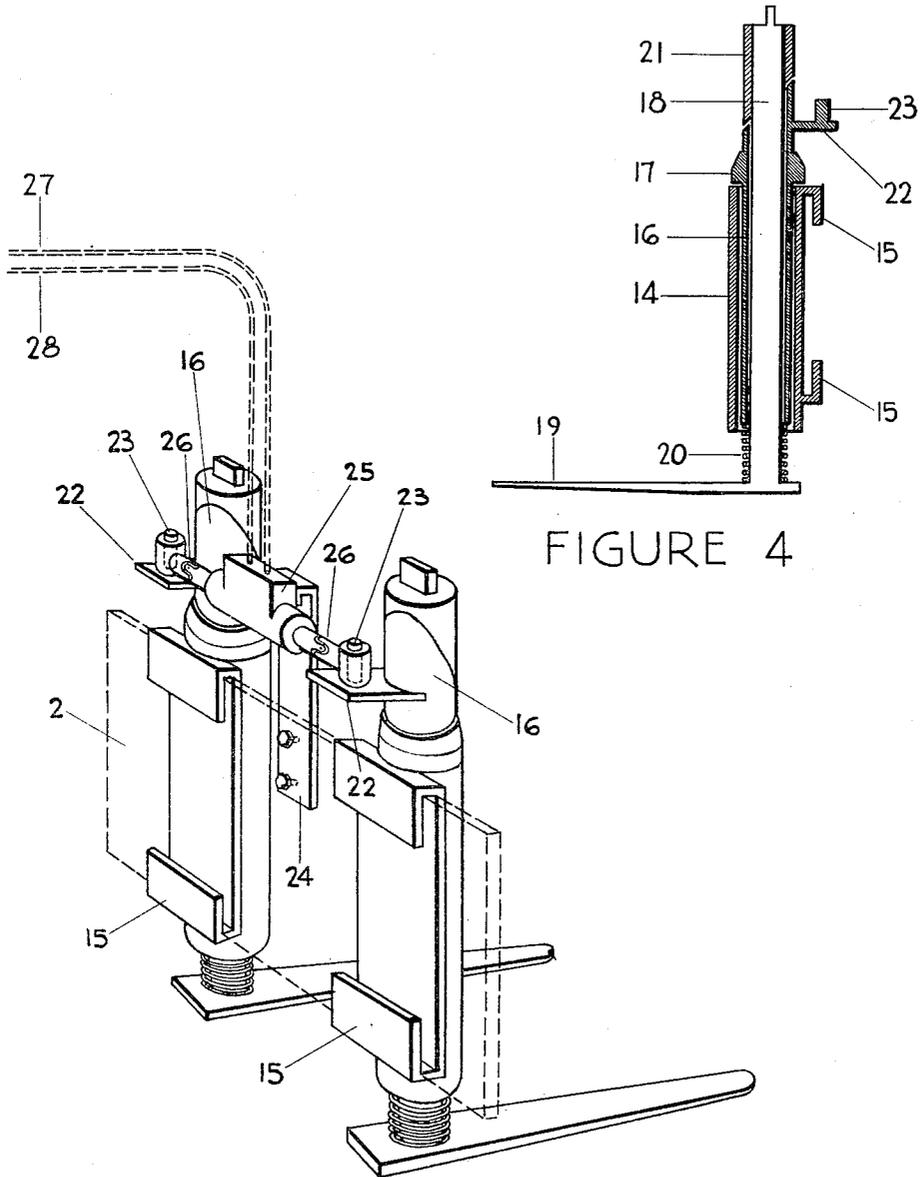


FIGURE 4

FIGURE 5

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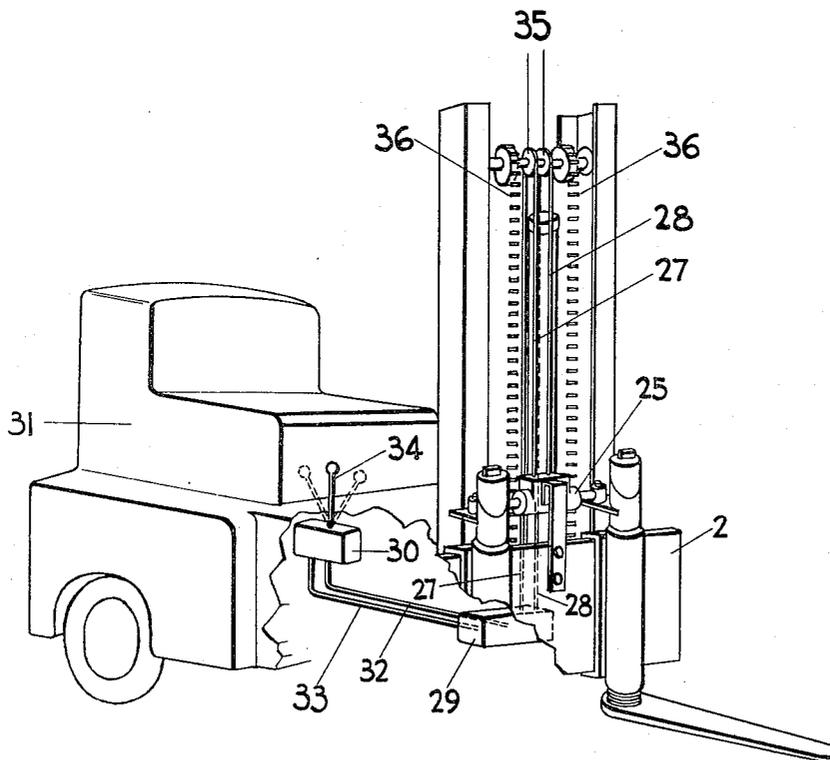


FIGURE 6

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PIVOTAL FORK UNIT FOR LIFT TRUCKS

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4 Claims. (Cl. 214-112)

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This invention relates to an improved lift truck fork unit adaptable to attachment to motorized industrial lift trucks of the type commonly used in materials handling operations wherein the materials handled are generally palleted.

In the presently available modification of fork trucks, the forks are rigidly built and portably attached, making the space necessary for the operation of the truck dependent upon the turning radius of the truck plus the length of the forks.

Because of this limitation, it is necessary that the aisleway space for the tiering of palleted material be sufficiently wide so that the lift fork trucks can be maneuvered into a position parallel with the openings of the pallet intended to receive the fork tines while the forks are out of contact with the pallet.

Attempts have been previously made to remedy this difficulty in fork truck construction by articulating the truck frame which allows a shorter turning radius than similar trucks with non-articulated frames. This method of reducing the turning radius of fork trucks is an extremely expensive arrangement, and because of the complexity and cost to manufacture, has never been widely adapted to the materials handling problem.

In another attempt to overcome the problem, a cylindrical mast has been disclosed about which the entire lifting assembly of the industrial truck may be rotated through a short arc at any point in its elevation. This method is not adaptable to the lift trucks now in use and is more complex in achievement than by the method herein disclosed.

The present invention is a simple modification of the previously rigid construction of the forks themselves and can be readily accommodated to the various commercial type lift trucks now in use for the handling of palleted materials.

The present invention has for its object to provide means of decreasing the amount of aisleway floor space necessary to the handling of palleted material by means of powered industrial lift trucks.

The present invention provides, in one modification, a demountable pair or set of forks readily attachable to standard lift type industrial trucks. The principal novel feature of the invention makes it possible for each fork to be independently swung about its own axis located within only a few inches forward of the hydraulic lift mechanism of the lift truck. The described

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forks are designed and mounted in such manner that their normal position is parallel to the forward movement of the truck.

The invention makes it possible for the operator of the truck to bring the forward or toe ends of the forks into frictional engagement with a pallet or other stationary object and thereby force the base plate or fork tine of the unit fork to swing about its axis and thus permit the operation of the lift truck within a considerably more narrow aisleway space than heretofore possible with the present rigid fork system now in use.

In a preferred modification, means are provided for the operator to control the position of the tines of the fork hydraulically from the cab so as to rotate the fork tines in parallel relationship with one another and yet maintain the advantage which allows movement of the fork tine by frictional engagement with the toe end. This feature allows the operator to maneuver a load-free truck without particular caution against the striking of an obstruction with the forks during a particularly confining maneuver.

To illustrate the commercial utility of the pivoted lift fork arrangements herein described, a test was arranged employing a lift truck standardly available having a 53½ inch over-all length without forks, and 77½ inches over-all length when equipped with forks. The wheel base of the truck was 30½ inches, the power being obtained through two power driven front wheels and steering through a single third wheel in the rear.

By trial, using a skilled driver, it was determined that a 74 inch aisle was a minimum width from which palleted stock could be recovered from and placed into storage. When the forks were adapted to pivot by frictional contact as described in the primary modification, the width of the necessary aisle could be reduced to approximately 62½ inches, a saving of more than 15% in actual aisle-way floor space necessary to mechanical storing by lift truck.

Upon utilizing a means of control effective from the cab of the truck as in a secondary modification, about 58½ inches were found a necessary aisle width. Cab control increased the aisle-way floor space saved to approximately 22%. This extra 22% saved could be utilized for warehouse storage and increase the effective space available in the building by a considerable number of square feet.

It is clear, of course, that the floor space saved will vary with the wheel base of the truck, its

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turning radius and the length of the forks employed. Effective savings with the improvement herein described will vary from the figures above cited, depending upon the specifications of the lift truck to which the invention is adapted.

One object of the invention is to increase the ease of operation of lift trucks by providing a pivoted fork system rotatable in a plane parallel to the floor whereby the fork truck operator may engage and disengage the forks of his truck within a more confined area than heretofore possible.

Another object of the invention is to provide a combined mechanical and hydraulic means of turning a powered lift truck with forks within a smaller radius than heretofore possible.

Other objects will become apparent as the invention is hereinafter more fully described.

With the above objects in view, the invention may be said to comprise the device as illustrated in the accompanying drawings, hereinafter described and particularly set forth in the appended claims together with such variations and modifications thereof as will be apparent to those having skill and experience in the art to which this invention appertains.

In the drawings which form a part of this specification, Figure 1 is a three-quarter full view of the fork truck with the dual fork units attached to the lift plate of the lift fork truck.

Figure 2 is a side elevation of one individual fork unit.

Figure 3 is a plan view of a pair of fork units in position as attached. The dotted lines show the position of the tines upon deflection by an external force.

Figure 4 is a further refinement allowing operability from a remote point illustrated by a side view of a unit fork as revealed in cross-section through its vertical axis and the center line of the fork tine.

Figure 5 is an isometric view of the secondary modification as seen from the rear of the lift plate.

Figure 6 is an additional three-quarter full view of the lift truck partially cut away to show the hydraulic system and application of the secondary modification to a commercial truck.

In the accompanying drawings, no details have been shown to illustrate the operation of a power truck used for the handling of palletted materials inasmuch as the truck itself is a more or less standard item of equipment and its construction and operation, though varying according to the particular manufacture and design, is understood by those engaged in handling palletted materials with powered industrial fork type trucks.

Referring more specifically to Figure 1, a pair of pivoted lift forks 1-1 are attached in a spaced relation to one another on lift plate 2 which is a standard element of industrial lift trucks and which is hydraulically powered to be vertically movable in parallel relationship to the vertical supports 3-3. Attachment is obtained by means of fingers 4 which are integrally a part of the sleeve 5 by sliding the fork units over opposite ends of lift plate 2.

Interiorly of sleeve 5 is shaft 6, the lower end of which is rigidly attached to the base plate fork tine 1. A spring 8 on shaft 6 is in very slight compression between the fork tines 1 and the sleeve 5 and provides a normally forward position of the tines 1. A second sleeve 9 of the same size and stock as sleeve 5 is rigidly attached to the top section of the shaft 6, the two sleeves

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being in a thrust bearing relationship to one another along a bearing surface obtained by cutting the sleeves at an angle of 45° to the plane of the tines 1. The extreme top section of the shaft 6 is cut to form a rectangular nub 10, useful under certain conditions to maintain the tines in rigid relation to one another. The fork tines 1 are fitted with anti-friction rollers 7. In operation of the truck, the operator brings the anti-friction rollers in engagement with an aisle defining structure which causes the tine 1 to pivot about the shaft 6 within sleeve 5, increasing the tension on spring 8 and a slight upward movement of the shaft and tine brought about by movement at the bearing surface between sleeve 5 and sleeve 9. After passing the obstruction, the compression of the spring 8, acting upon the thrust bearing surfaces between sleeves 5 and 9, returns the tine to its normal position independent of direct control by the truck operator. By the means described it becomes possible to operate a given fork type lift truck within a more confined area than possible without the described changes.

Figure 2 reveals in greater detail the elements of the invention as they appear in each unit fork making up the dual unit fork assembly. 4-4 are the fingers allowing slideable attachment with the lift plate 2 of the industrial truck. 5 and 9 are sleeve members within which shaft 6 rotates with respect to sleeve 5, but which shaft is rigidly attached to sleeve 9. 1 is the fork tine at the heel of which is rigidly attached shaft 6, and 7 is a vertical axis anti-friction roller (optional) at the toe of the said tine. The spring 8 is brought into slightly increased compression by rotation of the tine 1, acting pivotally through shaft 6 and sleeve 5 and assists return of the tine to a position normal to the lift plate.

Figure 3 illustrates movement of the fork tines when attached to the lift plate 2. The solid lines show the position to which the fork tines 1 return upon removal of stress upon rollers 7. The dotted lines show the fork tines after an obstruction has rotated the fork tines out of normal position into a stress position, decreasing the radius necessary for operation of the truck. 12 is a sheet steel plate fitted with rectangular slots 13 which may be used (optionally) in certain instances by engaging the rectangular nubs 10 of the individual units with the slots 13. Attachment prevents operation of the pivoting feature and is useful, for example, when elevating drums by frictionally engaging the circumferential corrugations of the drum with the inner sides of the fork tines.

Figure 4 illustrates the secondary and more complex modification of the pivoted fork tine. This modification provides all of the advantages of the earlier described unit fork and additionally provides for positive control of pivotal movement through hydraulic control means located conveniently near the operator and remote from the forks themselves. A sleeve 14 is provided with fingers 15 which can be slideably engaged with the lift plate 2 of an industrial truck. A second sleeve 16 is rotatably engaged within the outer sleeve 14, and is held in position by means of a thrust bearing 17 which is rigidly a part of sleeve 16 a short distance from the top thereof. Above the thrust bearing and to the rearward of the sleeve 16 is rigidly attached a horizontal lever 22 and a vertical pintle 23. Fitted within sleeve 16 is a vertical shaft 18 at the bottom end of which is fixed the load bearing base plate fork

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tine 19 at its heel. Intermediate the fork tine 19 and sleeve 16 is a spring 20, held in slight compression through a thrust bearing formed between the top of sleeve 16 and a sleeve cap 21 conveniently made of the same tube stock as used for sleeve 16; the said sleeve cap 21 rigidly fastened to the shaft 18 as shown. The thrust bearing surface existent between sleeve cap 21 and the top of sleeve 16 is defined by cut at a 45° angle between the cap 21 and sleeve 16.

From the construction illustrated in Figure 4, it follows that if force be applied to the pintle 23 and normal to the lever 22 the entire mechanism within the sleeve 14 will be rotated to give arcuate movement to the tines of the forks, said tines moving in parallel relationship one to the other through the connecting linkage supplying the force.

If, however, the operator fixes the position of the lever 22 and pintle 23 through hydraulic or mechanical control means so that the sleeve 16 is not rotatably moveable, the truck may be operated as previously described in the primary modification allowing the fork tines 19 to be deflected by contact with an aisle defining obstruction to exert horizontal deflection pressures without undue attention being paid thereto by the truck operator. If pressure is applied to the tine 19, rotational motion is transferred through the shaft 18 causing a slight lifting of the shaft by the resultant force on the thrust bearing surface due to displacement between sleeve cap 21 and sleeve 16. Upon release of the force bearing against the tine 19, stresses set up in the spring 20 cause a return of the thrust bearing area to a stable position.

Referring to Figure 5, one may follow the mechanical detail of the hydraulically operated unit more readily. A bracket 24 fastened to the lift plate 2 supports a hydraulic piston 25 which is operably connected through universal couplings 26 to pintles 23, levers 22 and the sleeves 16. Upon admitting hydraulic fluid under pressure through line 27, the linkages 26 are forced to the left, causing a rotation of the tines of the fork to the right, fluid being retired through line 28. The direction of the tines by a similar means is reversible by transferring positive pressure through line 28 and retiring fluid from the hydraulic cylinder through line 27 through the control element 30 mounted on the truck 31 (shown in Figure 6).

Referring to Figure 6, taps are taken from the hydraulic unit 29, one from the pressure side and another from the sump carrying hydraulic fluid to and from the control box 30 mounted conveniently to the operator on truck 31 through hydraulic lines 32 and 33. The course of the fluid arriving at the control box 30 is directed by operation of a control lever 34 through hydraulic lines 27 and 28 to the hydraulic cylinder 25 integrally mounted on plate 2. Hydraulic lines 27 and 28 are carried from the control box 30 upwards over added pulleys 35 in parallel relation with chains 36 and move at the same rate of speed as chains 36 upon elevation of lift plate 2.

Assuming that a forked lift truck operator wishes to pick up a pallet of goods from a warehouse aisle to his left side, the truck is driven to the extreme right of the aisle and upon approaching the selected pallet the control knob is positioned so as to move the pivoted tines to the left to be in proper position to enter the pallet upon further forward movement of the truck. The operator then turns his steering wheel sharp-

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ly to the left and moves the truck forward. Upon development of any lateral tension on the fork tines during engagement with the pallet an adjustment automatically occurs relieving the pressure. After engaging and lifting the pallet, the truck is reversed and the pallet removed to the aisle, then to a point desired.

After placing a pallet in position, an operator may warp his truck free from the pallet with little regard for the arcuate path normally followed by his fork tines. Upon contacting an obstruction, the tines pivot about their axes to provide a free disengagement from the palleted material.

The modification first described allows instantaneous conversion of standard lift trucks to a more flexible and useful warehousing tool. Because of its simplicity and ease of fitting by the lift truck operator, these factors favor the modification over the cab-controlled hydraulic unit.

However, where warehousing space is at a premium, the additional complexity of the cab-controlled modification is outweighed by the additional element of control when desired and the consequently increased aisle space savings.

It is apparent that the structural strength of the additional parts introduced need not be unduly a matter of concern as the features are of importance only in handling the truck before picking up or after depositing a pallet load, e. g., the pivotal feature is not operative when the fork tines are load bearing.

It is obvious that the invention described above can be modified in a great many details and it is to be understood that the variations and modifications of the specific device herein shown may be made without departing from the spirit of the invention.

I claim:

1. A lift truck fork unit which comprises a pair of horizontal fork tines rigidly attached at their rearward ends to vertical shafts, said shafts rotatably housed within vertical interior sleeves, said interior sleeves rotatably suspended within exterior sleeve members, said vertical shafts rotatable within said interior sleeves upon application at any point along said fork tines of horizontal deflecting forces to allow a resulting skew position of the said tines, means within said assembly to return said tines from a skew to a parallel relation to one another after release of said force, clamping means rearward of said exterior sleeves to provide attachment of said fork units to the lift plate of an industrial truck, said shafts and interior sleeve members rotatable within said exterior sleeves to provide dependent, arcuate, parallel motion of the said tines by means of levers attached to said interior sleeves, said levers cooperatively linked with an actuating mechanism, and said mechanism in turn controllable from a point remote from the said fork units.

2. A fork unit adaptable to dual attachment to industrial fork trucks of the class described, each of said fork units comprising a horizontal load bearing fork tine rigidly attached at its rearward end to a vertical shaft rotatably housed within a vertical sleeved clamping member, said shaft providing for arcuate movement of the tine upon transmission of torque to said shaft, cooperative means to energize return of said tine to its original position upon release of said torque, a roller rotatable about a vertical axis mounted at the tip of said tine so that a portion of its periphery is in advance of said tine tip, and a slotted bar adaptable to hold said tines in a

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fixed position in spaced parallel relationship to one another upon attachment to the vertical shaft of each fork unit.

3. A fork unit adaptable to dual attachment to industrial fork trucks of the class described, each of said fork units comprising a horizontal load bearing fork tine rigidly attached at its rearward end to a vertical shaft rotatably housed within a vertical interior sleeve member which is in turn rotatably housed within a vertical exterior sleeve member having rearwardly thereto clamping means for attachment to a lift truck, said interior sleeve suspended within said exterior sleeve by a first thrust bearing, a lever rigidly attached to said interior sleeve, the shaft within said interior sleeve suspended at its upward end therein by a second thrust bearing attached to said shaft and at its downward end by a helical spring about said shaft held in slight compression through attachment between the shaft and fork tine, said shaft providing for arcuate movement of the tine upon application of torque to said shaft, said second thrust bearing and spring providing for return of said shaft to a determined position within the interior sleeve upon release of said torque, and said interior sleeve and shaft rotatable within said exterior sleeve independently of the first movement described by additional torque applied to said interior sleeve through linkages in cooperation with said lever operable from a point remote from the fork units.

4. In an industrial truck, a lift unit which comprises dual horizontal load engaging means individually pivoted at one end within interior vertical journals, said interior journals rotatably

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suspended within exterior journals, rotation within said interior journals effected upon application of horizontal deflection forces at any point along either of said dual load engaging means to allow a resultant skew position of said load engaging means, means within said assembly to return said dual load engaging means from skew to a parallel relation to one another and normal to said load elevating means after release of said force, means for attachment between said exterior journals and said elevating means, said pivot and said interior journals rotatable within said exterior journals to provide dependant, arcuate, aligned motion of said dual load engaging means by and through linkage means in co-operative attachment therewith and with an actuating means controllable from a point remote from said fork unit.

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