

2,598,515

LIFT TRUCK AND ATTACHMENT THEREFOR

5 Sheets-Sheet 1

FIG_1

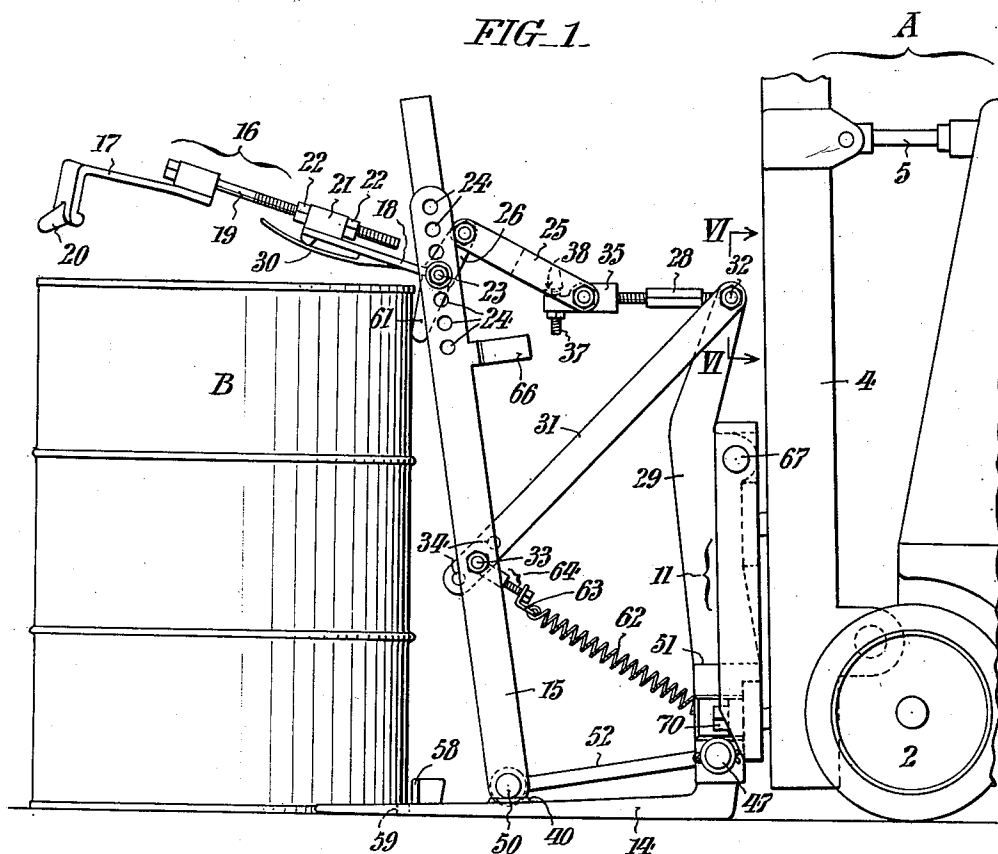
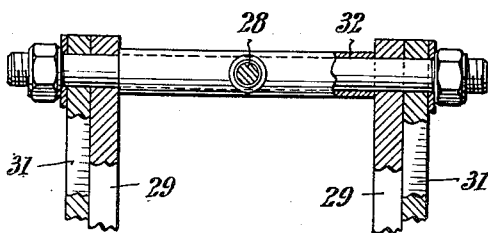


FIG. 6.



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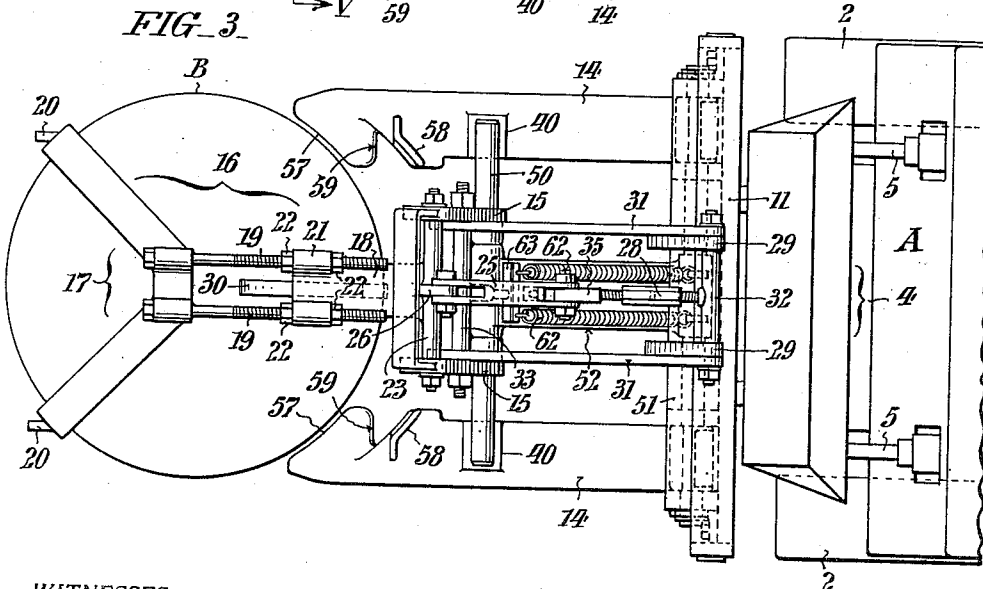
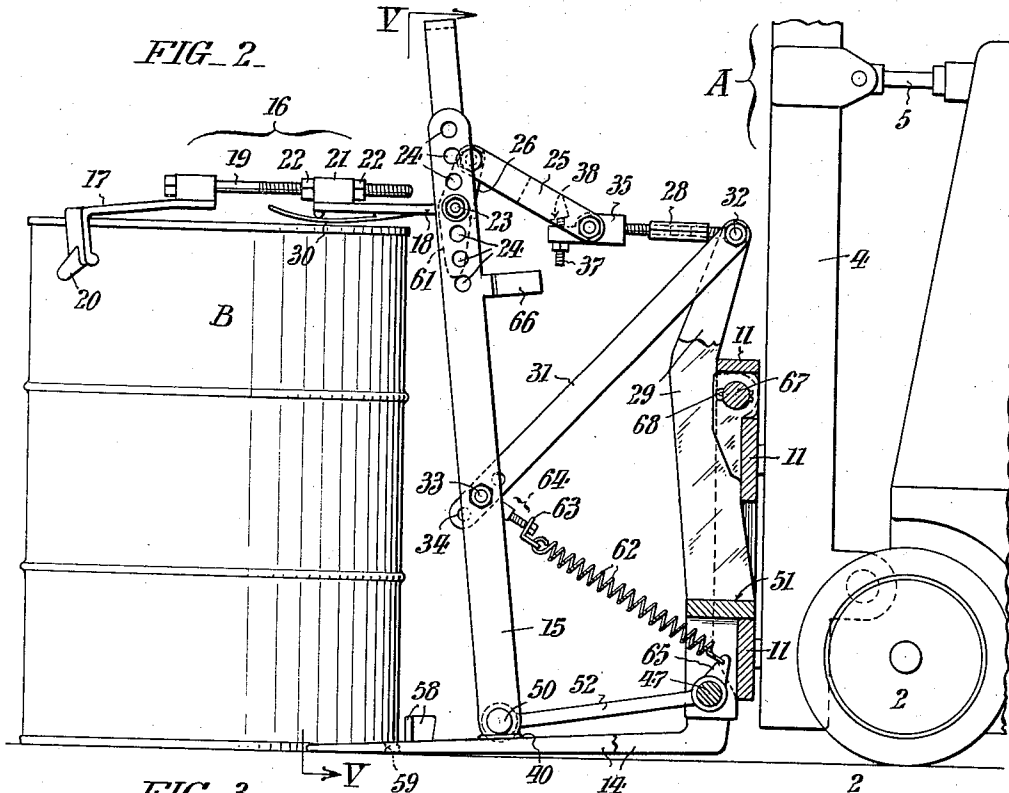
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LIFT TRUCK AND ATTACHMENT THEREFOR

Filed Nov. 17, 1948

5 Sheets-Sheet 2



WITNESSES

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LIFT TRUCK AND ATTACHMENT THEREFOR

Filed Nov. 17, 1948

5 Sheets--Sheet 3

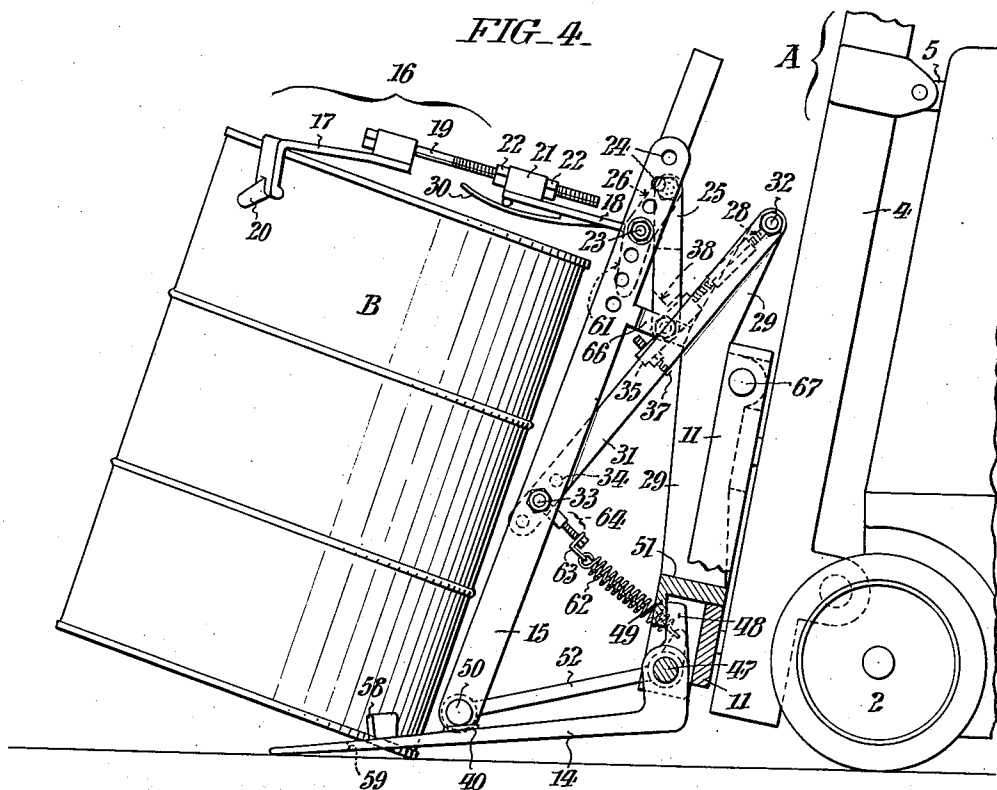


FIG. 7

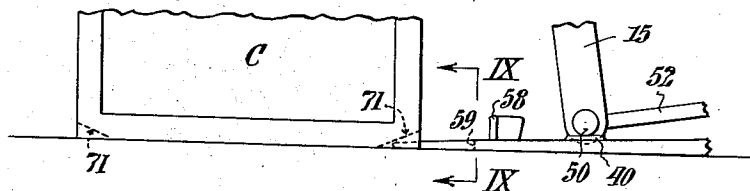


FIG. 8.

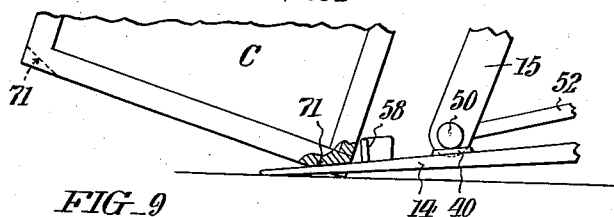
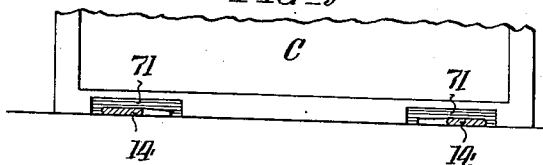


FIG_9



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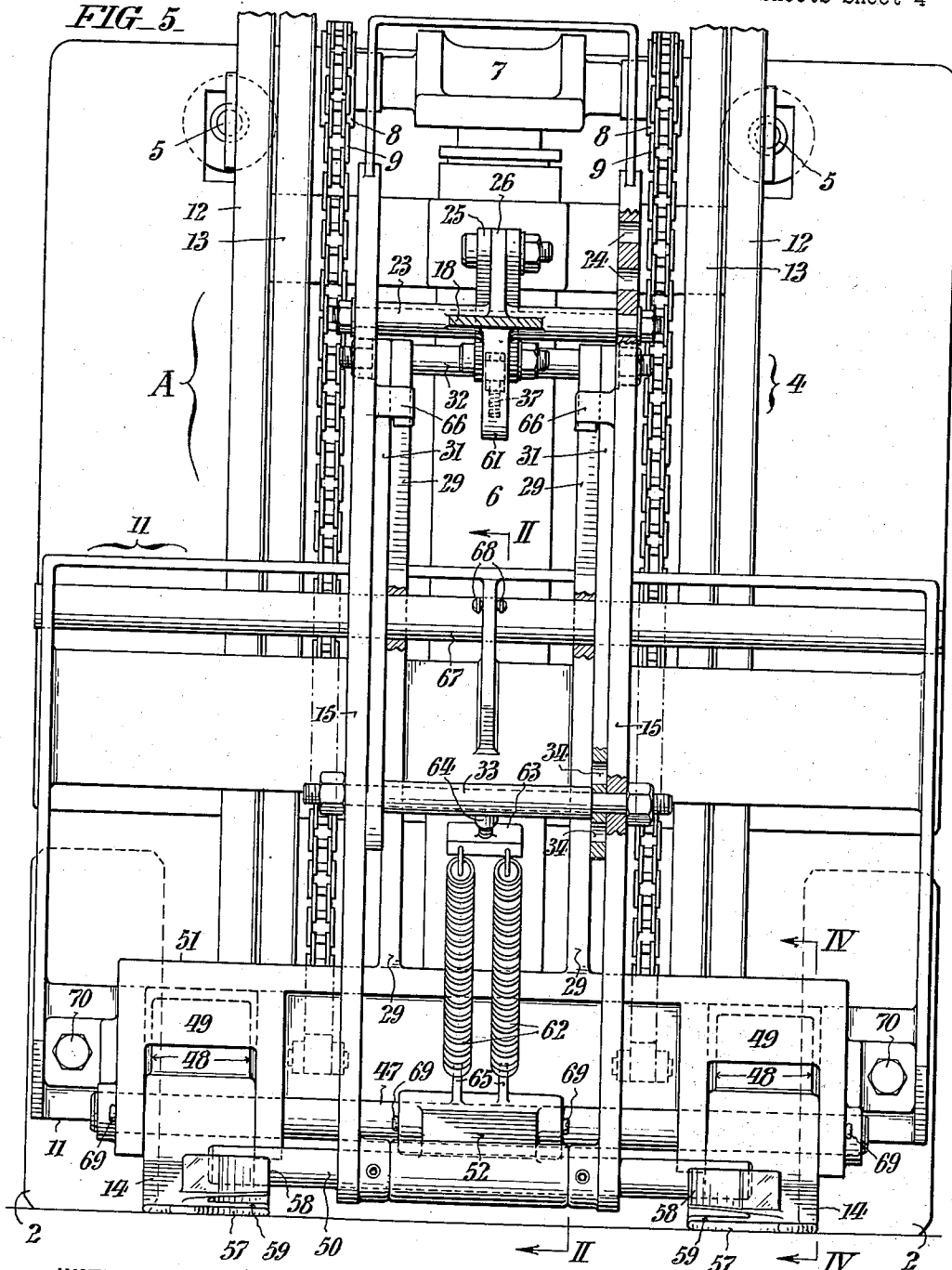
2,598,515

LIFT TRUCK AND ATTACHMENT THEREFOR

Filed Nov. 17, 1948

5 Sheets-Sheet 4

FIG. 5



WITNESSES

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LIFT TRUCK AND ATTACHMENT THEREFOR

Filed Nov. 17, 1948

5 Sheets-Sheet 5

FIG. 10.

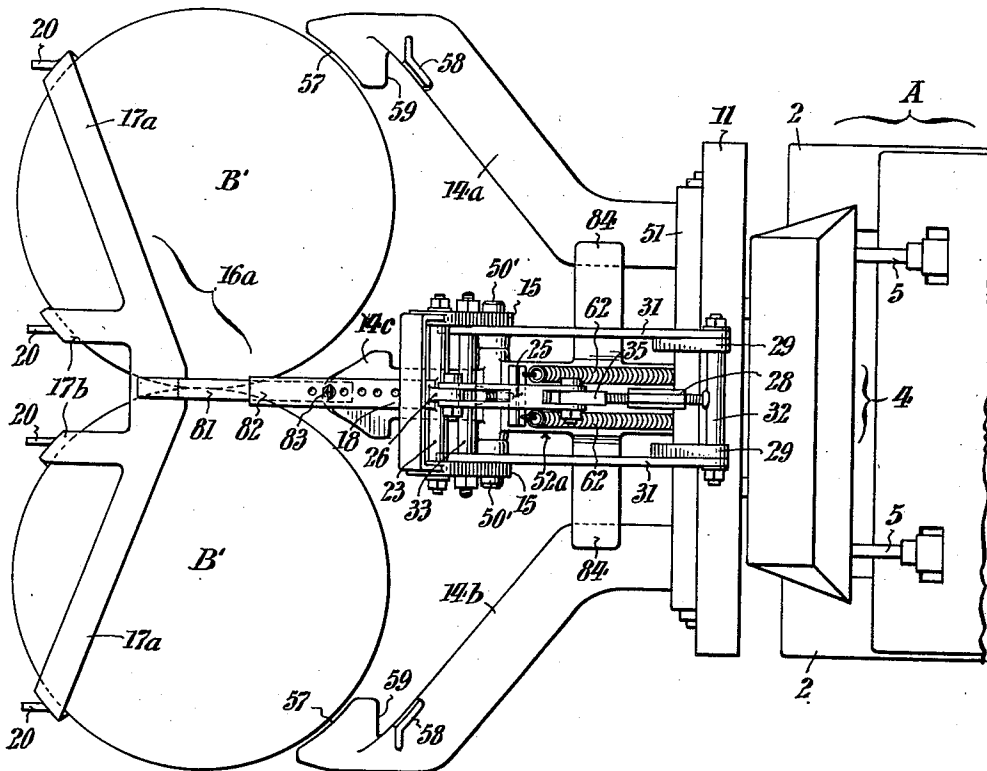
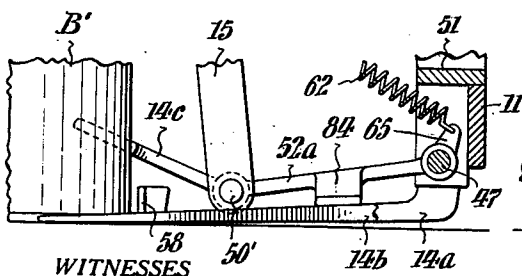
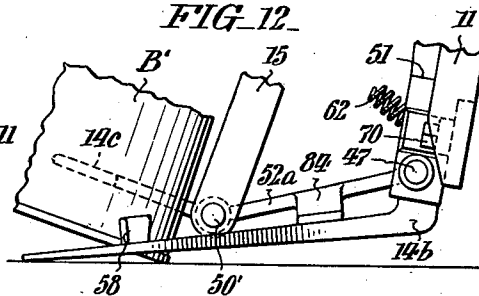


FIG. 11.



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FIG. 12.



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UNITED STATES PATENT OFFICE

2,598,515

LIFT TRUCK AND ATTACHMENT THEREFOR

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Application November 17, 1948, Serial No. 60,606

9 Claims. (Cl. 214—66)

1

This invention relates to lift trucks and attachments therefor and is particularly applicable to a lift truck having a tiltable mast and a load carrying member, such as a pair of forks, movable vertically on the mast.

In my pending application for Letters Patent of the United States, Serial No. 24,706, filed May 3, 1948 and now Patent No. 2,539,233 granted January 23, 1951, I have described and claimed an invention in a Lift Truck which overcomes difficulties customarily involved in handling large heavy objects such as drums, barrels, bales, rolls etc. Such invention uses the mast of a truck as a means of mechanically inclining the load preparatory to its being lifted by the forks which are movable on the mast. My present invention satisfies all of the objects set forth in the specification of my previously filed application and in addition possesses certain advantages which are more particularly described herein.

In gripping the top of a load, such as a drum, in order to incline it from a vertical position and thus permit the forks of a truck to be inserted beneath the load so that it may be readily picked up and transported to a new location, it is important that the movements of the load gripping device involved in inclining the load shall not in any way disturb the proper positioning of the forks with relation to the floor or foundation upon which the load rests. A very slight raising of the forks above the floor at this stage of the operation may make it difficult to slide them under the edges of the tilted drum or other object to be transported.

My present invention includes a linkage connecting the load gripping and inclining device with a tiltable mast in such manner that the engagement and release of the load at the top thereof and its inclination preparatory to lifting has no effect upon the proper positioning and independent action of the forks or other members used for supporting the base of the load. Accordingly the operator may utilize the load gripping device and the forks to their fullest advantage, thus increasing the range of operations and versatility of a lift truck equipped with such an attachment.

Other objects and advantages, including those derived from simplicity and economy, will become more fully apparent from a description of one embodiment of the invention which follows hereinafter having reference to the accompanying drawings.

Fig. 1 represents in side elevation a portion of the forward end of a conventional lift truck

2

equipped with a load carrying attachment of this invention, showing the same in the position which it assumes when about to engage a drum, the mast of the truck being tilted forwardly;

Fig. 2 represents a similar side elevation of said apparatus, showing the position which the attachment assumes when it grips the drum, the mast being then in a vertical position;

Fig. 3 represents a plan view of the same;

Fig. 4 represents a view similar to Figs. 1 and 2, showing the position which the attachment assumes when it inclines the drum preparatory to lifting it, the mast of the truck being rearwardly tilted;

Fig. 5 represents an enlarged front view of the truck, taken as indicated by the arrows V—V of Fig. 2;

Fig. 6 represents an enlarged cross section, taken as indicated by the arrows VI—VI of Fig. 1, showing the pivotal connection between certain parts of the load carrying attachment.

Figs. 7 and 8 represent in side elevation the bottom portion of a crate having inclined slots at its base to adapt it for engagement by the forks of a lift truck of this invention, the crate being shown in upright and inclined positions respectively;

Fig. 9 represents a vertical section of the aforesaid crate and forks taken as indicated by the arrows IX—IX of Fig. 7;

Fig. 10 represents in plan view a modified form of load carrying attachment adapted to handle two drums at one time; and

Figs. 11 and 12 represent fragmentary views of the forks of the modified attachment, with certain parts cut away for clearness of illustration, showing the load and the forks in positions corresponding to Figs. 2 and 4.

With specific reference to Figs. 1 to 6 there is shown an example of the invention as applied to a well known type of lift truck, comprehensively designated at A. The particular truck selected for illustration is mounted upon wheels 2 and includes a tiltable mast 4 of a conventional type which may be tilted forwardly to an angle of about two degrees from the vertical position and may be tilted rearwardly to an angle of about ten degrees from the vertical position. Such tilting is effected by movement of power operated rods 5.

To raise and lower the load carrying attachment a hydraulic cylinder 6, see Fig. 5, is employed. This cylinder actuates a ram 7 having sprocket wheels 8 which serve to raise and lower chains 9 having their lower ends fixed to a carriage 11 movable up and down on the mast 4 and

guided in such movement by columns 12 and 13. It may be assumed that the truck A is self propelled and that there is available to the operator suitable controls for advancing or reversing, for steering, for operating the ram 7 to raise and lower the carriage, and for tilting the mast forwardly or rearwardly, as desired. Such controls and other details of the truck are not herein described as they are well known in the art and form no part of this invention.

Upon a transverse shaft 47 of the movable carriage 11 there is pivotally mounted a pair of forks 14 which project forwardly from the mast and constitute the load carrying members. The forks 14 have capacity for limited angular movement with respect to the carriage 11, each fork being formed with an upstanding arm 48, see Fig. 4, which is adapted to abut against a block 49 depending from a ledge 51 of the carriage to limit relative angular movement between the fork and the carriage. It will be observed that the forks 14, when the carriage 11 is lowered to the bottom of the mast, will rest on the floor. In this position they can adjust themselves to any irregularities in the floor surface so that they can readily slide beneath the base of the load, but when the carriage 11 moves upwardly on the mast, the abutment of the arm 48 against the block 49 prevents the forks from swinging downwardly below the position represented in Fig. 4.

Projecting forwardly from the carriage 11 between the forks 14 is a supporting leg 52 which is also pivoted on the shaft 47 but independently of the forks 14. A pair of parallel rocker arms 15 is pivotally connected to a shaft 50 at the forward end of leg 52 and serves to support a load gripping device 16 which spans the top of the drum B, or whatever object is to be transported, and grips or releases the far edge of the same according to whether it is swung downwardly or upwardly. The rocker arms 15 have capacity for swinging and upward vertical movement independently of the forks 14.

For the handling of drums or other cylindrical objects the gripping device 16 desirably embodies prongs 17 with downwardly extending flanges which hook over the top edge of the object and which are adjustably connected to a bell crank lever 18 by means of threaded bolts 19 passing through sleeves 21 in said parts and secured by nuts 22 as shown most clearly in Figs. 1, 2 and 4. In an obvious manner the effective length of the gripping device 16 may be varied by adjustment of the nuts 22 on the bolts 19 and thus the device may be adapted to accommodate loads of varying size. In order to prevent the downwardly projecting flanges of the prongs 17 from catching on any protuberance at the top of the drum, such as a bung, such flanges are preferably provided with smoothly curved cam surfaces 20. Below the sleeve 21 an additional cam surface 30 is provided. When, after release of a drum, the truck is backed away, if the gripping device should strike any part of the upper drum head it will do so at the cam surfaces 20 or 30 which are so formed as to cause the gripping device to ride over any sharp corners rather than to catch thereon. Bell crank lever 18 is fulcrumed on a pivot pin 23 the ends of which pass through two of a series of aligned holes 24 in the upper ends of the rocker arms 15 and are held in place by nuts and washers.

To effect the desired swinging and rocking movements of the gripping device 16 several extensible and retractible linkages are employed.

Swinging of the gripping device about its pivotal connection with the rocker arms 15 is accomplished by a link 25 bifurcated and pivotally connected at its outer end to the arm 26 of bell crank lever 18 and bifurcated and pivotally connected at its inner end to a turnbuckle, such connection being in the form of a knuckle joint. The knuckle joint between link 25 and turnbuckle 23 includes a fitting 35 connected to the latter which carries a set screw 37 which engages an inclined shoulder 38 near the end of link 25 and limits the extreme angular separation between link 25 and turnbuckle 23, and hence regulates the angular position of the gripping device 16 and the limits of its swing. As illustrated in Fig. 6, the inner end of turnbuckle 23 is joined to a horizontal bar 32 which bridges between a pair of pedestals 29 extending upwardly from the shelf 51 of the movable carriage 11. The bar 32 turns freely within the upper ends of the pedestals. The linkage consisting of turnbuckle 23 and link 25 serves to swing the gripping device 16 upwardly preparatory to its engagement with the load and incident to its release from the load, such upward swinging being accomplished by the forward tilting of the mast.

The second linkage consists of a pair of parallel links 31 which at their inner ends are pivotally connected to the bar 32 and at their outer ends are pivotally connected to the rocker arms 15 by means of a pivot pin 33. To render the links 31 adjustable and thus provide for loads of varying shapes and sizes, the outer end of each link has a number of holes 34 into any one of which the pivot pin 33 may be fitted. To vary the effective length of the links 31 simply involves removal and re-setting of the pivot pin into the appropriate aligned holes 34 at the end of the links.

Shaft 50 upon which the rocker arms 15 are mounted for swinging movement, as shown in Fig. 3, extends transversely at both ends across the upper faces of the forks 14 and is adapted at times to bear upon pads 40 on the forks. Inasmuch as the rocker arms 15 are pivotally connected to the leg 52, independently of the forks 14, the forks are free to follow surface irregularities in the floor and cannot be raised off the floor by an upward movement of the rocker arms. At the same time the lower ends of the rocker arms 15 cannot descend below the level of the forks. This independence of action as between the rocker arms 15 and forks 14 and as between the forks themselves insures smooth working of the apparatus in bringing it to engage both the top and the bottom of the load, irrespective of floor conditions.

Each fork 14 has an arcuately shaped forward edge 57 (Fig. 3) and to the rear thereof is provided with a V-shaped notch 59 and an upstanding flange 58, the latter being adapted to abut against the bottom edge of a drum or the like when the drum is inclined and the fork ends are slid beneath it, as shown in Fig. 4. Thus the load is not only engaged from beneath by the forks 14 but it is seated in a set position in engagement with the upstanding flanges 58 preparatory to raising the carriage 11 on the mast 4. Means are also provided for contacting the top of the load on the side facing the mast. The arm 26 of bell crank lever 18 desirably includes a downward extension 61 which when the apparatus first engages a drum or the like strikes the same near the top, as shown in Fig. 1, giving an added kick to the downward swinging of the

5

gripping device 16 and insuring that the prongs 17 thereof will engage the far edge of the drum on the opposite side.

In order to render the apparatus more positive in its operation tension springs 62 are preferably provided. The outer ends of springs 62 are affixed to a bracket 63 which is secured by an adjusting screw 64 to the pivot pin 33 near the lower ends of links 31. The inner ends of springs 62 are affixed to arms 65 (Fig. 2) integral with the horizontal leg 52. In an obvious manner the force of springs 62 tends to retract or collapse the various linkages and draw the parts thereof to the relative positions in which they are represented in Fig. 4. The degree of tension exerted by the springs 62 may be varied by means of the adjusting screws 64. In the fully collapsed condition of the apparatus, as shown in Fig. 4, rearwardly extending spacer bars 66 on the rocker arms 15 strike the pedestals 29, limiting the extent to which the rocker arms 15 may swing rearwardly about shaft 50.

The movable carriage 11 near the top thereof includes a removable bar 67 which passes through holes in the pedestals 29 and is held in place by cotter pins 68 (Fig. 5). Shaft 47 at the base of the carriage is also removable and held in place by cotter pins 69. Whenever it is desired to employ the lift truck A for a different purpose in which the load gripping device of this invention is unnecessary, it is a simple matter to unscrew bolts 70, withdraw shafts 47 and 67 and thus remove from the carriage 11 the frame including pedestals 29, shelf 51 etc., together with the entire load handling apparatus described herein. In substitution therefor ordinary forks may be applied to the carriage.

In Figs. 7, 8 and 9 the apparatus of this invention is shown in its application to the handling of a crate C or other box-shaped article. In order to permit the passage of the forks 14 beneath the base of the crate the bottom edges thereof are provided with inclined slots 71 spaced at intervals substantially corresponding to the horizontal distance between the forks. As shown in Fig. 8 when the crate C is inclined from its normal upright position the forks 14 may slide along the floor through slots 71 until the base of the crate is engaged by the upstanding flanges 58. By employing such inclined slots 71 at the bottom edges of the crate the advantages of a palletized load are gained without the expense and inconvenience of using pallets. The gripping device engaging the top of a crate or the like may, of course, be modified to suit its shape and dimensions.

In Figs. 10, 11 and 12 a modification of this invention is represented in which the apparatus is adapted to handle two drums B' at one time. Such modification involves no change in the lift truck A, its mast 4, or its carriage 11. In lieu of a pair of straight forks two specially shaped forks 14a, 14b and a wedge member 14c are provided. The wedge member 14c projects forwardly from the movable carriage 11 centrally between the forks 14a, 14b and is adapted to engage the two drums at their adjacent sides incident to their being inclined. Forks 14a and 14b are bent in a horizontal plane and span the two drums. The gripping device 16a is substantially similar to the device previously described therein except that it includes telescoping tubes 81 and 82 connected together by a pin 83. The prongs 17a and 17b connected therewith are differently shaped so as to extend forwardly and laterally

6

and bridge across the drum heads and engage them at points remote from the wedge member 14c. It may be assumed that the linkages for operating the gripping device 16a are in all respects similar to the previously described linkages except that in lieu of extending the shaft 50 on which the rocker arms 15 are pivoted so as to expand the forks, the center leg 52a is formed with an element in the form of a plate 84 which extends transversely over the top faces of forks 14a and 14b and serves to limit relative swinging movement between said links and the forks.

The operation of the apparatus of this invention is as follows. Upon the assumption that it is desired to employ the truck for the handling of a drum, such as represented at B in the drawings, the various parts of the apparatus are first adjusted to suit the particular size of the drum to be handled. In this connection it may be noted that the apparatus is capable of handling other objects of various sizes and shapes. The truck A is driven to a position adjacent to the drum B, such as represented in Fig. 1, the mast 4 being forwardly tilted so that the gripping device 16 is swung upwardly, and the ends of the forks 14 being brought to a position close to the base of the drum B. Thereupon the mast 4 is swung to the vertical position, as represented in Fig. 2. The resulting movement of the various linkages causes the rocker arms 15 and the gripping device 16 to assume the positions thereshown. The drum B is firmly engaged at the top thereof and is ready to be inclined rearwardly.

Next, the operator tilts the mast 4 rearwardly, causing the drum to be inclined from its normal upright position, as represented in Fig. 4. It will be observed that the drum may be so approached by the truck and gripped by the apparatus of this invention that it may be readily separated from a group of similar drums even though they are nested closely together, either along side each other or one on top of the other. Incident to the advancement of the forward ends of the forks 14 and the inclination of the drum B the forks 14 slide under the raised bottom edges of the drum and cause such edges to be seated adjacent to the upstanding flanges 58. In this manner the base of the drum is steadied and restrained against sliding rearwardly on the forks. At the same time the V-shaped notches 59 restrain the drum against sliding forwardly on the forks.

The operator then by means of cylinder 6 and ram 7 raises the movable carriage 11 with the load thereon. The drum may then be transported to its destination firmly held at top and bottom by the load carrying attachment. The operations involved in releasing and discharging the drum are substantially the reverse of the operations which have been described, the drum being brought to the floor by lowering the carriage on the mast and being uprighted and released by swinging the mast to its forwardly tilted position.

It will further be observed that the various linkages which control the angular position of the gripping device are so related to the carriage and to the forks projecting forwardly therefrom that the operator may at certain times actuate the gripping device by a movement of the carriage downwardly or upwardly, either in conjunction with a tilting of the mast or without such tilting. This gives the operator two separate means of effecting movements of the gripping device which results in a substantially increased measure of control over the apparatus, particu-

larly when stacking or unstacking drums above the floor level.

The operations involved in handling crates with slotted bases, as represented in Figs. 7, 8 and 9 and also the operations involved in handling a pair of drums with the modified form of apparatus shown in Figs. 10, 11 and 12 are substantially the same. It will be observed that the two springs 62, which tend to collapse the various linkages, assist in retracting the rocker arm 15 and that a more positive operation of the gripping device results from the employment of the downward extension 61 of lever arm 26 which serves as a kicker, more effectively swinging the gripping device 16 into engagement with the top of the drum. Cam surfaces 20 and 30 also aid in causing the gripping device to operate more smoothly in engaging and releasing the drum. Additionally the independent action of the rocker arms 15 and forks 14 facilitates the various operations in engaging and releasing the load, especially where unusual conditions such as irregularities in the floor are encountered.

Although I have described in considerable detail one example of my invention together with a modification thereof, it will be apparent that the apparatus is capable of a wide variety of applications and uses and that certain features thereof may be used to advantage without the use of other features. It is to be understood that the specific mechanisms referred to and claimed herein are intended to comprehend all mechanical equivalents and reversals of parts which function in a similar manner to accomplish the same result.

Having thus described my invention, I claim:

1. In a lift truck, a truck body, a tiltable mast thereon, a carriage movable up and down on said mast, a load carrying fork pivotally connected to the carriage with capacity for limited angular movement with respect thereto, a device for gripping the load at the top thereof, a support to which said gripping device is pivotally connected comprising a linkage pivotally connected to said carriage independently of said fork, and mechanism for swinging said gripping device about its pivotal connection and for moving said supporting linkage with respect to the carriage, all in response to tilting of the mast, whereby said gripping device is adapted to engage the load and incline it preparatory to its being lifted by said fork, said gripping device including prongs at its forward end and a downwardly projecting arm at its rear end adapted to assist the downward swinging of the gripping device about its pivotal connection when the load is first engaged by the approach of the truck.

2. In a lift truck, a truck body, a tiltable mast thereon, a carriage movable up and down on said mast, a pair of load carrying forks pivotally connected to the carriage with capacity for limited angular movement with respect thereto, a device for gripping the load at the top thereof, a support to which said device is pivotally connected comprising a linkage including a bottom leg pivotally connected to said carriage between said forks and having a pivotal axis in common with said forks, and mechanism for swinging said gripping device about its pivotal connection and for moving said supporting linkage with respect to the carriage, all in response to tilting of the mast, whereby said gripping device is adapted to engage the load and incline it preparatory to its being lifted by said forks.

3. In a lift truck, a truck body, a tiltable mast

thereon, a pair of load carrying forks pivotally connected to the carriage with a capacity for limited angular movement with respect thereto, a device for gripping the load at the top thereof, a support to which said device is pivotally connected comprising a leg pivotally connected to said carriage and projecting forwardly therefrom between said forks and terminating in a free end adapted to engage the load at its base, and a rocker arm pivotally connected to said leg; and mechanism for swinging said gripping device about its pivotal connection and for swinging and vertically moving said rocker arm with respect to the carriage, all in response to tilting of the mast, whereby said gripping device is adapted to engage the load and incline it preparatory to its being lifted by said forks.

4. In a lift truck, a truck body, a tiltable mast thereon, a carriage movable up and down on said mast, a load carrying member supported by said carriage, a device for gripping the load at the top thereof, a support to which said gripping device is connected comprising a linkage connected to the carriage independently of the load carrying member, and mechanism for swinging said gripping device and said support in response to tilting of the mast to incline the load preparatory to its being lifted by said load carrying member, said linkage and actuating mechanism magnifying the tilting movement of the mast so as to produce a greater inclination of the load than the inclination of the mast.

5. In a lift truck, a truck body a tiltable mast thereon, a carriage movable up and down on said mast, a load carrying member supported by said carriage, a device for gripping the load at the top thereof, a support for said gripping device comprising an extensible and retractable linkage connected to the mast, mechanism for retracting said linkage in responsive to rearward tilting of the mast to incline the load preparatory to its being lifted by said load carrying member, said linkage and the mechanism for retracting it magnifying the tilting movement of the mast so as to produce a greater inclination of the load than the inclination of the mast, and a resilient tensioning device connected to said mast and linkage for assisting in the retraction of the linkage incident to rearward tilting of the mast.

6. In a lift truck, a truck body, a tiltable mast thereon, a carriage movable up and down on said mast, a load carrying member supported by said carriage a device for gripping the load at the top thereof, a support for said gripping device comprising an extensible and retractable linkage connected to the mast, mechanism for retracting said linkage in response to rearward tilting of the mast to incline the load preparatory to its being lifted by said load carrying member, said linkage and the mechanism for retracting it magnifying the tilting movement of the mast so as to produce a greater inclination of the load than the inclination of the mast, a resilient tensioning device connected to said mast and linkage for assisting in the retraction of the linkage incident to rearward tilting of the mast and a spacer disposed between said support and mast limiting the permissible extent of the retraction of said linkage.

7. An attachment for a lift truck having a tiltable mast and a carriage movable on the mast comprising a load carrying member pivotally mounted on said carriage with capacity for limited swinging movement thereon, a device for gripping the load at the top thereof, and mech-

9

anism for inclining the load preparatory to its being lifted by said load carrying member consisting of a series of pivotally joined links supporting said gripping device and connecting it to said carriage independently of said load carrying member to cause the support for said gripping device to move forwardly and rearwardly in response to tilting movements of the carriage, and an additional linkage for swinging said gripping device upwardly and downwardly about said support in response to tilting movements of the carriage.

8. An attachment for a lift truck having a tiltable mast and a carriage movable on the mast comprising a load carrying fork pivotally mounted on said carriage with capacity for limited swinging movement thereon, a device for gripping the load at the top thereof, and mechanism for inclining the load preparatory to its being lifted by said fork consisting of a series of pivotally joined links supporting said gripping device and connecting it to said carriage independently of said fork to cause the support for said gripping device to move rearwardly in response to rearward tilting movements of the carriage, and an additional linkage for swinging said gripping device downwardly about said support to engage the load in response to a forward tilting of the carriage.

9. An attachment for a lift truck having a tiltable mast and a carriage mounted on the mast

10

with capacity for vertical movement thereon comprising a load carrying member projecting forwardly from said carriage, a device for gripping the load at the top thereof, mechanism for inclining the load preparatory to its being lifted by said load carrying member consisting of a series of pivotally joined links connecting said gripping device to said carriage whereby tilting of the carriage causes the gripping device to swing in one direction to engage the load and incline it and to swing in the opposite direction to right the load and release it, all in response to tilting movements of the carriage, said gripping device including a cam surface at its lower edge to prevent its being caught on protuberances at the top of the load incident to its release therefrom.

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