

[54] **MATERIAL HANDLING ATTACHMENT  
FOR A FORKLIFT TRUCK**

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294/87**

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[58] Field of Search ..... **214/620, 653, 654, 730,  
214/731, 750, 655, DIG. 3, DIG. 4; 294/87**

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[57]

**ABSTRACT**

An attachment for an industrial forklift truck has a plurality of foldable arms an operator can automatically fold to an extended or retracted position. Each of the foldable arm members can be actuated through a series of actuators and appropriate control system to fold flat against the carriage assembly in a manner that cooperates with the load to be handled. Fork arm members are utilized to handle appropriate loads while a pair of side arm members are utilized to clamp and hold appropriate loads. A center arm member can be actuated to allow the side arm members to clamp and hold cylindrical loads.

**6 Claims, 8 Drawing Figures**

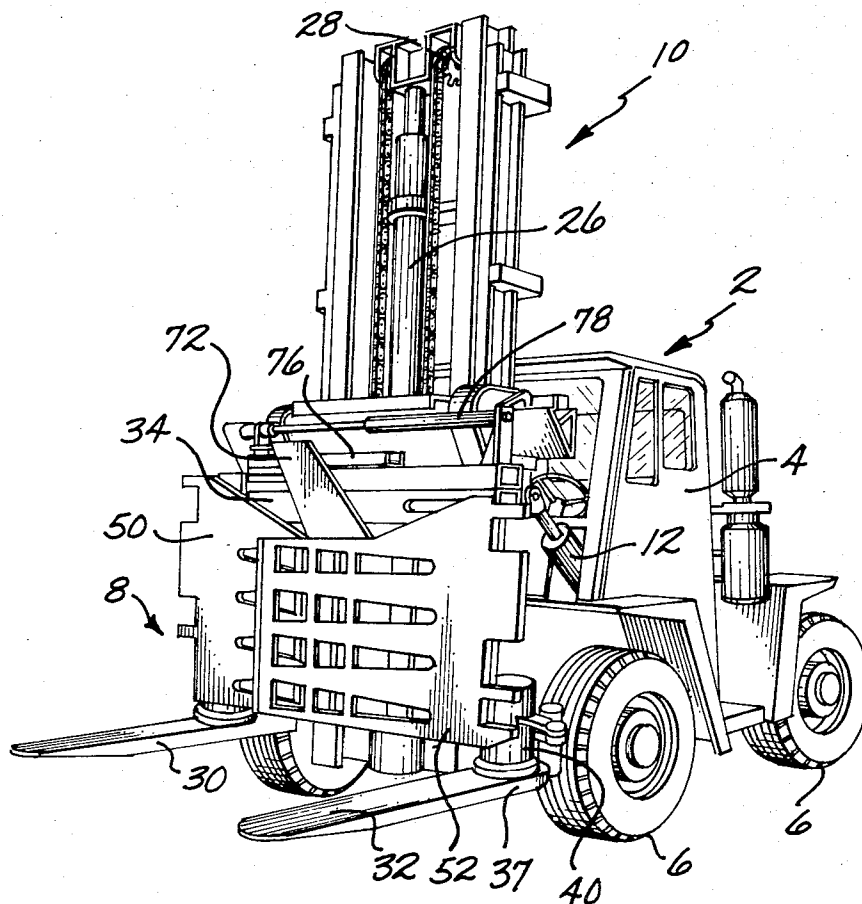


*Fig. 1*

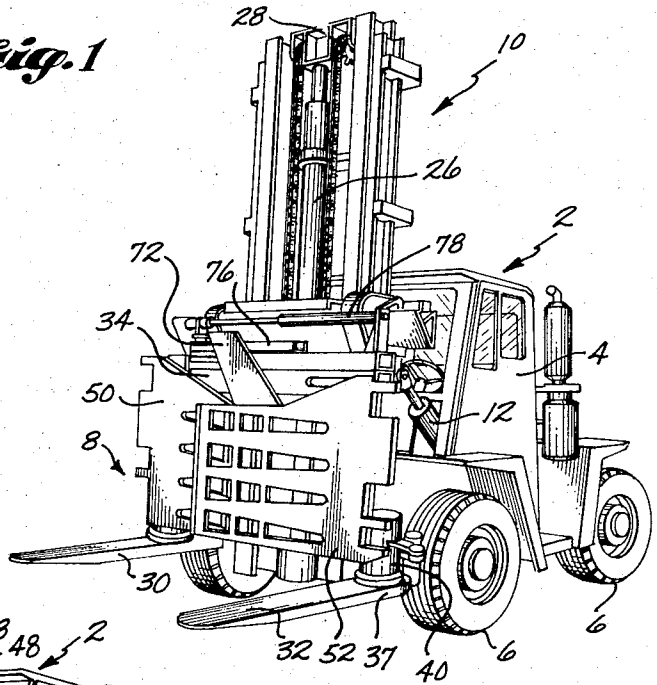


*Fig. 2*

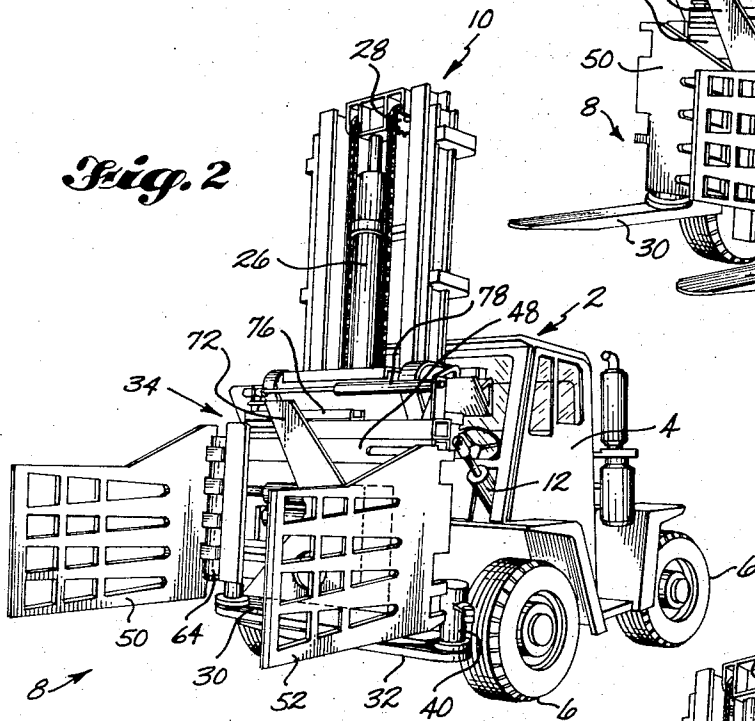


*Fig. 3*

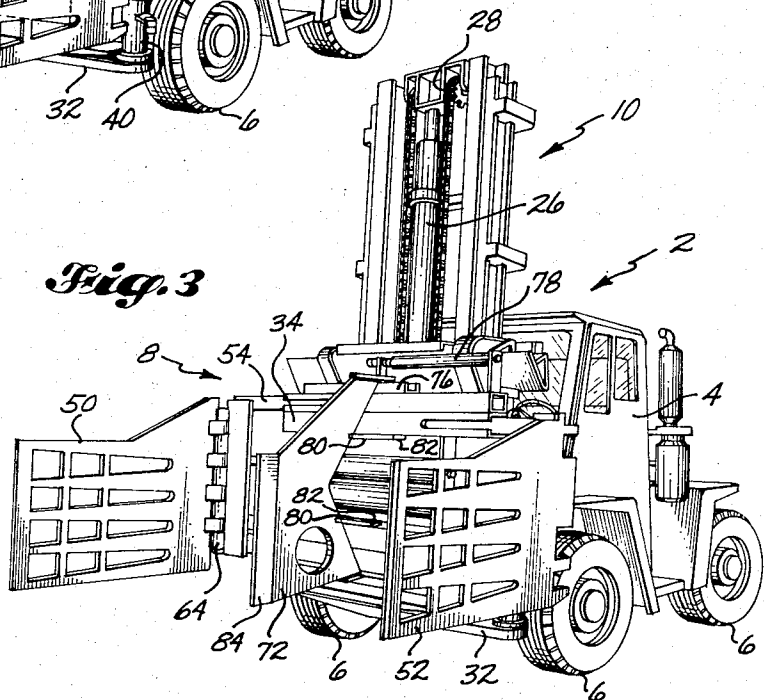


*Fig. 4*

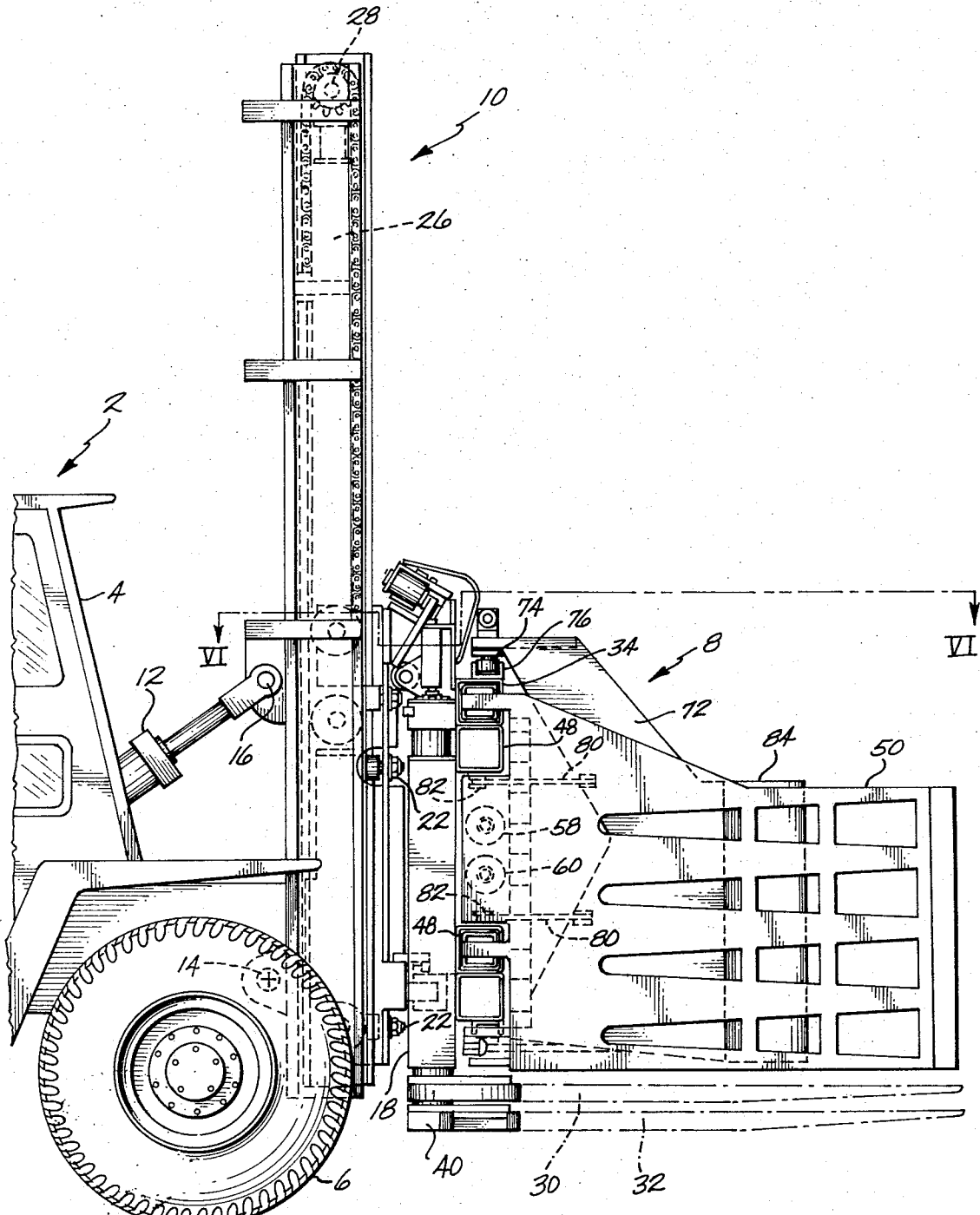


*Fig. 6*

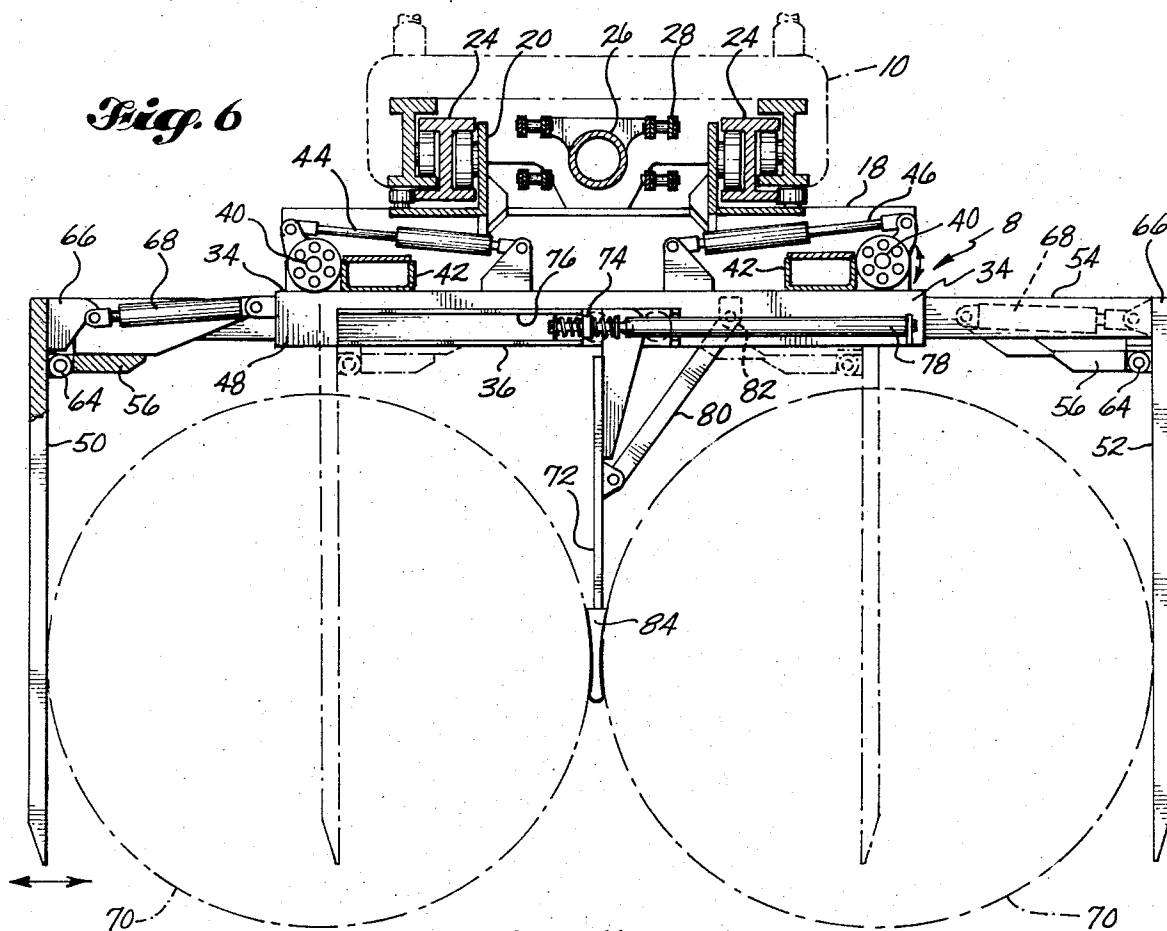


*Fig. 5*

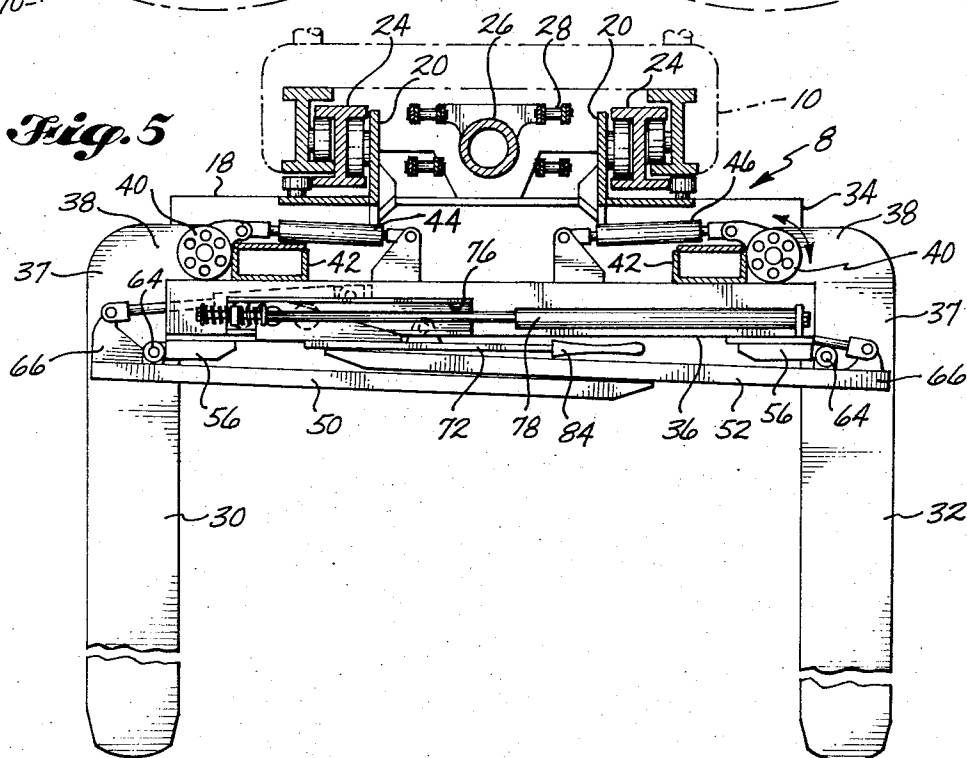


*Fig. 7*

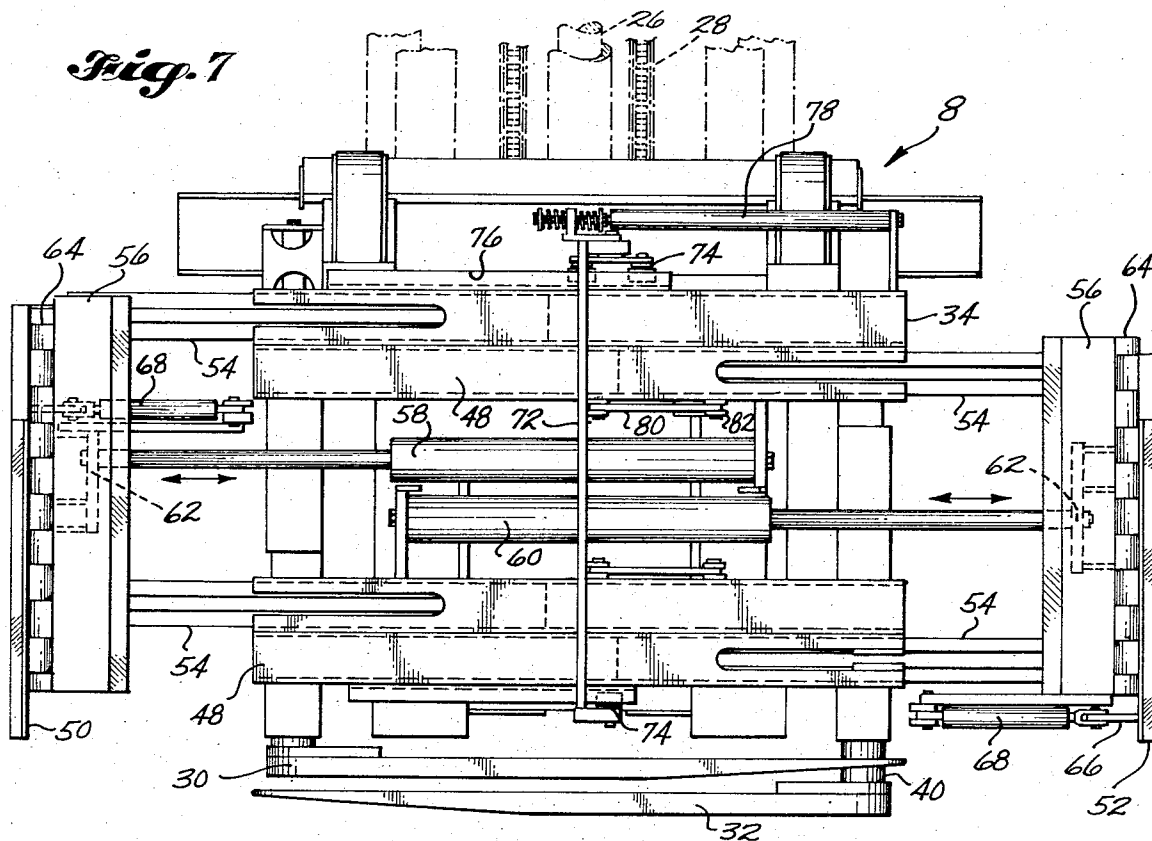
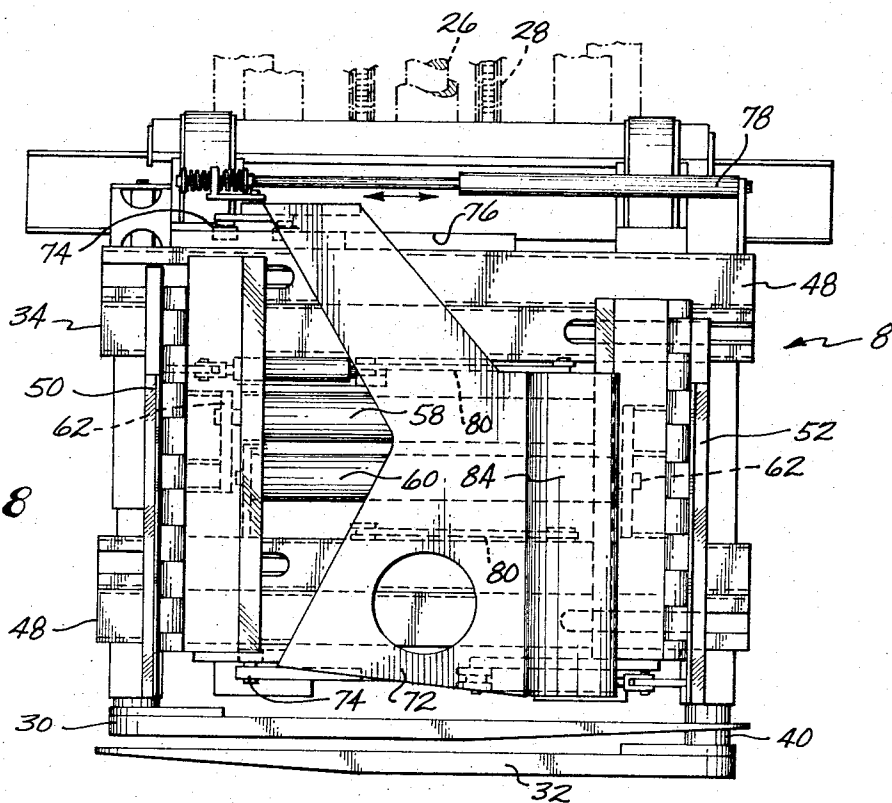


*Fig. 8*



# MATERIAL HANDLING ATTACHMENT FOR A FORKLIFT TRUCK

## BACKGROUND OF THE INVENTION

This invention relates generally to industrial forklift trucks for handling various loads and more particularly to a carriage attachment for a forklift truck that has the capability of carrying various types of loads by automatic folding of the several arm members.

Industrial forklift trucks have been available to the materials handling industry for a number of years and most are of common design. For example, a typical forklift truck is shown in the patent to E. C. Sawyer - U.S. Pat. No. 3,477,600 - and has a typical vertical frame for movement thereon of a standard carriage to which is attached the horizontal fork arms. This particular forklift truck with its carriage as disclosed is one for picking up loads through the horizontal fork arms and providing the load support with the fork arms as the load is carried to its destination. Well known mechanisms such as shown in the Sawyer patent are available for vertically positioning the carriage member on the vertical frame. This function is provided, of course, to allow the carried load to be discharged at various vertical levels as desired. In some forklift truck designs, the entire vertical frame and carriage assembly is tiltable, generally at a point close to the ground, such that a load being carried can be supported in a more efficient manner; not only through the horizontal fork arms, but also through resting against the carriage. The disadvantage in a forklift carriage and horizontal fork arm assembly as in Sawyer, is that with only fork arms the lift truck will not be able to pick up and carry other types of loads such as cylindrical loads, or a plurality of rectangular loads such as pulp bales.

Other forklift truck attachments are available for offering the capability of carrying other types of loads. For example, the patent to E. A. Horton - U.S. Pat. No. 3,245,562 - shows a typical forklift truck which has a carriage mounted to a vertical frame that has a plurality of side arm members. The side arm members as shown in the Horton patent are adjustable in the horizontal direction in order to clamp the particular load that is to be picked up and carried. Thus, it will be appreciated that the carriage as shown in the Horton patent offers a clamping type side force to a particular load, whereas the horizontal fork arms as shown in the Sawyer patent provide a horizontal supporting type load handling characteristic. It is apparent that the carriage of Horton could not support a load of lumber, for example, by the utilization of the clamping arms and conversely, the carriage member of Sawyer could not adequately hold and clamp a plurality of pulp bales, or the like. Other prior art patents likewise do not show a multiload pickup and carrying function that is contemplated by the present invention. Other prior art patents showing one type of load handling carriage or another are U.S. Pat. No. 2,795,347, 3,675,803, 3,438,525, 3,184,088, 3,029,962, 3,088,614, 2,671,571, 2,788,148 and 2,950,830. All of the above cited prior art patents are incorporated herein by reference for their various teachings of lift truck and carriage assembly design.

Another feature that apparently is lacking in prior art forklift truck and carriage assembly designs is that the load carrying arms do not have the capability of being folded inwardly so as to lay flat against the carriage

wall, thereby reducing the amount of space required for storage of the entire lift truck assembly.

While several of the prior art carriage designs indicate that manual removal of one set of load carrying arms may be carried out and another set positioned on the carriage, none show a combined automatic system for providing dual functions within a single carriage assembly. For example, the F. J. Schenkelberger patent - U.S. Pat. No. 2,795,347 - shows a load handling attachment for a forklift truck that has separate manual attaching means for a pair of horizontal fork arms and for a pair of side arm clamping members. By requiring manual attachment and removal, valuable time is lost in actual load handling capability.

Thus, from the foregoing, it will be apparent that one object of the present invention is to provide a load handling attachment for an industrial forklift truck that offers several load handling alternatives, such as horizontal bottom support and vertical side support.

Another object of the invention is to provide a versatile load handling attachment where the particular arms required for each mode of operation can be manipulated automatically into the appropriate position.

Still a further object of the invention is to provide automatic folding means with a suitable control system, such that the arm members may be moved independently of one another.

A further object is to provide foldable arm members such that all may be folded against the carriage wall so as to reduce the space requirement of storage.

Still a further object of the invention is to provide a center foldable arm such that a pair of cylindrical loads can be picked up and carried in a side-by-side relationship.

These and other objects of the present invention will become apparent upon reading the following specification in conjunction with the attached drawing.

## SUMMARY OF THE Invention

Briefly, this invention is practiced in one form by mounting a pair of horizontally extending fork arm members to a carriage through means that can operate to fold or pivot the forks inwardly toward the carriage face such that each fork will be substantially normal to its extended position after being folded inwardly. Similarly, a pair of vertical side arm members are also mounted to the carriage through means that will allow them to be folded inwardly to a position against the carriage face which is substantially normal to their extended position. Either of the plurality of foldable arm members can be actuated independently of the other in order to provide separate load handling functions. An optional center support arm may be provided which also is attached to the carriage through means that allows it to be folded inwardly to lay flat against the carriage face.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of an industrial fork lift truck showing the carriage of the present invention with its bottom fork arm members extended.

FIG. 2 is a similar perspective view of a fork lift truck showing the bottom fork arm members retracted and the side arm members extended.

FIG. 3 is also a perspective view which shows the carriage with both the side arm members and the center

support arm in their extended positions with the fork arm members retracted.

FIG. 4 is a side elevation view showing the carriage assembly and a portion of the industrial lift truck.

FIG. 5 is a top plan view showing the carriage assembly with the fork arm members extended.

FIG. 6 is a similar top plan view of the carriage assembly showing the side arm members and the center support arm extended.

FIG. 7 is a front elevation view of the carriage assembly showing the side arm members and the center support arm member extended.

FIG. 8 is a similar front elevation view showing the carriage assembly with the arm members all retracted and folded against the carriage assembly.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

#### GENERAL ASSEMBLY

Referring to FIGS. 1-4, a general description of an industrial lift truck, together with its load handling attachment, will be given. In FIG. 1, the truck assembly is generally designated at 2. Truck assembly 2 can be of any suitable type that is commercially available for use by the materials handling industry. The truck assembly 2 is movable from place to place through a suitable power source and is controlled by an operator who sits within the cab enclosure 4. The truck assembly 2 is mounted on the ground through a plurality of wheels 6, a pair of which are steerable by the operator. Within the cab enclosure 4 the operator has the capability to not only steer the truck assembly 2 from place to place, but also to control the various movements of the overall carriage assembly which is generally designated as 8. Attached to the front of the truck assembly 2 and generally towards the lower end is the common vertical frame generally indicated at 10. Vertical frames 10 are generally attached to industrial lift trucks in a manner that allows them to be pivoted toward the ground level through a suitable actuating cylinder 12 or other suitable driving means which extends from the truck assembly 2 to the vertical frame 10. The pivot point for the vertical frame 10 is indicated at 14 in FIG. 4 and is the bottom point of attachment for the vertical frame 10 to the truck assembly 2. Of course it will be recognized that the attachment point 16 for the actuating cylinder to the vertical frame will be at a position vertically spaced from the pivot point 14, thereby allowing the desired tilting movement.

As is well known to manufacturers and users of industrial lift truck assemblies, the carriage assembly 8 is constructed so as to be vertically movable on frame 10. A typical carriage assembly would be movably mounted to a portion of the vertical frame assembly 10 such that it acts to provide the vertical movement to the carriage 8. Still in general terms and referring to FIGS. 4 and 5 the attachment mechanism for properly fixing the carriage assembly 8 to the vertical frame assembly 10 will be described. The rear vertical face 18 of the carriage assembly is comprised of a pair of vertically extending flange members 20 which are removably attached to the rear carriage face 18 through suitable bolting means indicated at 22. Thus it will be appreciated that the carriage assembly 8 may be easily disengaged from the overall truck assembly 2, should maintenance be necessary. The flange members 20 are in turn secured to a pair of I-beam members 24 or other

suitable means that are adaptable to travel vertically within the vertical frame assembly 10. The standard vertical frame assembly has suitable means to move the flange members 20 and the attached I-beam members 24 vertically within the frame assembly 10. The vertical movement may be provided in any known manner, such as through an actuating cylinder 26 which is operatively connected to a chain drive mechanism 28. By actuating the chain drive mechanism 28, the carriage assembly 8, which is bolted to the flange members 20, will be caused to move up or down vertically, depending on the desired direction. A suitable control system is provided for actuating the cylinder 26 and also for actuating the tilting cylinder 12.

#### CARRIAGE ASSEMBLY

Turning now to a detailed description of the carriage assembly 8, it should be noted that the carriage 8 is an integral unit which is detachable from the vertical frame assembly 10. The necessary control system for the actuators to be subsequently described is obviously designed such that the various parts can be separated if it is desired to remove the carriage assembly. Referring to all figures of the drawing, a pair of horizontally extending fork arm members are depicted as 30 and 32 respectively. The arm members 30, 32 extend outwardly as depicted in FIG. 5 from a carriage bulkhead depicted as 34. As previously mentioned, the rear vertical face 18 of the bulkhead 34 forms the back wall of the carriage assembly 8. A front vertical face 36 also forms a part of carriage bulkhead 34 and is that portion of the carriage assembly 8 against which a load would normally rest. Between the front and rear vertical faces 36 and 18, there is the space within which are positioned the various actuating means for moving the fork arm members 30, 32 and the other arm members. With a normal fork lift carriage assembly, the fork arm members would be fixedly attached to the lower portion of the carriage. However, in the present invention, the fork arm members 30, 32 are pivotally mounted at their inner ends within the carriage bulkhead 34. At the inner ends 37 of the fork arm members, an extension 38 is provided that extends normal to the fork arms. The extension members 38 are adapted to fit within a hinge mechanism depicted at 40 such that the entire fork arm member can be pivoted about the hinge mechanism 40. Normally, the fork arm members 30, 32 will only need to be pivoted through an angle of 90° either to the fully extended position or to the fully retracted position. Approximately midway between the front and rear vertical faces there is positioned a pair of vertically extending channel sections 42 generally in the area of the hinge mechanisms 40, or if desired, the full vertical length of the bulkhead 34.

Providing the pivotal motion for the fork arm members 30, 32 is a pair of actuating cylinder mechanisms depicted as 44 and 46 respectively. A simple actuating cylinder is connected between a ground point and a dog member on each of the hinge mechanism, which, when activated, can act to turn the respective fork arm member about its pivot point. Of course, the actuating cylinder, which forms part of the actuating mechanism, is suitably sized so as to offer the 90° turn to the fork arm member. The vertical channel sections 42 provide supporting means for the respective fork arm members 30, 32 and their actuating mechanisms 44, 46. The fork arm members as depicted in FIG. 6 are in their re-

tracted position (hidden from view) with the respective actuating mechanisms 44, 46 being in their extended positions. The position of the hinge mechanisms 40 and the sizing for the extensions 38 with respect to the position of the front vertical face 36 is such that when the fork arm members 30, 32 are in their retracted position, they will generally be under the bottom edge of the front face 36 or underneath bulkhead 34. When the fork arm members are in their extended position, they are generally on a common horizontal plane. Upon folding the fork arms 30, 32 to their retracted position, a cam mechanism (not shown) or other suitable means, within one of the hinge mechanisms 40 allows the particular fork arm to lie displaced vertically so as not to interfere with the other fork arm. In this manner when the fork arm members 30, 32 are retracted, they will be in an overlapping relationship underneath bulkhead 34, as mentioned, and rearwardly of the front face 36.

Positioned upwardly of the hinge mechanisms 40 and generally spaced vertically along the channel sections 42 are a plurality of transversely extending channel sections, each being depicted as 48. Channel sections 48 generally traverse the distance between the two hinge mechanisms 40 and may be securely attached to the channel sections 42 in any suitable manner, such as by welding or the like. The front walls of each of the channel sections 48 can form the front carriage face 36, as will be apparent to one skilled in the art. Slidably mounted within selected channel sections 48 are the opposing side arm or clamping members 50 and 52 respectively. The side arm members 50, 52 are similar to those depicted in several other prior art patents, such as the Horton Patent - U.S. Pat. No. 3,245,562 - and are adapted to move toward or away from each other in a horizontal direction and to thusly clamp the material that is being handled. The means to motivate the side arm members 50, 52 toward or away from each other can be very similar to the means disclosed in the Horton patent. For example, a plurality of sliding rails 54 are positioned within corresponding channel sections 48 and extend outwardly to a fixed vertical post member 56. The respective side arm members 50, 52 then extend outwardly, as will be subsequently described, from the post members 56. Physically attached through appropriate means to the post members 56 are actuating cylinders 58 and 60 respectively. One end of each actuating cylinder is fixed to the bulkhead 34 while the other end is linked through appropriate connection means 62 to the post members 56. When the cylinders 58 or 60 are actuated, they operate to cause the sliding rails 54, together with the side arm members 50, 52 and the associated structure to move outwardly in a lateral direction from the main body of the bulkhead 34. During the movement, the sliding rails 54 are constrained to move within their respective transverse channel sections 48. The appropriate control system is provided that will allow each side arm member 50 or 52 to be moved laterally independent of the other, or conversely if it is desired to move them together in the same direction such a control system can be provided.

As will be seen by referring to FIG. 7, the actuating cylinders 58, 60 are spaced vertically from the transverse channel sections 48 such that the appropriate clearance is provided for proper actuation of the cylinders. It will also be appreciated that for the load handling function, it is necessary that the actuating cylinders 58, 60 be nestled rearwardly of the vertical plane

that is established by the front carriage face 36 but forwardly of the hinge mechanisms 40 and channel sections 42 so as to not interfere therewith.

The side arm members 50, 52 are attached to the post members 56 through suitable hinge means 64 such that they can be pivoted through an angle of approximately 90° from their fully extended position to their fully retracted position where they are laying generally flat against the front face 36. The hinge means 64 are best shown by referring to FIGS. 5 and 6. In order to provide the pivoting motion to each of the side arm members 50, 52, an extended portion 66 on each arm member is provided outwardly from the hinge means 64. At least one actuating cylinder 68 is in operative communication with the extended portion 66 of each side arm member. The actuating cylinders 68 can be mounted on the fixed post member 56 and each is appropriately positioned so as to not interfere with either the transverse channel sections 48 or the sliding rails 54. Thus, on the right side arm member 52 the respective actuating cylinder 68 is mounted below arm member 52, as shown in FIG. 7. Conversely, the actuating cylinder 68 for the left side arm member 50 is mounted approximately midway up the arm member 50 in a convenient manner to avoid contact with either the transverse channel sections 48 or the sliding rails 54.

Upon a command signal through the appropriate control system, each actuating cylinder 68 either individually or together, depending on the type of control system, is actuated to turn the respective side arm member 50, 52 through a 90° angle. The extended portion 66 on each arm member, of course, acts as a moment arm when a force is exerted on it by the actuating cylinder. As shown best in FIG. 5, when the side arm members 50, 52 are retracted in the lateral direction, that is, closest together laterally, they will be in an overlapping relationship when folded against the front vertical face 36. Thus, it will be appreciated that one or the other of the side arm members 50, 52 will be first turned inwardly in order to avoid contact with the other as it is being folded inwardly.

It should be recognized that the side arm members 50, 52 are utilized to clamp and hold loads that are generally of a quadrilateral nature such that the interior faces of the side arms can grip and hold the material to be handled. Usually, when the side arm members 50, 52 are in use, the fork arm members 30, 32 have been retracted to their position below the carriage bulkhead 34 so they will not interfere with the load being handled by the side arm members.

An additional function that may be carried out by the overall carriage assembly 8 is one of handling cylindrical loads and is graphically depicted in FIG. 6. Two cylindrical objects 70 are depicted in side-by-side relationship with respect to the carriage assembly 8 and the side arm members 50, 52. It is obvious that without some means to stabilize the side-by-side cylinders 70 they would tend to roll outwardly. In order to provide a stabilizing function and offer the capability to the industrial truck assembly 2 of handling side-by-side cylindrical loads, a center support arm member and cooperating mechanism is provided and is generally depicted as 72. The center arm member 72 is similar to the respective side arm members 50, 52 in that it is adapted to be folded through an angle of approximately 90° from a fully extended position to one which is retracted such that it lays flat against the vertical face 36. The

center arm member 72 is constructed similarly to a side arm member in that it may be comprised of steel plate so as to extend outwardly from the carriage bulkhead 34 a distance which is equal to or less than the length of a side arm member. In the embodiment as depicted in the figures, the dimension of the center arm member 72 is somewhat less than that of a side arm member.

The mechanism for extending and retracting the center arm member 72 can be any that is suitable for the function. In the present embodiment, the center arm member 72 is adapted to fold outwardly from the front vertical carriage face 36 through a pair of pivotal attachments 74 at the upper and lower interior ends of the center arm member 72. A pair of tracking channels 76 contain the pivotal connections 74 and a suitably sized actuating cylinder 78 operates to cause the pivotal connection 74 to move within the tracking channels 76. The single actuating cylinder 78 is mounted toward the top of the bulkhead 34 at a position above the top transverse channel section 48 so as to not interfere with other movements in the bulkhead 34. In order to cause the center arm member 72 to fold outwardly, a pair of struts 80 are pivotally connected to the center arm member 72 and at their other end they are pivotally connected to their own sliding pivotal connections 82. The length of travel of the pivotal connection 74 is greater than the length of travel of the pivotal connections 82 and when the actuating cylinder 78 begins to unfold the center arm member 72, the pair of struts 80 reach their stop points and consequently act to turn the center arm member 72 outwardly to its extended position. The struts 80 and their sliding pivotal connections 82 are positioned toward the center of the center arm member 72 and in a manner that allows them to avoid contact with the sliding rails 54 and their respective side arm members 50, 52 when they are nearest to one another and when the center arm member 72 is either retracted or extended.

Extending vertically along the front edge of the center arm member 72 is a stabilizing pad 84. The opposing two surfaces of stabilizing pad 84 are curvilinear in shape and are, of course, adapted to accept the curvilinear shape of a cylindrical object and generally stabilize the object to be handled such that a side-by-side relationship of cylindrical objects can effectively be handled. It should also be appreciated that the control system for causing actuation of the center arm member 72 will be such that if both side arm members 50, 52 are extended and the center arm member 72 is also extended, center member 72 will be the first to be retracted to lay flat against the front face 36. In retracting the center arm member 72, the actuating cylinder 78 is simply extended and the sliding pivotal connections 82 travel less distance than do the pivotal connections 74, thereby allowing the center arm member 72 to lay flat against the carriage bulkhead 34.

#### Operation of the Invention

Assume that the basic load handling function to be carried out by the carriage assembly is with the use of the fork arm members 30, 32. They will be extended outwardly from the front face 36 and generally on a flat horizontal plane such that the operator can pick up appropriate loads in the normal manner with the fork arm members. The side arm members 50, 52 and the center arm members 72 will all be retracted and laying flat against the vertical front face 36. In this mode of operation, the carriage and truck assembly are operable in

the normal manner and the truck may be used to handle stacks of lumber or other suitable loads.

Suppose now that pulp bales are to be handled. The control system for the actuating cylinders will be operable to retract the fork arm members 30, 32 and extend the side arm members 50, 52 from their retracted position to their extended position as depicted in FIG. 2. Depending on the width of the load to be handled in this mode of operation, the side arm members 50, 52 can be shifted toward or away from one another through the actuating cylinders 58, 60. As the load is grasped, the actuating cylinders then serve to clamp the load in a fixed position for transport.

Assume now that cylindrical loads 70 are to be handled. The side arm members 50, 52 are extended if they are in their retracted position and then the actuating cylinder 78 acts to extend the center arm member 72 to its extended position. With both side arm members extended and the center arm member extended, the configuration is like that depicted in FIG. 3. In grasping a pair of cylindrical loads 70 in a side-by-side relationship, it would usually be necessary to move the side arm members 50, 52 away from each other a distance which is slightly greater than the width of the two cylinders. The truck assembly 2 then moves forward to extend the three arm members about the pair of cylindrical loads. The stabilizing pad 84 will be positioned similar to that as shown in FIG. 6 while the side arm members 50, 52 will grasp the outer edges of the cylindrical loads. Actuating cylinders 58, 60 then bring the side arm members 50, 52 toward one another to clamp and hold the cylindrical loads 70. An example of a pair of side-by-side cylindrical loads are a pair of paper rolls.

While a detailed example of the principal embodiment has been described, it is understood that many changes and modifications may be made in the above described carriage assembly without departing from the spirit of the invention. All such modifications are intended to be included within the scope of the appended claims.

What is claimed is:

1. A carriage assembly for an industrial load handling apparatus of the type adapted to be vertically movable on a frame, wherein the improvement comprises:

- a carriage bulkhead having a front substantially vertical face,
- a plurality of spaced apart fork arm members attached to said bulkhead toward the bottom thereof, means to rotate said fork arm members from an extended working position to a retracted position generally behind said bulkhead,
- a plurality of side arm members attached to said bulkhead generally at the sides thereof, means to rotate said side arm members from an extended working position to a retracted position juxtaposed against said bulkhead,
- a center support arm attached to said bulkhead and extending generally in a vertical plane, means to rotate said center support arm from an extended working position to a retracted position juxtaposed against said bulkhead, and
- said fork arm members, side arm members, and center support arm being rotatable independently of each other depending upon the type of load to be handled.

2. The improved carriage assembly as in claim 1 in which said side arm members are slidably mounted in

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said bulkhead so as to be adjustable depending on the load to be handled.

3. The improved carriage assembly as in claim 1 in which at least one actuating cylinder is operable to rotate said fork arm members between their extended and retracted positions.

4. The improved carriage assembly as in claim 1 in which at least one actuating cylinder is operable to rotate said side arm members between their extended and retracted positions.

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5. The improved carriage assembly as in claim 1 in which at least one actuating cylinder is operable to rotate said center support arm between its extended and retracted positions.

6. The improved carriage assembly as in claim 1 in which a stabilizing pad is positioned on said center support arm having opposed curvilinear surfaces so as to stabilize side by side cylindrical loads.

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