

July 15, 1969

R. GRIGSBY

3,455,476

ATTACHMENT FOR LIFT TRUCK

Filed March 10, 1967

4 Sheets-Sheet 1

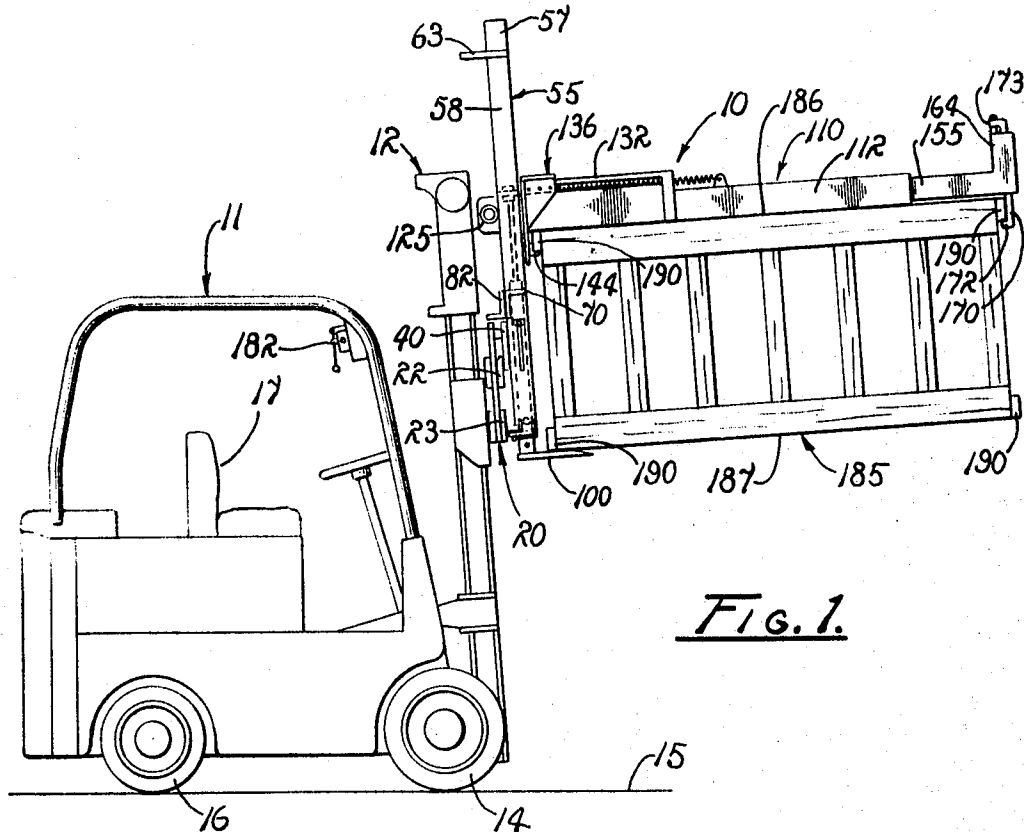


FIG. 1.

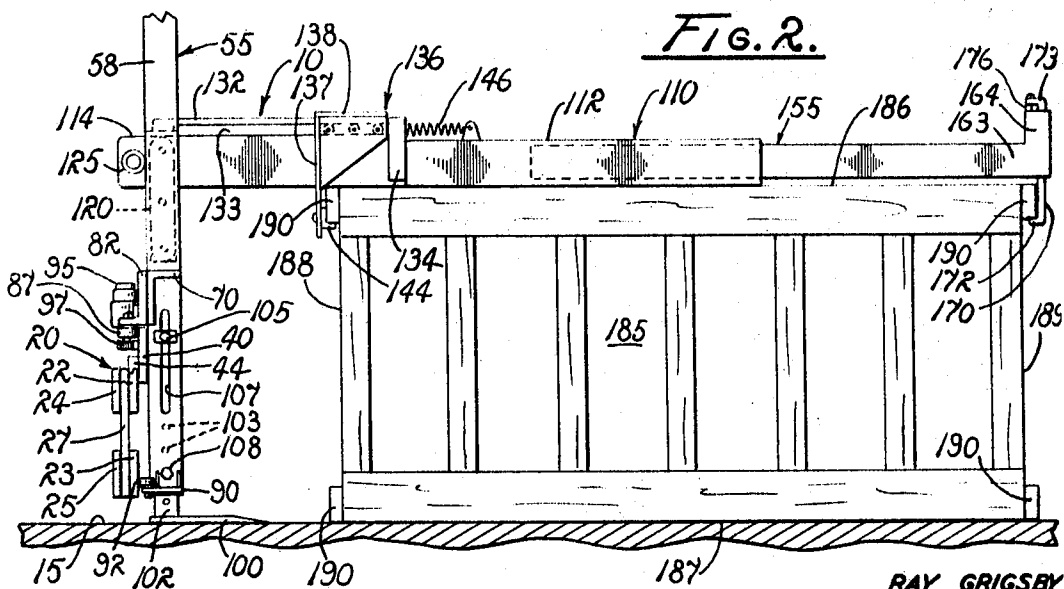


FIG. 2.

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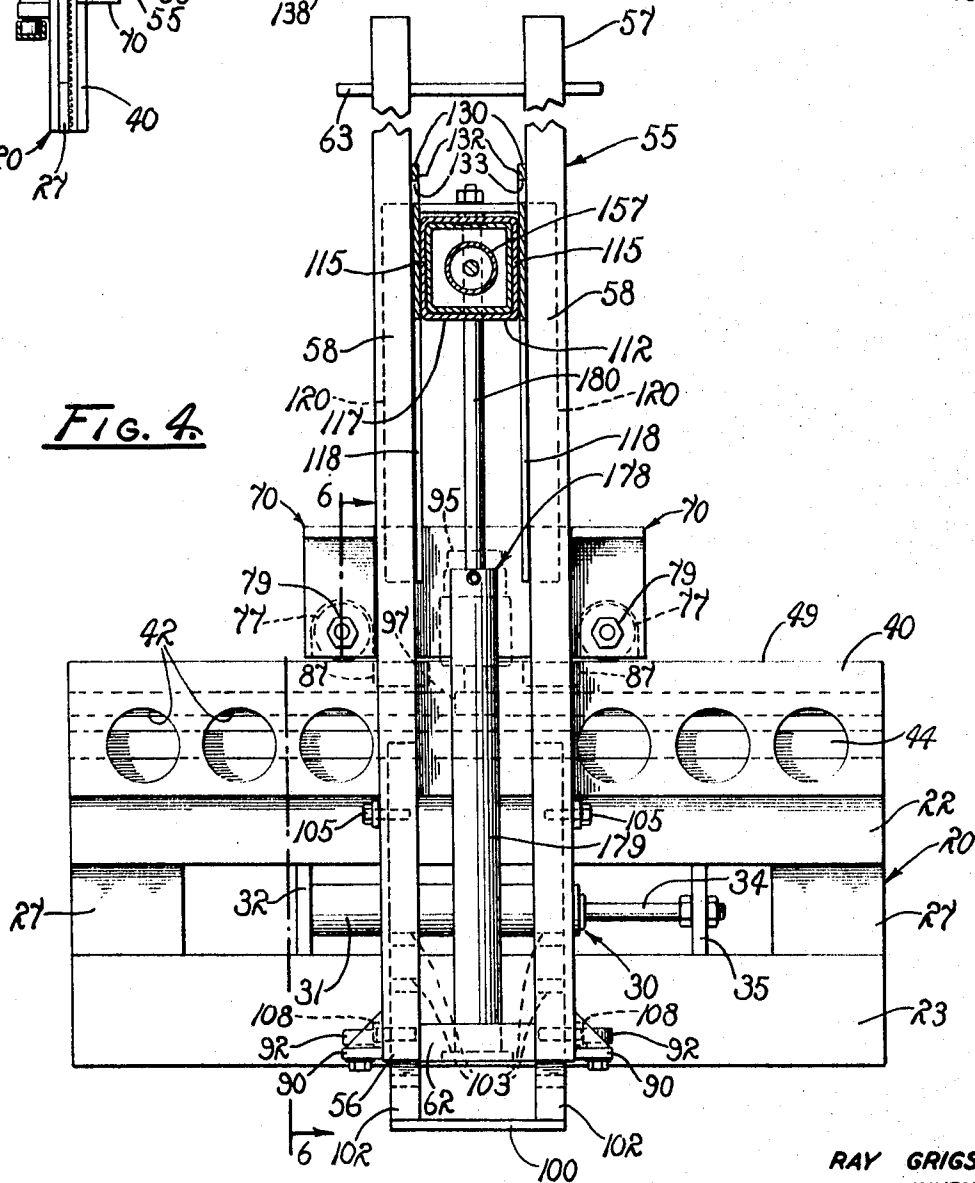
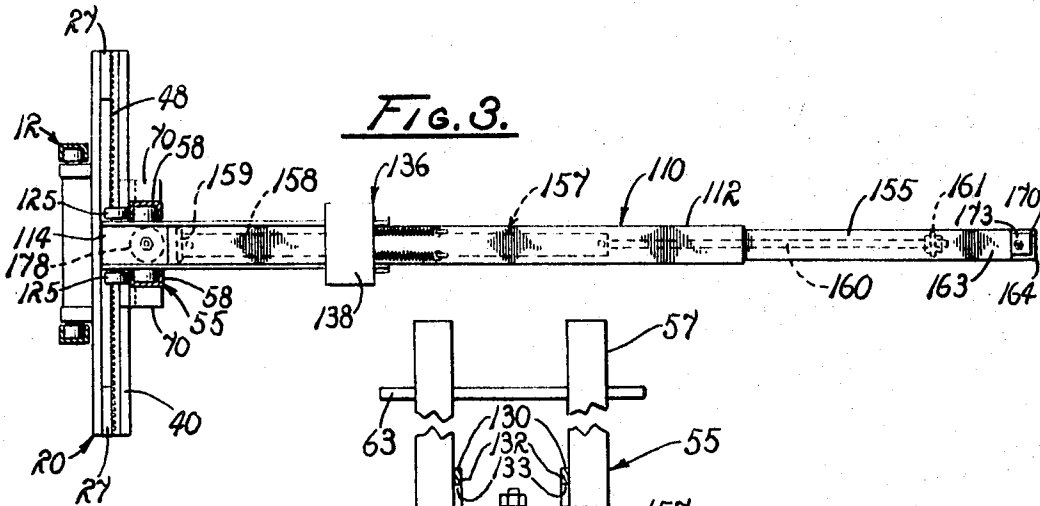
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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

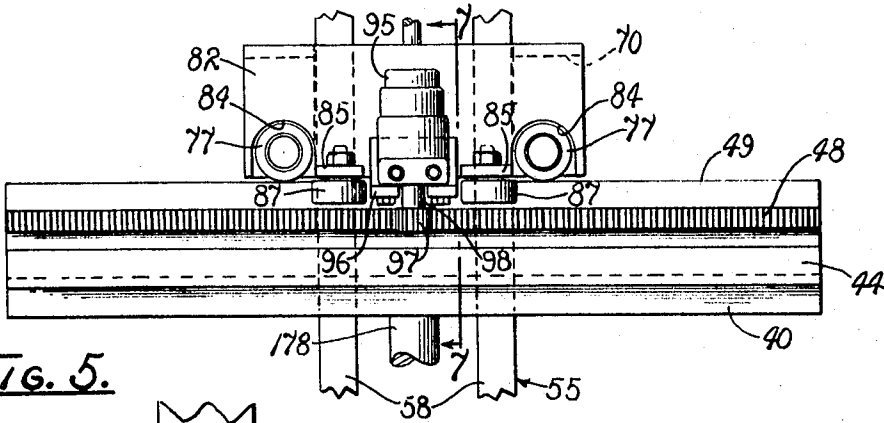


Fig. 5.

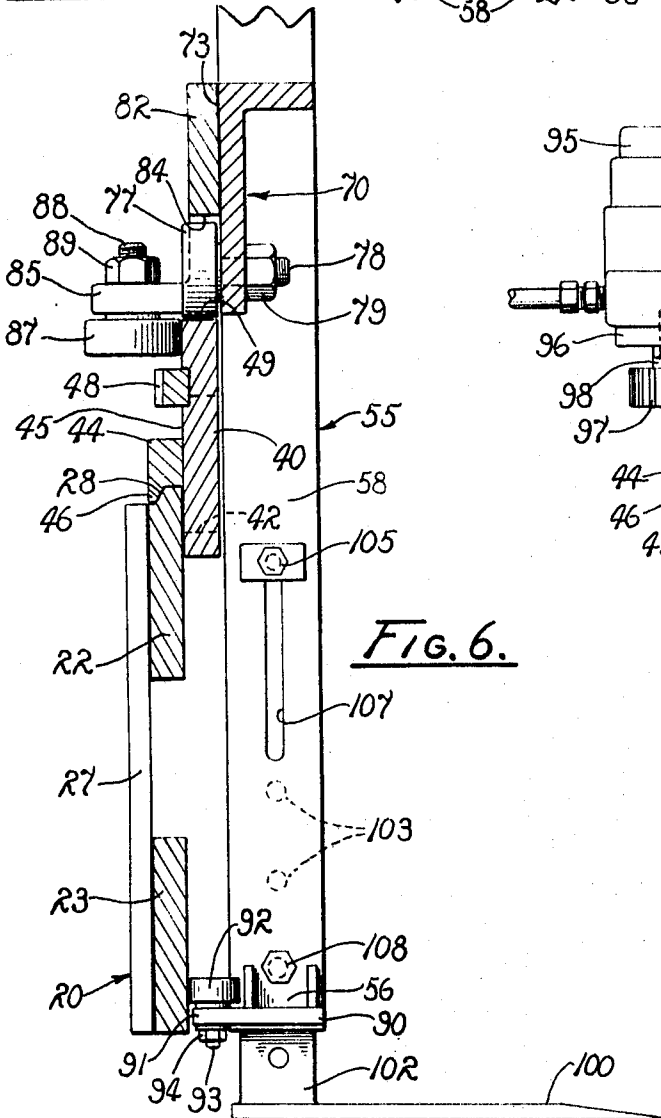


Fig. 6.

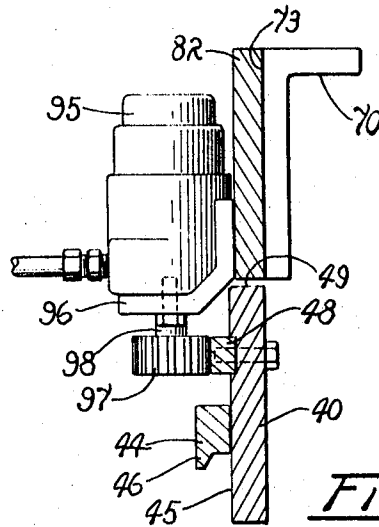


Fig. 7.

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4 Sheets-Sheet 4

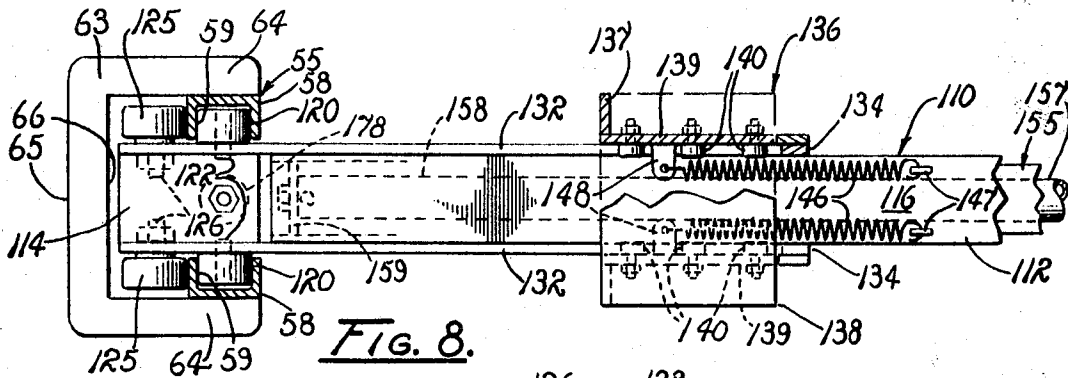


FIG. 8.

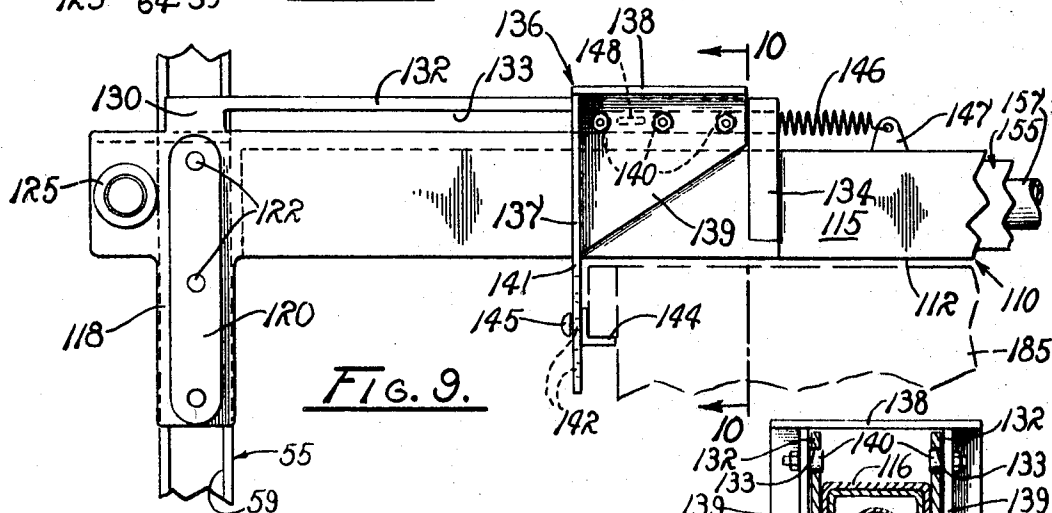
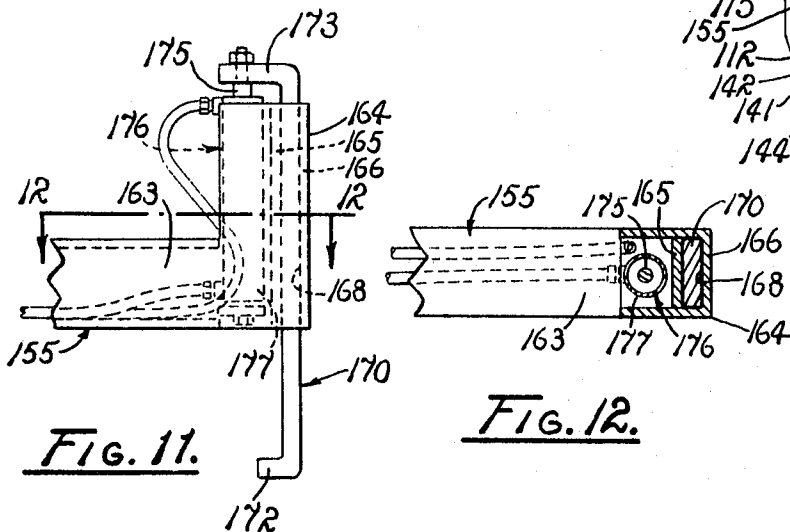


FIG. 9.



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ATTACHMENT FOR LIFT TRUCK

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U.S. Cl. 214—620

10 Claims

ABSTRACT OF THE DISCLOSURE

The present invention resides in an attachment for lift trucks and more particularly to such an attachment which is adapted for handling crates of sheet glass even when the crates are rested directly upon a floor surface, against a wall or in stacked relation on each other. The attachment permits endward handling of such crates for storage in side-by-side relation within a minimum of space by a single handling operation and eliminates the necessity of support pallets, stickers or any other crate handling equipment. The attachment of the present invention is effective dependently to clamp and to hold the crates of glass in endward longitudinally extended relation from the lift truck and rearwardly to shift the weight of the crate over the load bearing wheels of the truck for improved stability and maneuverability.

Essentially, the present invention consists of an elongated mast which is adapted to be mounted in a substantially upright position on the carriage and lift frame of a fork lift truck with the forks removed therefrom. A load engaging foot is mounted on the lower end of the mast in elevationally opposed relation to an elongated telescoping load clamping arm which is elevationally reciprocable on the mast. The load clamping arm mounts a pair of longitudinally reciprocable relatively inwardly and outwardly spaced load clamping claws which are extendible and retractable toward and from each other as well as toward and from the mast during telescoping movement of the arm to clamp a load therebetween and for dependably constraining such a load against the load supporting foot. The inwardly disposed clamping claw is spring-loaded outwardly from the mast to a load lifting position for grasping the load initially to lift the lower edge of the load from the surface on which it is rested to permit insertion of the foot member between the load and the support surface. Movement of the foot member beneath the load is permitted by the relative sliding movement of the inner claw with respect to the support arm incident to retraction of the outer claw or forward movement of the lift truck. Upon continued retraction of the outer claw during elevational movement of the attachment, the weight of the load is shifted rearwardly to a position substantially above the front wheels of the lift truck.

Many problems are encountered in the handling of relatively large crates of sheet glass which frequently weigh as much as 3,000 pounds and must be handled with extreme care in view of their fragile contents. Such problems are compounded by the relatively large number of separate handling operations which have heretofore been necessary during the loading, unloading and storing procedures. For example, the crates of sheet glass may be transported adjacent to a warehouse by way of railroad box cars. The conventional lift trucks having a sufficient lift capacity usually provide a relatively high mast which cannot enter the box car. Accordingly, the crates are required to be lifted within the box car by suitable hoisting equipment for deposit outwardly thereof onto the forks of the lift truck for transport into the storage

warehouse. The crates are received on the forks of the lift truck in a transversely disposed position with respect to the longitudinal axis of the truck which affords only a minimum of support for the crates and which seriously restricts the maneuverability of the truck in view of the width of the crates. Additional handling procedures are then necessary to unload the crates from the lift truck and to stack the crates in endward side-by-side relation within the warehouse. The present handling procedures further utilize pallets, stickers, and the like as spacers to elevate the crates from the support surface to permit the placement of handling equipment beneath the crates. With the crates stacked in such side-by-side relation, it is virtually impossible to remove a single crate from a group without removing the crates on at least one side thereof. Such relatively large number of handling procedures thereby substantially weakens the crate structures and substantially increases the frequency of breakage.

Accordingly, it is an object of the present invention to provide an attachment for a lift truck which affords more efficient handling of load elements such as crates of sheet glass than possible with present handling procedures.

Another object is to provide such an attachment which enables all the operations necessary in the handling of relatively large crates of sheet glass to be accomplished by a single lift truck.

Another object is to provide an attachment of the character described which is capable of handling crates of sheet glass in endwardly substantially upright attitudes.

Another object is to provide an attachment for a lift truck which dependably constrains the crates in a substantially square condition so as to preclude or minimize racking of the crates.

Another object is to provide an attachment which may be effectively adapted for use on relatively low capacity lift trucks.

Another object is to provide an attachment for a lift truck which is capable of handling crates of glass even when the crates are rested upon a support surface such as a floor, against a side wall, between previously stacked crates or when superimposed on other similar crates.

Another object is to provide an attachment for a lift truck which is effective to transfer the weight of a crate borne thereby rearwardly substantially above the load supporting wheels of the truck.

Other objects and advantages of the present invention will subsequently become more clearly apparent upon reference to the following description in the specification and accompanying drawings.

In the drawings:

FIG. 1 is a side elevation of an attachment embodying the principles of the present invention shown mounted on a lift truck and constraining a load such as a crate of glass in an elevated position.

FIG. 2 is a somewhat enlarged side elevation of the attachment of FIG. 1 disposed in a lowered initial load grasping position.

FIG. 3 is a top plan view of the attachment of the present invention with its upper load clamping arm shown in the load engaging position of FIG. 2.

FIG. 4 is a somewhat enlarged front elevation of the attachment with portions broken away for illustrative convenience.

FIG. 5 is a fragmentary rear elevation of the attachment showing a mast mounting and transverse drive mechanism therefor.

FIG. 6 is a fragmentary somewhat enlarged transverse vertical section through the mounting mechanism, taken along the line 6—6 of FIG. 4.

FIG. 7 is a fragmentary somewhat enlarged transverse vertical section through the drive mechanism, taken on line 7—7 of FIG. 5.

FIG. 8 is a somewhat enlarged fragmentary top plan view of the inner portion of the upper load clamping arm of FIG. 3.

FIG. 9 is a somewhat enlarged fragmentary side elevation of the inner portion of the load engaging arm of FIG. 8.

FIG. 10 is a transverse vertical section through the inner end of the load lifting arm, taken on line 10—10 of FIG. 9.

FIG. 11 is a fragmentary side elevation of the outer end of the load clamping arm.

FIG. 12 is a transverse horizontal section through the outer end of the load clamping arm taken on line 12—12 of FIG. 11.

Referring more particularly to the drawings, an attachment embodying the principles of the present invention and generally indicated by the reference numeral 10 is shown in FIG. 1 mounted on a lift truck 11. The lift truck provides a substantially erect tiltable lift frame 12 disposed slightly forwardly of and extended above a pair of load supporting front wheels 14 rollably engaging a support surface 15. The lift truck includes steerable rear wheels 16 which are controlled from an operator's station 17 in the usual manner. A main fork mounting carriage 20 is slidably mounted on the lift frame 12 for elevational reciprocable movement by a hydraulic ram on the lift frame, not shown, also in the usual manner. As best shown in FIG. 4, the carriage provides upper and lower forwardly disposed spaced substantially parallel plates 22 and 23, respectively, and upper and lower rearwardly disposed plates 24 and 25, respectively. A pair of spaced substantially parallel side plates 27 are individually sandwiched between the opposite ends of the upper and lower sets of plates and are secured in rigid interconnecting relation, as by welding or the like. The upper forward plate 22 has a tapered notched profile along its upper edge 28. The carriage is transversely shiftable by a hydraulic jack 30 having its cylinder end 31 mounted on a bar 32 on the lift frame 12 and its rod end 34 connected to a bar on the carriage.

The attachment of the present invention utilizes an elongated adapter plate 40 which, as best shown in FIG. 4, is substantially the same length as the carriage 20 and preferably has a plurality of circular openings 42 there-through merely to reduce the weight of the plate. An elongated notched hanger bar 44 is mounted on the rearwardly disposed side 45 of the adapter plate and includes a depending hook portion 46 which is receivable in intimate conforming relation with the notched upper edge 28 of the forward plate 22 of the carriage 20 so as dependably to hold the adapter plate upon the forwardly disposed surface of the plate 22 of the carriage. An elongated toothed rack bar 48 is secured to the rearward side of the adapter plate, as by welding or the like, in upwardly spaced substantially parallel relation to the hanger bar 44. The adapter plate further includes an upper edge 49 which affords a substantially flat horizontal roller engaging surface.

An elongated mast 55 is adapted to be mounted on the carriage 20 by way of the adapter plate 40 in a substantially upright attitude and in forwardly spaced substantially parallel relation to the lift frame 12 of the lift truck 11. The mast provides a predetermined lower end 56 extended somewhat below the lower plates 23 and 25 of the carriage and an opposite upper end 57 extended above the carriage. The mast is formed by a pair of transversely spaced substantially parallel rails 58. As best shown in FIG. 8, the rails are U-shaped in cross section individually to provide inwardly facing guide channels 59 between the opposite upper and lower ends of the mast. The rails are interconnected at the lower end of the mast by a pair of externally disposed connecting straps 62 in-

dividually secured at their ends to the rails, as by welding or the like. The rails are interconnected adjacent to the upper end of the mast by a rearwardly disposed U-shaped connecting bracket 63 so as to maintain the guide channels completely free of any obstruction endwardly of the mast. The ends 64 of the bracket are secured, as by welding, to the opposite sides of the rails and include an intermediate portion 65 rearwardly spaced from the rails to define an opening 66 therebetween.

The mast 55 is supported in closely spaced forwardly disposed relation with respect to the adapter plate 40 on a pair of roller mounting angle brackets 70. The angle brackets are individually secured to the opposite sides of the rails 58 of the mast intermediate their ends, as by welding or the like. The brackets provide outer rearwardly disposed surfaces 73 which are substantially flush with the rearward side of the mast. Each of the brackets mounts a roller 77 having a bearing bolt 78 extended through the bracket and secured by a lock nut 79. The rollers 77 are thereby disposed for rotation about a substantially horizontal axis with their peripheries in rolling engagement with the upper edge 49 of the adapter plate 40.

An auxiliary roller mounting plate 82 is secured in intimate facing engagement against the rearward surfaces 73 of the angle brackets 70, as by welding or the like, and includes adjacent to each of its ends a substantially semi-circular notch 84 in spaced conforming relation to the irrespective rollers 77. A pair of integral rearwardly extended right angularly related arms 85 are disposed inwardly adjacent to the notches 84 individually to mount a pair of rollers 87. Each of the rollers 87 are secured in depending relation from the arms by a bearing bolt 88 and a lock nut 89 for rotation about a substantially vertical axis with their peripheries in rolling engagement with the rearward side of the adapter plate 40 above the rack bar 48. A pair of roller mounting brackets 90 are individually secured to the opposite sides of the rails 58 adjacent to the lower end 56 of the mast 55 and include roller mounting portions 91 extended rearwardly from the rails. A roller 92 is disposed above each of the mounting portions by a bearing bolt 93 and a lock nut 94 for rotation about a substantially vertical axis with the peripheries thereof rollably engaging the front surface of the forward lower plate 23 of the carriage 20.

Accordingly, the mast is longitudinally shiftable along the adapter plate 40 and carriage 20 with the above described arrangement of rollers effectively resisting any binding of the mast and resistance to such movement which might be imposed thereagainst by a load. As best shown in FIGS. 5 and 7, a hydraulic motor 95 is mounted on the rearward side of the auxiliary roller mounting plate 82 between the rollers 87 by a pair of brackets 96 secured, as by welding or the like, to the plate. A drive gear 97 is mounted on a shaft 98 extended from the hydraulic motor with the gear in meshing engagement with the rack bar 48 on the adapter plate 40 for selective movement of the mast 55 transversely of the longitudinal axis of the lift truck 11.

As best shown in FIGS. 2 and 4, a load engaging and supporting foot 100 is disposed at the lower end 56 of the mast 55 in forwardly extended relation therefrom with respect to the direction of forward travel of the lift truck 11. The foot includes a pair of transversely spaced upstanding legs 102 which are individually slidably received within the guide channels 59 of the rails 58 for elevationally positioning the foot relative to the mast. Each of the legs includes a plurality of spaced screw-threaded bores 103 which are accessible for the introduction of an upper locking bolt 105 therein through an elongated opening 107 in each of the outer sides of the rails. Each of the rails also includes a lower lock bolt 108 for introduction into a selected bore 103 in the associated leg 102.

An elongated telescopic load clamping boom or arm 110 is mounted in forwardly extended relation from the

mast 55 and is adapted for elevational reciprocal movement on the mast toward and away from the foot 100. The clamping arm includes an elongated tubular inner section 112 which is substantially square in cross section and which includes a rearward end 114 rearwardly extended through the mast. The inner section provides opposite side walls 115 and continuous upper and lower side walls 116 and 117, respectively. The opposite side walls provide depending leg portions 118 which are of the same width as the width of the rails 58 of the mast. A pair of elongated guide shoes 120 are individually mounted by a plurality of pins 122 on the legs slidably within the guide channels 59 of the rails. The shoes maintain the clamping arm in precise right angular relation to the mast and insure against any relative cocking or binding of the arm relative to the mast.

Free elevational reciprocal movement of the clamping arm 110 is further insured by a pair of rollers 125 mounted on the outer surface of the opposite side walls 115 at the rearward end 114 of the arm. The rollers 125 are disposed for rotation on the arm about substantially horizontal axes by bearing bolt and nut assemblies 126 respectively associated therewith. The peripheries of the rollers rollably engage the rearward surface of their adjacent rails 58. The side walls 115 further provide upper extensions 130 which include outwardly extended rail portions 132 disposed in spaced substantially parallel relation to the upper side walls 116 of the inner section 112 of the clamping arm 110. An elongated slot 133 is thereby formed between the rails and their respective top edges of the side walls with the outer ends of the rails being individually supported by a pair of upstanding straps 134 individually secured to the side walls of the arm.

A movable clamp mounting bracket 136 is disposed about the inner section 112 of the clamping arm 110. The bracket includes a substantially U-shaped depending plate 137, 138 and a pair of inwardly spaced side plates 139 immediately outwardly adjacent to the opposite side walls 115 of the arm in interconnecting relation with the depending plate and the top plate. A plurality of rollers 140 are rotatably mounted within the side plates in rolling engagement against the upper edge of the side walls 115 of the arm within the slots 133. The U-shaped plate 137 includes a lower portion 141 having a plurality of sets of elevationally spaced apertures 142 therethrough for adjustably mounting a load clamping claw 144 formed of angle iron with the upper portion of the claw providing a pair of spaced rivets or projections 145 for selective extension through the apertures 142. A pair of elongated tension springs 146 are individually connected at their outer ends to a pair of brackets 147 secured to the upper wall 116 of the arm and at their opposite ends to a pair of fingers 148 inwardly extended from the side plates 138 of the clamp mounting bracket 136. The springs are effective normally to tension the clamp mounting bracket and the load clamping claw 144 in outwardly spaced relation from the mast against the straps 134 which serve as stop members to position the clamping claw in an initial load engaging position.

The load clamping arm 110 further provides an elongated outer extendible section 155 which is telescopically slidably received within the inner section 112 of the arm. As best shown in the dashed lines in FIG. 3, a hydraulic jack 157 is disposed within the arm and has a cylinder end 158 connected to a wall 159 within the inner section 112 and an opposite rod end 160 connected to a wall 161 within the outer extendible section of the arm. As best shown in FIGS. 11 and 12, the outer extendible section has an outer end 163 which mounts an upwardly extended box section 164. A pair of inner and outer spaced wall sections 165 and 166, respectively, of the box section form therebetween a guide slot 168 for an elongated outer clamping member 170. The clamping member has a lower hook or claw end 172 and an upper right angularly related end 173. The upper end of the clamping member

is connected to the rod end 175 of a hydraulic jack 176 and has a cylinder end 177 mounted within the box section for elevational extension and retraction of the clamping member.

Elevational reciprocal movement of the clamping arm 110 on the mast 55 is accomplished by a hydraulic jack 178 disposed between the rails 58 of the mast. The jack has a lower cylinder end 179 connected to the mast by a plate extended between the lower connecting strap 62 at the lower end of the mast. The jack includes an upper rod end 180 which is connected to the rearward end 114 of the inner section 112 of the clamping arm. The hydraulic jacks 30, 157, 176, 178, and the hydraulic motor 98 are all connected by suitable hydraulic hoses, not shown, with a hydraulic system on the lift truck for selective actuation by a plurality of control valves indicated generally by the reference numeral 182.

As best shown in FIGS. 1 and 2, the attachment of the present invention is particularly adapted for handling a relatively large crate of sheet glass, which is generally indicated by the reference numeral 185. The crate has an elongated substantially rectangular configuration providing opposite upper and lower edges 186 and 187, respectively, and opposite predetermined inner and outer ends 188 and 189, respectively. Each of the ends includes upper and lower crate strengthening cleats 190 which are conveniently utilized for handling of the crates by the attachment of the present invention.

Operation

The operation of the described embodiment of the subject invention is believed to be clearly apparent and is briefly summarized at this point. Prior to use, the foot 100 is elevationally adjusted with respect to the mast so as to accommodate a particular size of crate. As previously described, the upper lock bolts 105 are initially loosened and the lower lock bolts 108 removed to permit elevational sliding movement of the legs 102 within the guide channels 59 of the mast 55. It is noted that the foot may be adjusted to the extent permitted by the slot 107 with the upper lock bolts 105 precluding complete withdrawal of the legs from the guide channels unless such lock bolts are entirely removed. It is apparent that with the foot rested against the support surface 15, either the main carriage 20 or the mast 55 may be raised by extension of their respective hydraulic jacks until the proper bore 103 is aligned with the lower locking bolts 108. Also, the inner clamping claw 144 can be elevationally adjusted with respect to the clamping arm 110 by removal and extension of the mounting rivets 145 through the apertures 142 in the clamp mounting plate 136 so as to accommodate cleat 190 on the crate 185.

After completion of the above described preliminary adjustments, the hydraulic jack 178 is actuated to raise the clamping arm 110 upwardly within the mast 55 in predetermined spaced relation to the foot 100 so as to be extendible above the crate in elevationally spaced relation thereto. The outer extendible section 155 of the clamping arm is also extended by actuation of the hydraulic jack 157 so as to space the outer clamping member 170 a distance from the inner clamping claw 144 greater than the length of the crate 185. With the main carriage 20 elevated somewhat on the lift frame 12 of the lift truck 11, the truck is driven to a position to dispose the foot 100 and the clamping arm in substantially longitudinal alignment with the crate. The main carriage is then lowered to rest the foot against the support surface 15 in closely spaced adjacent relation to the crate. If such longitudinal alignment is not accomplished with the initial approach of the lift truck, the attachment is selectively laterally positionable by actuation of the hydraulic motor 95 for shifting the mast relative to the adapter plate 40 and main carriage 20 by rotation of the drive gear 97 along the toothed rack bar 48. Accordingly, it is readily apparent that the lift truck need not be precisely posi-

tioned with respect to the selected crate or to a storage compartment for the crate.

The clamping arm 110 is then lowered by retraction of the hydraulic jack 178 until the clamping arm is rested against the upper edge 186 of the crate. The lift truck 11 is then driven forwardly a sufficient distance to locate the inner clamping claw 144 in a gripping position beneath the upper cleat 190 on the inner end 188 of the crate, as shown in FIG. 2. The hydraulic jack 176 is then retracted to extend the outer clamping member 170 to a predetermined lower position to insure positioning of the lower claw end 172 thereof beneath the cleat 190 on the opposite outer end 189 of the crate upon actuation of the hydraulic jack 157 to retract the outer extendible section 155 of the arm. When the lower claw end of the outer clamping member 170 is disposed against the cleat, its hydraulic jack 176 is extended dependably to clamp the upper edge 182 of the crate tightly against the lower side wall 117 of the inner section 112 of the arm.

The hydraulic jack 178 is then actuated to raise the clamping arm 110 and the lower edge 184 of the crate to a position disposed in a plane slightly above the foot 100. The outer extendible section 155 of the arm is then retracted by actuation of its hydraulic jack 157 to telescope the outer section into the inner section 112. Such movement of the outer extendible section is transmitted through the outer clamping member 170 and through the crate concurrently to move the inner clamping claw 144 toward the mast. During such movement, the rollers 139 of the clamp mounting bracket 136 roll through the slots in tensioning relation against the springs 146. Such movement continues until the clamp mounting plate 137 abuts the mast and the inner lower corner of the crate is disposed above the foot. The hydraulic jack 178 is then retracted tightly to clamp the crate between the upper clamping arm 110 and the foot. It will be noted that the hydraulic jacks 157 and 176 provide a continuous clamping force against the crate dependably to maintain the crate in a substantially undistorted rectangular condition.

The crate 185 is then elevated a desired distance from the support surface by actuation of the hydraulic jack controlling the main carriage 20. After movement of the crate by the lift truck to the desired location, the crate can be deposited directly upon a support surface by the attachment of the present invention without requiring pallets, stickers, or other equipment normally employed to space the crate from the floor surface an amount sufficient to permit the introduction of conventional handling equipment beneath the crate. This is accomplished by reversing the above described lifting procedure by lowering the main carriage 20 sufficiently to rest the foot 100 against the floor surface. The outer extendible section 155 is telescoped outwardly from the inner section 112 after releasing the outer clamping member 170 from its associated cleat 190 on the crate to permit lowering of the opposite lower edge of the crate to the floor surface. It is noted that the end of the crate rested upon the foot is somewhat elevated above the floor surface. The lift truck 11 is then backed away from the crate in order to withdraw the foot from between the crate and the floor surface. During such movement, the inner clamping claw 144 remains engaged with its associated cleat on the crate to maintain that end of the crate in such elevated position during automatic retraction of the clamp mounting bracket 136 by the springs 146. As soon as the foot is fully retracted from beneath the crate, the clamping arm 110 is lowered gently to dispose the crate against the support surface and rearward movement of the lift truck is continued to retract the inner clamping claw from its associated cleat. The clamping arm 110 is then raised sufficiently so that upon further rearward movement of the lift truck the outer clamping member 170 is permitted to pass above the crate.

From the foregoing, it is readily apparent that the structure of the present invention provides an attachment

for lift trucks which permits improved handling procedures of relatively heavy, difficult to handle, load elements such as crates of sheet glass and the like. The attachment enables such crates of glass to be grasped from an endward position so that the crates can be removed from a storage area where the crates are usually stacked in side-by-side relation and enables the crates to be lifted and deposited directly upon a support surface without the use of pallets or other supporting equipment.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An attachment, for a lift truck having a longitudinal axis and providing an upstanding lift frame and a carriage mounted on the frame for elevational reciprocable movement, comprising a mast mounted on said carriage; load engaging and supporting means mounted on said mast; load clamping means providing an elongated support member having a longitudinal axis outwardly substantially horizontally extended from the mast in endward substantially parallel relation to said longitudinal axis of said lift truck for elevational reciprocable movement upon the mast and including a tubular section disposed adjacent to the mast and an extendible retractable section telescopically mounted within said tubular section; a pair of load clamping members individually reciprocally mounted in depending relation on said sections of the support member in opposed clamping relation relative to a load borne thereby for constraining the load against said load engaging and supporting means; a pair of transversely spaced guide shoes slidably disposed within the mast to guide the support member during said reciprocal elevational movement, and powered means operatively connected between said sections of the support means for positioning the clamping member on said retractable extendible section toward and away from the mast.

2. The attachment of claim 1 including a bracket slidably mounting said clamping member on the tubular section for movement between a load lifting position spaced from the mast and a load constraining position adjacent to the mast.

3. The attachment of claim 2 including powered means to extend and retract said clamping member on the extendible retractable section of the support member in a path of movement substantially normal to the longitudinal axis of the support member, and means on the tubular section biasing said clamping member thereon to its load lifting position and being movable toward the mast to its load constraining position by a load element disposed between said clamping members incident to retraction of said extendible retractable section of the support member and movement of the clamping member thereon toward the mast to position and to constrain said load element upon said load engaging and supporting means on the mast.

4. An attachment for a lift truck having a longitudinal axis and providing a substantially upstanding lift frame and a carriage mounted for elevational reciprocable movement on the lift frame comprising an elongated substantially vertically disposed mast having a pair of transversely spaced substantially parallel channels; an adapter plate disposable on said carriage; means mounting said mast on the adapter plate for relative movement transversely of the longitudinal axis of the truck; a load engaging and supporting foot mounted on the mast in depending outwardly extended relation from the mast coextensively with the longitudinal axis of the truck; an elongated load

clamping arm outwardly extended from the mast in coexistentive relation with the longitudinal axis of the truck; an elongated load clamping arm outwardly extended from the mast in coexistentive relation with the longitudinal axis of the truck and in predetermined spaced substantially parallel relation to said foot, said clamping arm including an inwardly disposed tubular section and an outwardly disposed extendible section telescoped within said inner section, said inner section including a pair of transversely spaced guide shoes individually slidably disposed within said channels of the mast for elevational reciprocal movement toward and away from said foot; an inner load lifting and clamping claw reciprocally mounted in depending relation from said inner tubular section for movement between a load lifting position spaced from the mast and a load constraining position adjacent to the mast; an outer clamping claw mounted in depending relation from the outer section of the clamping arm; and powered means operatively connected between said sections of the clamping arm for positioning said outer clamping claw toward the mast whereby said inner clamping claw is simultaneously moved toward the mast to its load constraining position by a load element disposed between said clamping claws to constrain said load element upon the load support foot.

5. The attachment of claim 4 including a pair of tension springs mounted on said tubular section and connected to said lifting claw for biasing the lifting claw to its lifting position so as initially to engage and to lift said load element a predetermined minimum distance from a support surface incident to elevational movement of the load clamping arm and being movable to its load constraining position by movement of the outer claw toward the mast in order to permit insertion of the foot between said support surface and the load element.

6. The attachment of claim 5 wherein said adapter plate provides predetermined front and rear surfaces and a top edge, an elongated rack bar disposed on said rear surface of the plate, said mast including sets of rollers individually rollably engaging said rear surface and said top edge of the plate, and a powered gear mounted on said mast engaging said rack bar in driving relation controllably to shift said mast along the plate transversely of the longitudinal axis of the truck.

7. The attachment of claim 6 in which said mast has a lower end extended below the carriage, and a set of rollers mounted upwardly adjacent to said lower end of the mast in rolling engagement with said carriage.

8. In a lift truck including a load transporting vehicle movable in predetermined forward and rearward direc-

tions with respect thereto, the improvement which comprises a load supporting foot mounted on the vehicle for adjustable elevational movement and forwardly extended therefrom; a substantially horizontal boom mounted on the vehicle above the foot for adjustable elevational movement thereon independently of the foot and forwardly extended from the vehicle; an inner claw mounted on the boom adjacent to the vehicle for adjustable movement toward and from the vehicle and forwardly disposed therefrom; an outer claw mounted on the boom in forwardly spaced relation from the inner claw for movement toward and from the vehicle independently of the inner claw and disposed toward the inner claw; powered means for relatively separating the claws to admit a load member to be transported therebetween and for forcing the claws relatively toward each other to clamp the load therebetween; powered means for raising the boom to clear a load to be transported, for lowering the boom to dispose the claws in load clamping position, and for raising the boom to elevate the load clamped by the claws; and powered means for selectively raising and lowering the foot independently of the boom elevationally to adjust the foot to slide under a load elevated by the boom and to draw the foot upwardly against the load to support the same or to move the foot downwardly to disengage the load and for selectively raising and lowering the foot with the boom to raise and to lower a load held by the foot and claws.

9. The improvement of claim 8 in which the outer claw is mounted on the boom for adjustable elevational movement with respect thereto, and including powered means connected to the outer claw for raising and lowering it with respect to the boom.

10. The improvement of claim 8 in which resilient means is connected to the inner claw and urges it forwardly and said powered means for the claws is connected to the outer claw adjustably to position it toward and from the inner claw.

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G. F. ABRAHAM, Assistant Examiner

U.S. Cl. X.R.

214—654; 294—67, 103