

Sept. 13, 1966

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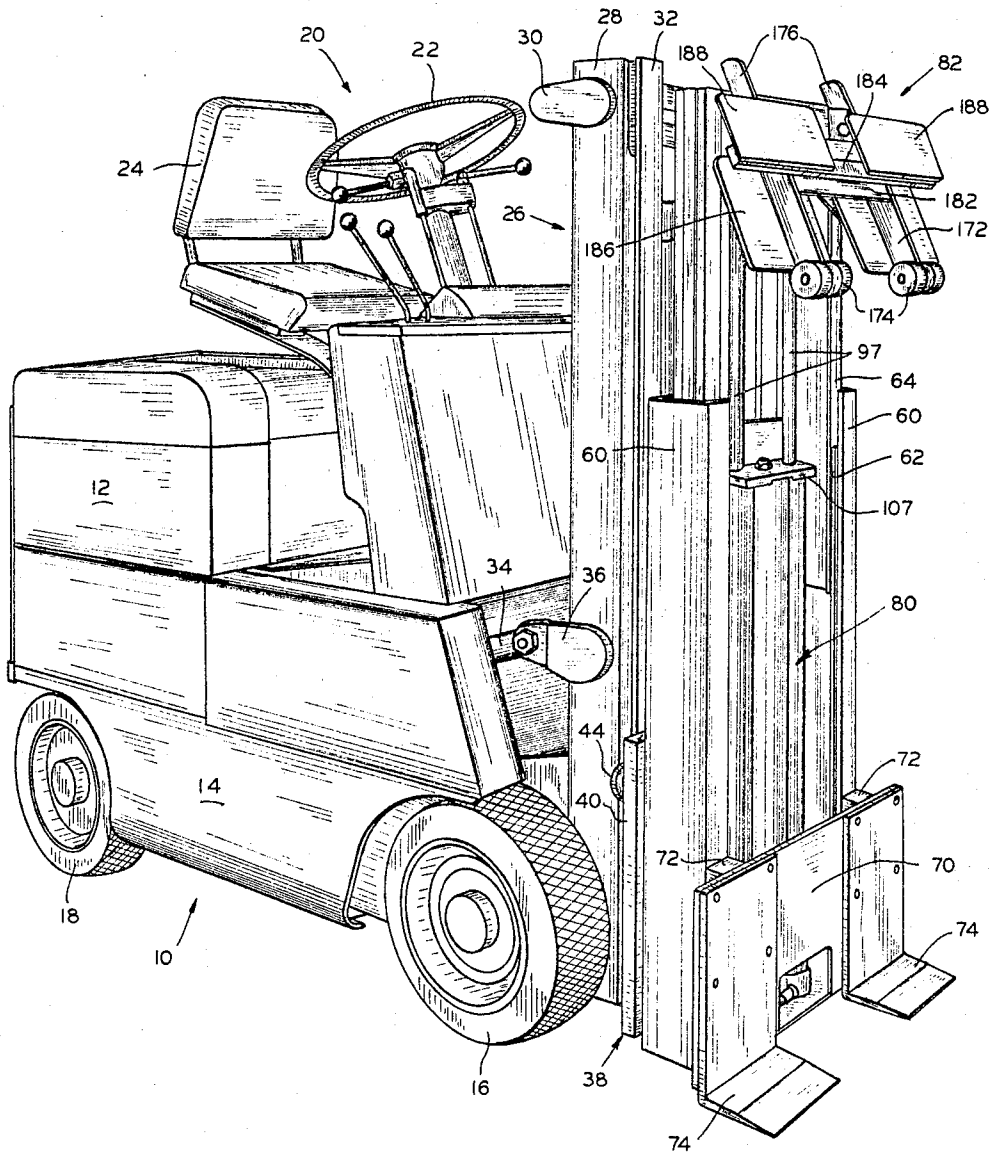
3,272,364

COMBINATION CLAMP-GRAB ATTACHMENT FOR LIFT TRUCK

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5 Sheets-Sheet 1

FIG. 1



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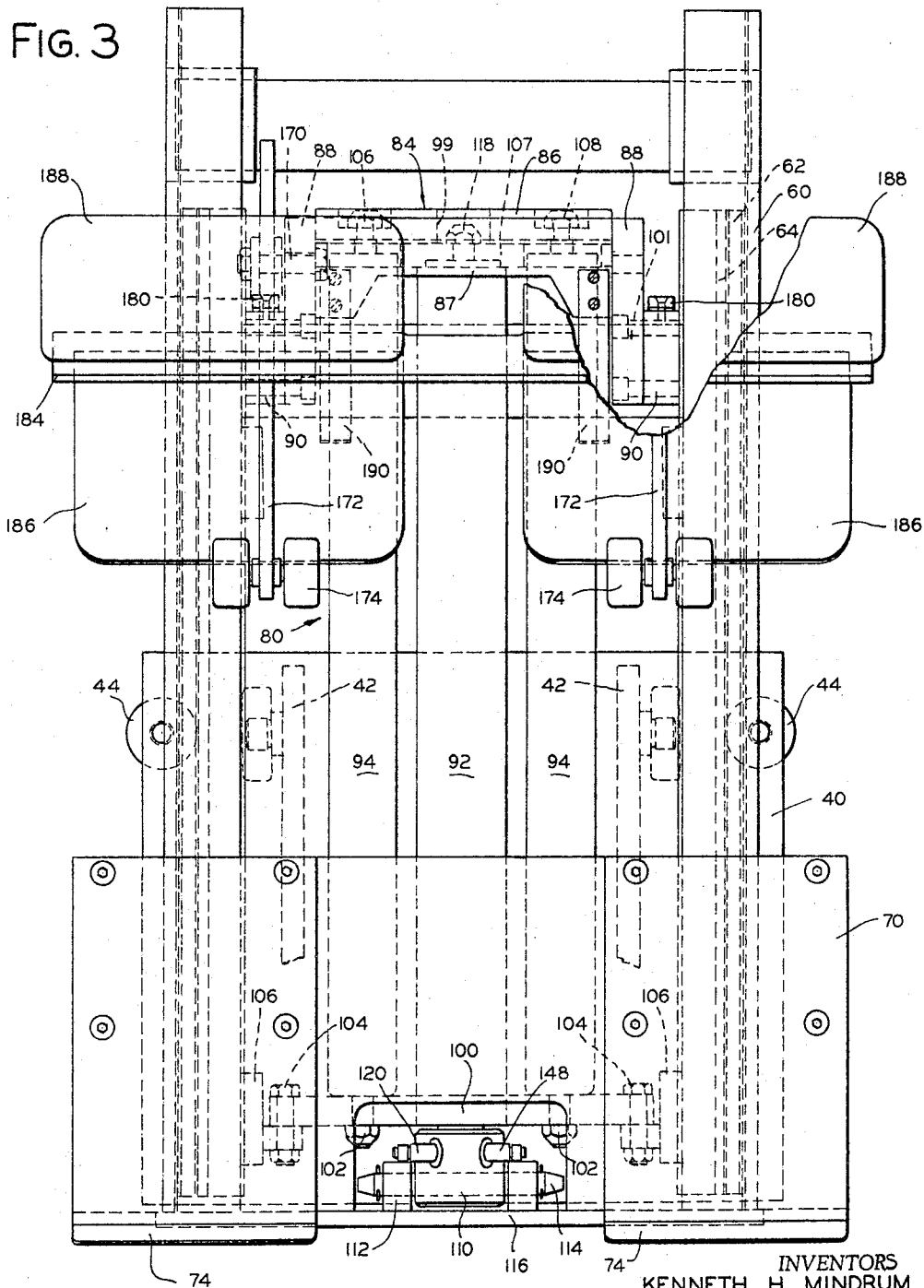
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FIG. 3



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FIG. 4

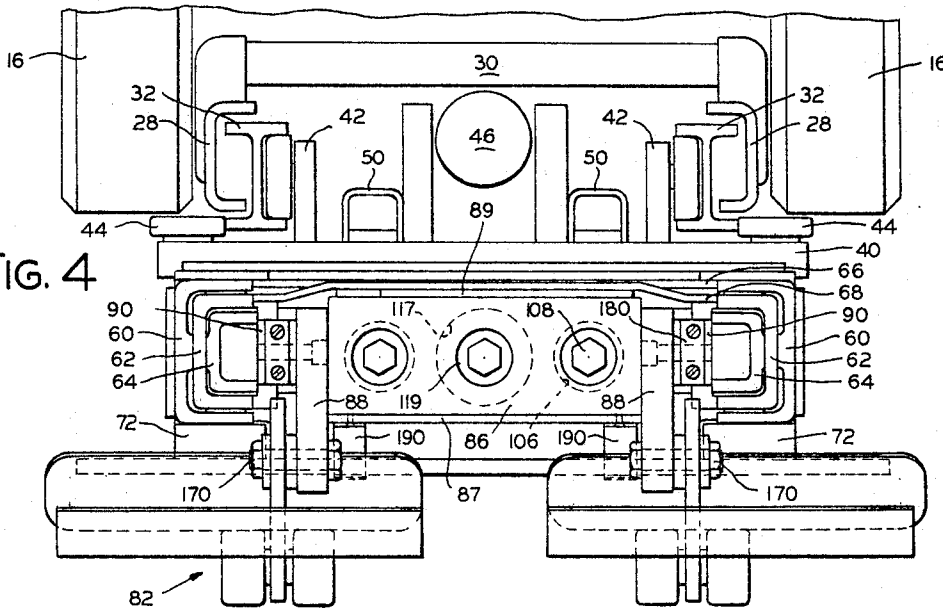
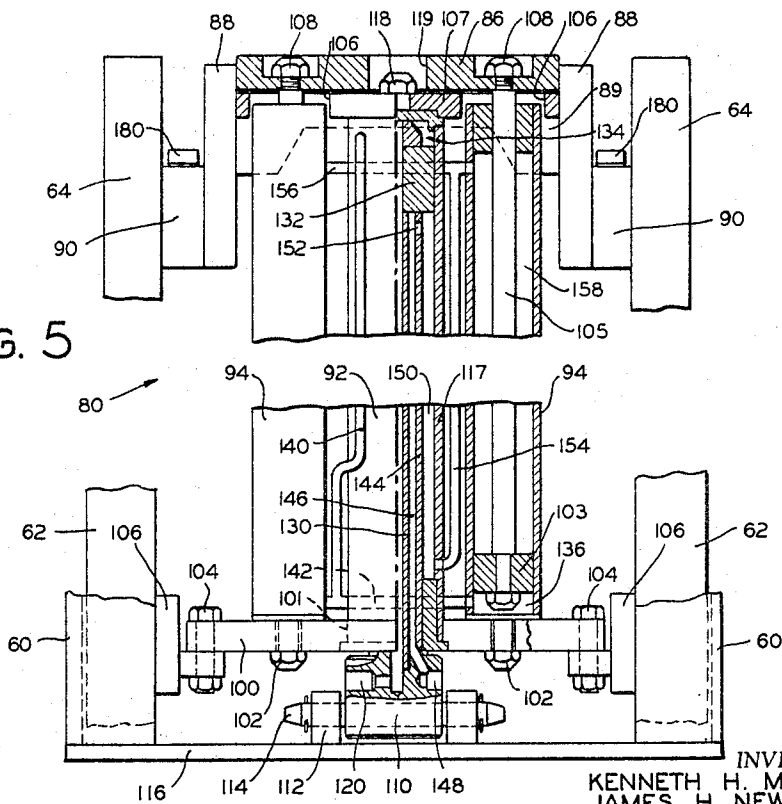


FIG. 5



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FIG. 6A

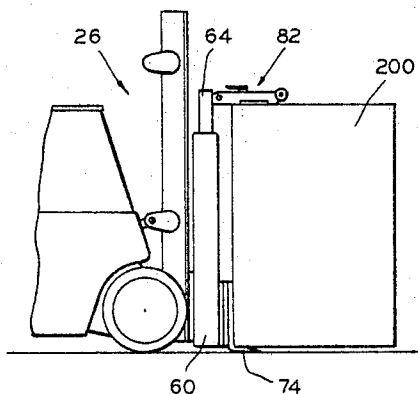


FIG. 6B

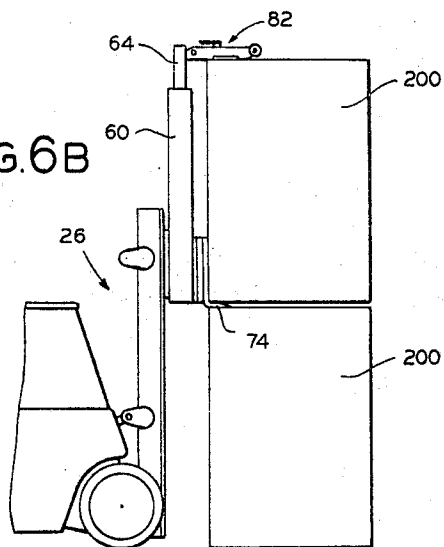


FIG. 7B

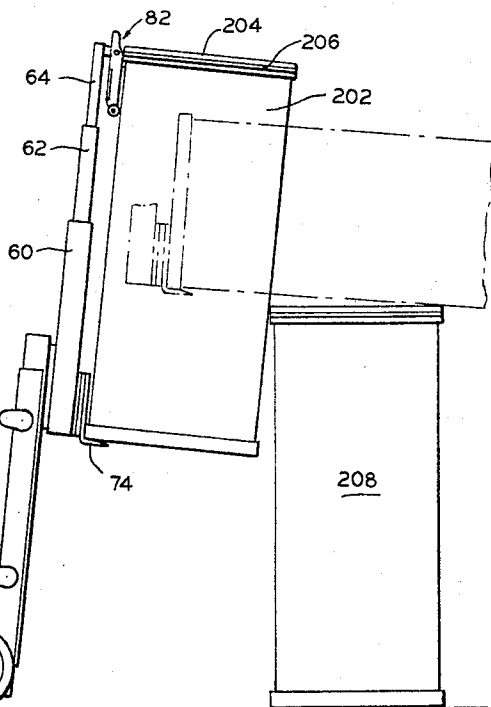
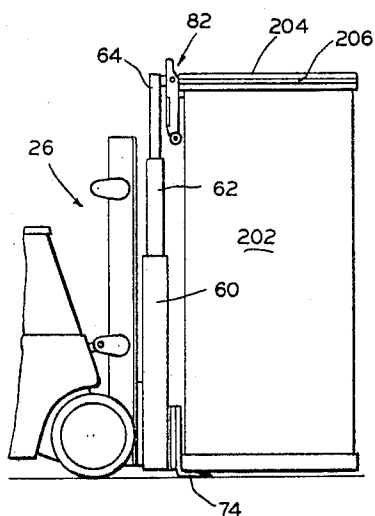


FIG. 7A



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3,272,364 COMBINATION CLAMP-GRAB ATTACHMENT FOR LIFT TRUCK

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Filed Dec. 13, 1963, Ser. No. 330,437
5 Claims. (Cl. 214-654)

Our invention relates to an article handling attachment for lift trucks and more particularly to an improved attachment device which is capable of handling a variety of articles of different heights while supporting same both at the top and bottom of the article.

In carrying out our invention we provide in combination with an elevatable conventional mast structure of an industrial lift truck, an auxiliary mast structure mounted for elevation on the main mast which embodies a novel clamping and lifting mechanism mounted adjacent the upper portion of the auxiliary mast for elevation thereon and for alternately clamping or engaging for lifting, as required, an upper portion of articles of various heights which are adapted to be handled by the attachment.

Our device constitutes a significant improvement over the devices disclosed and claimed in U.S. Patents Nos. 2,799,417, dated July 16, 1957, and 3,039,635, dated June 19, 1962.

It is a principal object of this invention to provide a generally improved and versatile article handling attachment for lift trucks.

A further important object of this invention is to provide an improved attachment device capable of both downward clamping action and upwardly directed engaging action for handling articles of various heights.

Other objects and advantages of the invention will be apparent in view of the following detailed description taken in conjunction with the drawings, wherein:

FIGURE 1 is a perspective view of an industrial lift truck which embodies our invention showing the attachment device in partially elevated position;

FIGURE 2 is a view in side elevation of that portion of FIG. 1 which embodies our invention showing the attachment device in a fully lowered position;

FIGURE 3 is a front elevational view of the structure shown in FIG. 2;

FIGURE 4 is a plan view of FIG. 3 plus a showing of the main mast structure of the truck shown in FIG. 1;

FIGURE 5 is a schematized partial sectional view of the lift cylinder assembly of the attachment;

FIGURES 6A and 6B are schematic views of certain steps in the operation of our device during the handling from ground level to an elevated position of an article of relatively low height; and

FIGURES 7A and 7B are schematic views of certain steps in the operation of our device during the handling of an article of relatively high vertical dimension to an elevated horizontal position.

Referring now in detail to the drawings, an industrial lift truck of well-known type is shown generally at numeral 10 and comprises a body portion 12 which is mounted upon a vehicle frame 14, said frame being connected suitably to the axle of front drive wheels 16 and to a pair of rear steer wheels 18, one of each of which is shown in FIG. 1 at numerals 16 and 18. An operator's station is illustrated generally at numeral 20 and includes a steer wheel 22, an operator's seat 24 mounted above body portion 12, and a plurality of controls for operating the truck and mechanism to be described which is associated therewith.

Located forwardly of the front axle and adjacent drive wheels 16 is a known telescoping mast construction 26

which consists generally of a pair of laterally spaced vertical channel members 28 held in fixed spaced relation by an upper transverse brace member 30 and pivotally connected in a well-known manner to the drive axle, and a pair of laterally spaced nested I-beam members 32 mounted for telescoping movement within the channels 28. Suitable roller mechanism, not shown, is adapted to be supportingly connected between channels 28 and I-beams 32. A pair of laterally spaced hydraulic piston and cylinder assemblies, the piston rod end of one of which is shown at numeral 34, are pivotally connected at the cylinder ends thereof to the truck frame and at the rod ends thereof to bracket means 36 on opposite sides of channels 28 for tilting the mast construction 26 forwardly and rearwardly on the drive axle housing from a vertical position. An elevatable carriage assembly 38 comprises a rectangular carriage plate member 40 extending transverse of the mast assembly 26 and mounted thereon for vertical movement on I-beams 32 in a well-known manner by means of a pair of laterally spaced bracket and roller assemblies 42. A pair of side thrust rollers 44 are mounted near the upper corner portions of plate 40 for engaging outer overlapping edge portions of I-beam sections 32. A hydraulic cylinder-piston assembly comprising a hoist motor 46 (FIG. 4) is mounted on the base of the mast structure and operatively to the telescoping I-beam structure and to plate member 40 in well-known manner by a sprocket and chain assembly, not shown, for raising and lowering carriage 38 on I-beams 32, and I-beams 32 on channels 28. Chain anchors 50 are secured to the rear side of carriage plate 40 for anchoring the one ends of the lifting chains which are operated by the hoist motor 46 for the above-stated purpose.

The construction as thus far described is conventional. A detailed description of the mast structure 26 will be found in copending patent application Serial No. 111,070, filed May 18, 1961, now U.S. Patent No. 3,213,967, granted October 26, 1965 and in the names of Hastings and Backofen (common assignee).

The attachment device which comprises our invention includes a pair of laterally spaced outer opposed channel members 60 secured, as by welding, in vertically extending parallel relation to carriage plate 40, a pair of laterally spaced intermediate channel slide members 62 nested within channels 60 for telescoping movement relative thereto, and a pair of laterally spaced inner channel slide members 64 nested within channels 62 for telescoping movement relative thereto. Transverse brace members 66 and 68 are welded to opposite rear flange portions of pairs of channels 60 and 62, respectively. Secured at the lower end of the outer fixed channels 60 is a transverse plate 70 mounted by means of a pair of welded members 72 to the forward flanges of channels 60, short fork tines 74 being bolted to plate 70. The inner and intermediate pairs of channels 62 and 64 are of approximately the same length, but of substantially less length than outer channels 60.

Mounted intermediate the pairs of channel members is an auxiliary lifting mechanism, shown generally at numeral 80, which is adapted to raise and lower, relative to short fork 74, an article clamping and engaging device shown generally at 82, the entire attachment device being elevatable with carriage 40 in mast assembly 26. Article handling device 82 is secured rigidly between inner channel members 64 by means of a transversely extending yoke assembly 84 which comprises a generally downwardly opening U-shaped construction having an upper transverse plate 86, a pair of longitudinally extending and transversely spaced yoke plates 88, a pair of outwardly extending bolted plate assemblies 90 secured to

the lower outer sides of plates 88 and welded to the inner flange edges of channels 64, and front and rear vertical plate members 87 and 89. Three transversely spaced lift cylinder assemblies comprising a large center cylinder 92 and a pair of outer smaller cylinders 94 are mounted in vertical parallel relation transversely between the pairs of channel members, and are connected together at the bottom or base ends thereof by means of a transversely extending plate member 100, to which cylinders 94 are bolted by means of bolts 102 and to which cylinder 92 is secured in an opening 101 in plate 100. The plate member 100 is secured at its transversely spaced ends by a pair of bolts 104 to a welded bracket assembly 106 which is secured to the edges of the flange portions of each intermediate channel member 62. Cylinder assemblies 94 each embody a piston head assembly 103 located at the lower ends of the cylinders when in a retracted position, and piston rods 105 which extend through laterally spaced openings 106 in a plate 107 for connection to plate 86 by nuts 108 which threadedly engage the ends of the piston rods 105, said piston rods being thus secured to plate 86. The gland end of cylinder assembly 92 is located at the lower end thereof, with the piston rod thereof extending through plate member 100 and being fixedly connected at the bottom of the auxiliary mast assembly to a fluid pressure inlet adaptor member 110 which is mounted pivotally in a bifurcated bracket 112 by a transverse pin 114, the bracket being secured to a transverse bottom plate 116 which is secured as a main brace member between the lower ends of outer channels 60. Cylinder 117 of assembly 92 is secured at the upper end of plate member 107 by a stud and nut 118 which nests within an opening 119 of plate member 86 when the assembly is fully retracted.

The piston rod assembly of cylinder assembly 92 comprises a central hollow fixed piston rod member 130 having a piston head construction 132 located in the upper end of the cylinder and forming therewith a pressure chamber 134, said rod 130 being connected with a conduit 120 for pressurizing chamber 134, the latter chamber being connected to pressure chambers 136, one of which is shown, in the base ends of cylinder assemblies 94 by way of conduits 140 and 142. An outer piston rod element 144 forms with inner piston rod 130 an annulus 146 which is connected to a second inlet conduit 148 in adaptor 110 and to a pressure chamber 150 beneath piston head 132 by means of opening 152 in the wall of outer piston rod 144. Conduits 154 and 156 connect the lower end of chamber 150 with the upper ends of chambers 158 of cylinder assemblies 94.

Conventional double-acting valve means, not shown, control selectively the flow of pressure fluid from pump means to either port 120 or 148, as desired, to elevate or lower the double-acting triple cylinder assemblies 92 and 94, the non-pressurized port being thereupon vented through such valve means to the sump. The combined effective area of pistons 103 is substantially larger than the area of piston 132, so that pistons 103 will always be energized first to raise or lower the assembly, at the end of the strokes of which the cylinder of assembly 94 is motivated to raise or lower the assembly. For example, introduction of pressure fluid in port 120 pressurizes chambers 134 and 136 by way of hollow piston rod 130 and conduits 140 and 142, whereby piston rods 105 are extended from cylinder assemblies 94 to elevate the yoke assembly 86, 88, 90, and thereby inner channel members 64 to the maximum extension of piston rods 105, at which piston heads 103 abut the gland ends of cylinder assemblies 94, whereupon the pressure in chamber 134 is effective to elevate center cylinder 117 on piston rod 144, and thereby the entire triple cylinder assembly 80 as a unit with upper plate members 86 and 107, lower connecting plate assembly 100, and pairs of channel members 62 and 64. During such elevation

fluid is ejected from the low pressure ends of each of the cylinders through conduits 156 and 154, chamber 150, port 152, annulus 146 and port 148 through conduit means to the pump sump.

The reverse operation occurs during lowering of the triple cylinder assembly upon directing pressurized fluid to port 148, which effects a pressurization of chambers 150 and 158 to first fully retract piston rods 105, following which cylinder 117 of assembly 92 is actuated downwardly to successively lower the channel members 64 and 62, respectively, during which lowering movement fluid is directed to the sump from the chambers 136 and 134 by way of conduits 142 and 140, inner piston rod 130, and port 120.

The above-described construction utilizing the three stage channel assembly of the attachment, combined with the above-described triple cylinder assembly, effects an extremely compact unit by means of which the attachment device is capable of retraction to a collapsed position, as shown in FIGS. 2 and 3, wherein the distance between fork members 74 and article handling mechanism 82 is relatively small. In extended position, such as shown in FIG. 7A, the triple cylinder assembly is fully extended as is the three stage auxiliary channel upright assembly to effect a relatively large vertical distance between the fork members 74 and article handling device 82, thereby producing a large range of vertical movement of the attachment assembly in an extremely compact construction of the attachment.

The article lifting and clamping mechanism shown generally at numeral 82 is mounted for pivotal movement on a pair of pivot pins 170 mounted in the forward portions of yoke plates 88 and pivotally supporting outwardly of said yoke plates a pair of transversely spaced upwardly extending ribs 172 having openings therein for receiving pins 170, said ribs having mounted thereon a pair of spaced roller assemblies 174 at the lower ends and upwardly extending stop portions 176 which are pivotal into abutment with a pair of stops 180 secured to the bolted plate assemblies 90 of the upper yoke assembly in the space between yoke plates 88 and the upper ends of inner channels 64. Pivotal movement of ribs 172 about pins 170 to a horizontal position actuates extensions 176 through said space into abutment with stops 180, thereby limiting the pivotal movement of the mechanism 82 in a counterclockwise direction, as seen in FIGS. 1 and 2. Ribs 172 are secured together by transverse support members 182 and 184, and secured to the lower edges of said ribs are a pair of transversely spaced clamp pads 186. A pair of transversely spaced upwardly extending spade members 188 are secured to the forward surface of support member 184. The article handling and clamping mechanism 82 is adapted to clamp cartons, boxes, and other articles, between clamp pads 186 and fork tines 74 when the clamp pads are located in a horizontal position, and to engage so-called "tube and cap" type cartons of well-known construction by wedging spade members 188 beneath the cap portion when the mechanism 82 is located in a vertical position, the mechanism being normally held in the biased position illustrated in FIGS. 1 and 2 by means of a pair of transversely spaced cantilever type springs 190 which extend downwardly from bolted connections thereof to front vertical plate 87 of the upper yoke plate 86.

Referring now particularly to FIGS. 6A and 6B, a typical operation of the attachment device is shown schematically, in which the device is utilized to pick up, transport and lift, and unload a carton having a relatively low height. The lift truck is driven into position on one side of a carton 200 with inner channel members 64 elevated by means of cylinder assemblies 94 such that article handling device 82 is located in its normal spring actuated position above the top of carton 200, whereupon fork elements 74 are wedged beneath the carton to support the bottom corner portion thereof and yoke 84 actu-

ated downwardly with piston rods 105 to actuate device 82 downwardly with channel members 64 so as to forceably clamp and hold the upper corner portion of the carton between device 82 and fork elements 74. The attachment device is then elevated slightly with carriage 40 in mast assembly 26 for transporting the carton to a desired location, at which the attachment is further elevated in mast assembly 26, as shown in FIG. 6B, for depositing the carton at a desired elevation. With the carton located for deposit at the desired elevation the clamping pressure holding the carton is relieved by actuating clamp device 82 upwardly with channels 64 to a non-engaging position in which the device 82 again is held in a normal downwardly biased position by means of cantilever springs 190, whereupon the carton tilts slightly forwardly into engagement with the supporting surface therefor, and the truck is backed away to disengage the fork elements 74. The clamping action of device 82 is effected by lowering the device from an elevated position, as aforesaid, such that roller elements 174 contact the upper surface of carton 200, or other article, which pivots device 82 in a counterclockwise direction, as shown, about pins 170 and away from the influence of springs 190 as rollers 174 roll along the upper surface of the carton during continued downward clamping movement of the channels 64 and mechanism associated therewith. Such pivotal movement of device 82 continues until rearward extensions 176 of the device contact stops 180, at which time the device is preferably located in a substantially horizontal position with the clamp pads 186 in full surface engagement with the upper surface of the carton. Additional clamping pressure may thereupon be applied by means of cylinder assemblies 94, as may be necessary to safely hold and transport the carton.

In FIGS. 7A and 7B is illustrated an operation of the attachment wherein a relatively tall tube and cap type carton, such as a refrigerator carton, is being handled. The truck is driven adjacent the carton and the fork elements wedged beneath the lower corner portion thereof which causes the facing side of the carton to actuate device 82 in a clockwise direction against the urging of springs 190 with channels 64 elevated such as shown in FIG. 1, thus actuating the device 82 into a substantially vertical position in which spade members 188 are brought into substantially flush engagement with the adjacent side portion of carton 202 and below cap 204 thereof. Pressure fluid is thereupon directed to cylinder assembly 92 by way of port 120 to further elevate the cylinder assemblies through the secondary stage of lift thereof and intermediate channel members 62 upwardly as center cylinder 92 is extended outwardly from piston 132 and piston rod 144, as previously described, to the position illustrated wherein spade members 188 are wedged beneath cap 204, which is held tightly on carton 202 by means of a tension band 206. The attachment is thereupon elevated slightly in the main mast assembly 26 for transporting the carton to a desired location, such as shown in FIG. 7B, wherein the carton and attachment are further elevated in mast 26 adjacent a row of similar cartons 208.

Assuming that the overhead clearance is such that it is required to deposit carton 202 in a horizontal position atop cartons 208, the tilt cylinder assemblies which actuate piston rods 34 are energized to tilt mast 26, and thereby the attachment and carton, forwardly to a position such as illustrated in FIG. 7B, with carton 202 located in contact with the top front corner portion of carton 208, in which position cylinder assemblies 94 are retracted by supplying pressure fluid thereto through port 148, so as to disengage spade members 188 from beneath cap 204. The lift truck is thereupon slowly backed away from cartons 208 which, with the carton 202 located as shown, will permit carton 202 to upend at a controlled rate and assume a horizontal position atop cartons 208. The fork

elements 74 are then moved into engagement with the new lower forward corner portion of the upended carton 202, raised a slight amount as shown in FIG. 7B, and moved along the tops of cartons 208 by the lift truck to a position of full support thereby, following which the fork elements are disengaged, the attachment device is retracted, and mast 26 is lowered for subsequent operations.

It will be appreciated that we have provided by means of our invention a versatile article handling attachment for lift trucks which is particularly useful in the handling of containerized equipment, as described above, and that although only one preferred embodiment of our invention has been described herein, this disclosure is merely for purposes of illustration and not as a limitation of the scope of the invention. It is therefore to be expressly understood that the invention is not limited to the specific embodiment shown, but may be used in various other ways, and that various modifications may be made to suit different requirements, and that other changes, substitutions, additions and omissions may be made in the construction, arrangement and manner of operation of the parts without necessarily departing from the scope of the invention as defined in the following claims.

We claim:

1. An extensible mast assembly for elevating loads comprising outer and inner telescoped lifting means, first load engaging means mounted on and adjacent to the lower end of one of said telescoped means, second load engaging means mounted on and adjacent to the upper end of the other of said telescoped means, and hoist motor means operatively connected to said outer and inner telescoped means for extending and retracting the said telescoped means and said second load engaging means, said second load engaging means being mounted relative to said other telescoped means for pivotal movement forwardly thereof to a substantially horizontal position for clamping articles intermediate the first and second load engaging means, and to a substantially vertical position for lifting articles during extension of said telescoped means, and means supported by said other telescoped means and engageable with said second load engaging means for urging said second load engaging means to a normally inoperative position intermediate said horizontal and vertical positions.

2. An attachment for lift trucks having a first extensible mast assembly located adjacent one end thereof, comprising a second extensible mast assembly mounted for elevating movement in the first said assembly, first load engaging means mounted at the lower end of the second mast assembly, second load engaging means mounted near the upper end of said second mast assembly for movement vertically relative to the first load engaging means, and motor means mounted in said second mast assembly for raising and lowering the second load engaging means relative to the first load engaging means, means locating said second load engaging means normally in an inoperative position extending forwardly and diagonally relative to the first load engaging means, said second load engaging means being actuatable pivotally from said inoperative position to a first operative position in which said first and second load engaging means cooperate to clamp a load therebetween, and said second load engaging means being actuatable pivotally from said inoperative position to a second operative position in which said second load engaging means is operable alone to lift a load.

3. A mast assembly comprising outer, inner and intermediate upwardly extending telescoped extensible means, upwardly extending hydraulic motor means mounted upon said telescoped means having different portions thereof secured to each of said inner, intermediate and outer telescoped means, first load engaging means secured to said outer telescoped means, and second load engaging means pivotally mounted from said inner

telescoped means and above said first load engaging means, means supported from said inner telescoped means and engageable with said second load engaging means for locating the latter in a normally inoperative load engaging position, said second load engaging means being pivotable in one direction from said inoperative position to a first operative position for clamping articles between said first and second load engaging means, and said second load engaging means being pivotable in an opposite direction from said inoperative position to a second operative position in which said second load engaging means engages articles for elevation with said inner telescoped means.

4. An attachment for lift trucks having a first extensible mast assembly mounted adjacent one end thereof, comprising a second extensible mast assembly mounted for elevating movement in the first said assembly, first load engaging means mounted at the lower end of the second mast assembly, second load engaging means mounted adjacent the upper end of said second mast assembly for movement vertically relative to the first load engaging means, and motor means mounted in said second mast assembly for raising and lowering the second load engaging means relative to the first load engaging means, said second load engaging means comprising forwardly extending load clamp and support means mounted from said second mast assembly for pivotal movement about a horizontal axis, said second load engaging means being adapted when in a substantially

horizontal position to cooperate with said first load engaging means to clamp a load therebetween, and adapted when in a substantially vertical position to engage and elevate a load, resilient means mounted on the second mast assembly to urge the second load engaging means to an inclined position so that upon contact thereof with the load said load engaging means is pivoted either upwardly to a horizontal position or downwardly to a vertical position.

5. An attachment for lift trucks as claimed in claim 4 wherein said second load engaging means also includes stop means cooperable with the second mast assembly to limit the upward movement of the load engaging means.

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