Feb. 25, 1964 H. C. FRENCH ETAL 3,122,250

CONTAINER HANDLING APPARATUS

Filed May 7, 1962 3 Sheets-Sheet 1

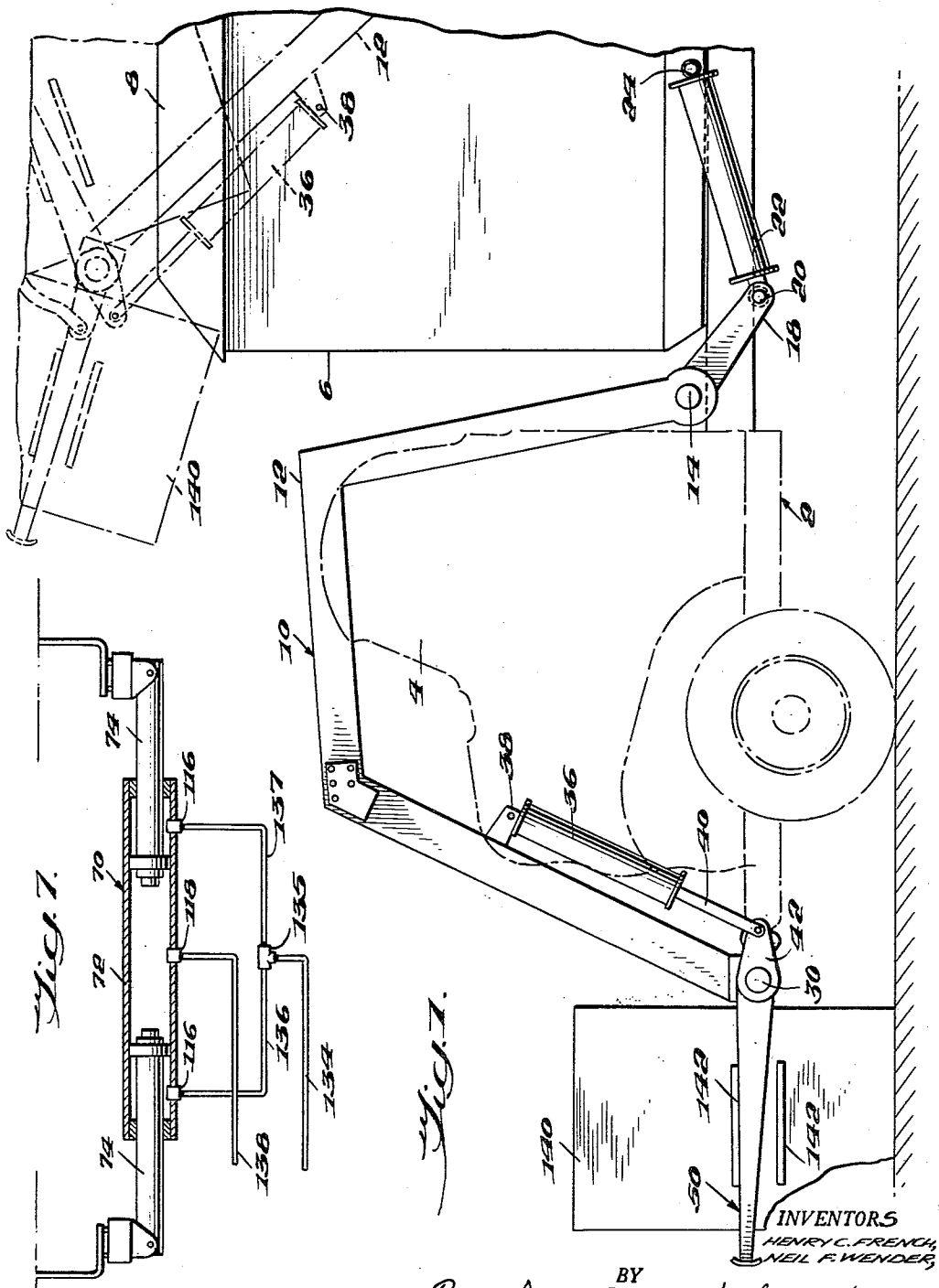

Fig. 1.

Fig. 2.

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Fig. 2.

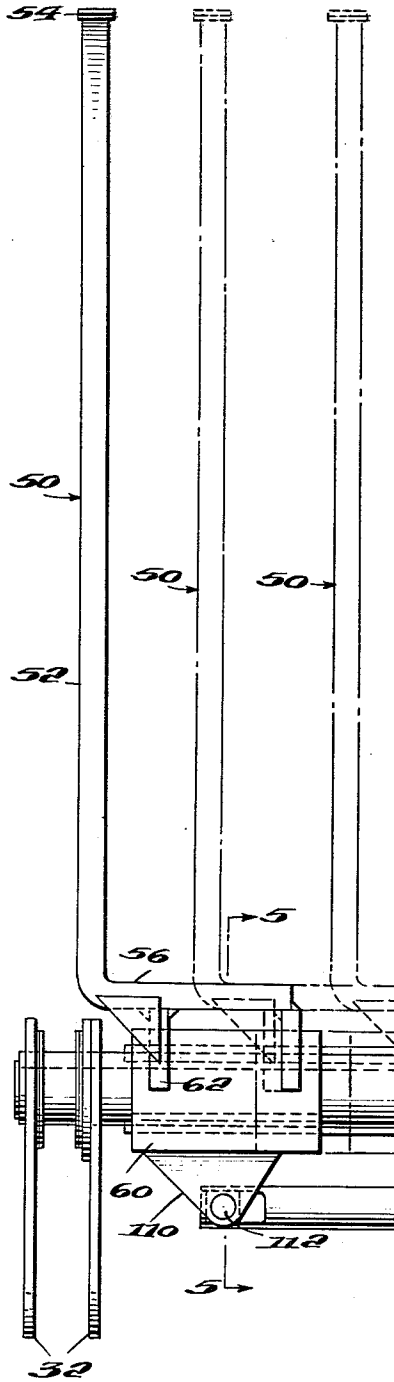
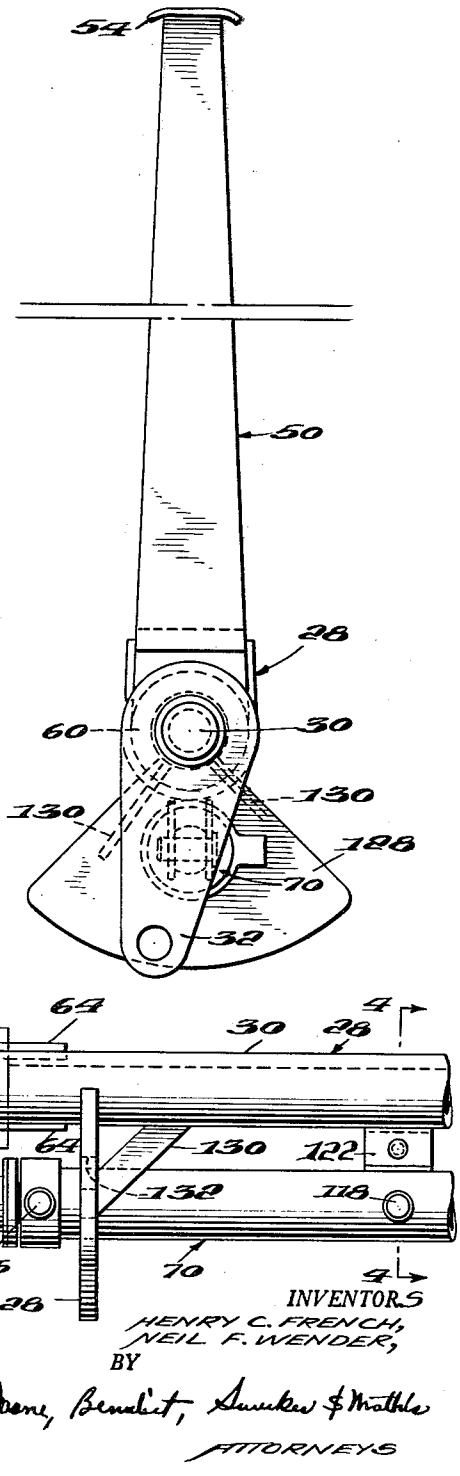


Fig. 3.



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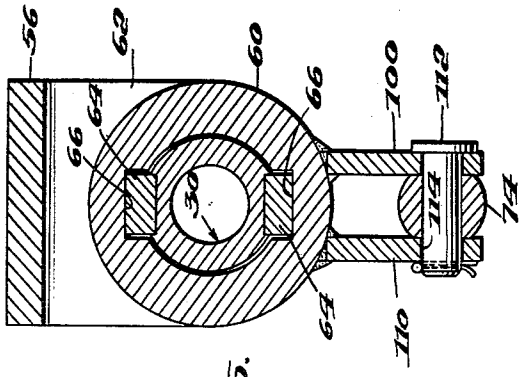

Fig. 5.

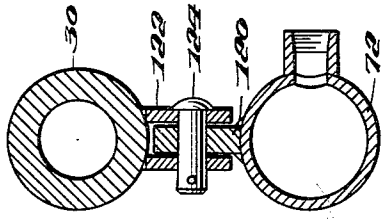

Fig. 4.

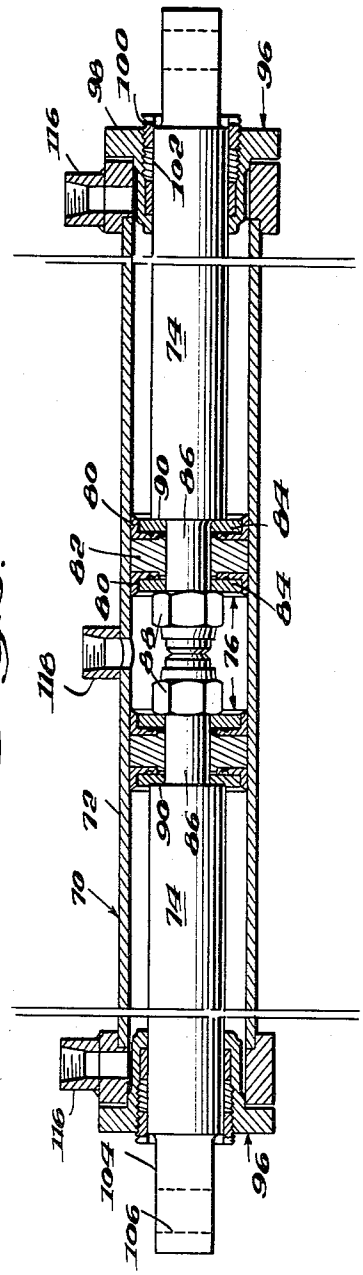

Fig. 6.

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CONTAINER HANDLING APPARATUS

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2 Claims. (Cl. 214—302)

This invention relates to improvements in container handling apparatus of the type used for picking up and dumping the contents of the container into the body of the vehicle. More specifically, this invention relates to improvements in apparatus used in connection with front end loaders whereby various size containers may be accommodated by the loading mechanism. This application is a continuation-in-part of co-pending application Serial No. 68,951, filed November 14, 1960, and now abandoned.

The general type of front end loader to which this invention relates employs a pair of lifting arms pivotally mounted to a vehicle chassis and extending forwardly in front of the cab of the vehicle in position to pickup a separate container which may be sitting on the ground or on a supporting surface in front of the vehicle. Power means are provided for operating the lifting arms so that the container may be swung to an elevated position over the body of the vehicle behind the cab and the contents of the container dumped into the body. The container then may be lowered to the ground, or the container may be transported on the lifting arms to a different location before being lowerd to the ground.

Front end loaders of this general type are described in Patent No. 2,900,096 to George R. Dempster and William A. Herpich. Such lifting mechanism employs a horizontally extending member or torque tube to which fork type members are attached for effecting a detachable connection between the lifting mechanism and the separate container. The torque tube extends between the lifting arms and is located in front of the vehicle when the lifting arms are lowered.

It is common practice in using mechanism of this type to proceed from point to point where various containers are located and to empty the contents of the containers into the vehicle body. Previous types of fork arm arrangements which are provided for engaging a container are fixed permanently to the lifting mechanism. Accordingly, the spacing between the fork arms cannot be varied in order to accommodate containers of various sizes. Attempts have been made in some instances to make the fork arms adjustable, but such devices usually employ a hand-manipulated connection such as nut and bolt arrangements for attaching the fork arms to the lifting mechanism. These previous types of devices are awkward and the adjustment is time consuming since the operator must leave the cab of the vehicle in order to make the adjustment.

One object of this invention is to provide apparatus that serves to connect firmly and safely a separate container and a front end loader lifting mechanism.

Another object of this invention is to provide lifting mechanism using fork arms wherein the fork arms may be adjusted easily to accommodate containers of various sizes.

Anther object of this invention is to provide an improvement in adjustable fork arm devices wherein a relatively simple and inexpensive, yet effective, power mechanism can vary the spacing between the fork arms.

Another object of this invention is to provide a hydraulically adjustable fork arm device which can be applied to existing container lifting mechanism without considerable modification thereof.

These objects may be accomplished according to a

preferred embodiment of the invention by providing the vehicle-mounted lifting arms of a front end loader with a horizontally extending torque tube assembly having a pair of fork arms which are movable towards and away from one another by a power device under the control of an operator located within the vehicle cab. Movement of the fork arms is caused by a hydraulically operated duplex, double-acting cylinder device. The spacing between the fork arms can be varied so that the arms may accommodate containers of various sizes. The containers used in connection with the lifting mechanism are provided at opposite sides with connecting structure adapted to receive the fork arms.

The hydraulically operated cylinder device which is used to adjust the spacing between the fork arms can be operated to spread or close the fork arms so that the fork arms may pass along the sides of a continer and engage the connecting structure on the side thereof. Once a connection has been completed between the lifting mechanism and a container, the lifting arms may be raised by a suitable power device so as to hoist the container above the cab of the vehicle and over the body so that the contents of the container may be dumped into the body. The container may then be lowered to the ground and the container disengaged from the lifting mechanism.

The vehicle may be driven to a new point where another container is located. The spacing between the fork arms may be adjusted according to the size of the container by operating the fork arm power device so that the container dumping operation may be repeated.

This embodiment of the invention is illustrated in the accompanying drawings in which:

FIG. 1 is a side elevation view of a vehicle having a refuse receiving body and equipped with a lifting mechanism, which mechanism is shown in detachable engagement with a container;

FIG. 2 is an enlarged plan view of the left-hand portion of the torque tube assembly of the lifting mechanism and showing a fork arm in various positions;

FIG. 3 is an end view of the torque tube assembly;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is a section view of the power device of the torgue tube assembly; and

FIG. 7 is a diagrammatic view of a portion of a fluid control system for the power device.

In FIG. 1 there is illustrated the type of front end loading equipment to which this invention may be applied. It is customary to use a vehicle of the character generally illustrated and indicated by reference numeral 2, and which is self-propelled under control of an operator located in a cab 4.

A body 6 is mounted on the vehicle chassis behind the cab 4 and may be of any suitable type adapted to receive material such as refuse, trash and the like. The body may be equipped with a packer mechanism for compressing material as it is deposited in the body. Preferably, the body 6 is provided with a filling opening or hopper 8 in the top near the front of the body through which material may be dumped. The character of the body may be varied otherwise as desired.

The lifting mechanism 10 used in connection with the vehicle 2 includes a pair of lifting arms 12 spaced apart a distance substantially corresponding with the width of the cab 4. These lifting arms may be of gooseneck shape or inverted U-shape, for example, so as to extend over the top and downwardly in front and back of the cab 4, as illustrated in FIG. 1. Other types of lifting arms may be used as well.

At the back of the cab 4, the lower ends of the lifting arms 12 are fixed on a rear horizontal member or torque tube 14 which extends substantially from one side of the vehicle to the other. The torque tube 14 is journaled in bearing boxes which are fixedly mounted on the vehicle chassis. In this manner, the arms 12 are pivotally mounted to the vehicle 2. Lever arms 18 are fixed on the torque tube 14 and extend downwardly therefrom. The free ends of the lever arms 18 are pivotally connected at 20 to suitable power devices 22 which, for example, may be conventional hydraulic cylinder assemblies. Each power device 22 is pivotally connected at 24 to the base of the body 6 by means of a suitable bracket. Other arrangements for raising and lowering the lifting arms 12 may be employed. For example, the power device could be connected to the vehicle chassis or the piston rod thereof could be connected directly with the lifting arms 12, rather than to a lever arm 18.

A torque tube assembly 28 (FIGS. 2 and 3) is located at the front of the vehicle 2, and includes a generally horizontally extending torque tube 30 connecting the lifting arms 12. A pair of lever arms 32 are connected at each opposite end of the torque tube 30 and extend perpendicularly therefrom. The torque tube 30 is journaled to the lifting arms 12 at points between the lever arms 32. A power device 36, for example a conventional hydraulic cylinder assembly, is connected by means of a bracket 38 to each lifting arm 12 and has a piston rod 40 pivotally connected at 42 with a corresponding pair of lever arms 32. Actuation of the power device 36 to extend and retract the piston rods 40 causes rotation of the torque tube 30 with respect to the lifting arms 12.

The torque tube assembly 28 is provided with a pair of fork arms 50, one at each opposite side thereof. Each fork arm 50 has a longitudinal portion 52 which extends perpendicularly away from the torque tube 30. A toe plate 54 may be attached on the free end of the fork arms. A leg portion 56 of the fork arm 50 extends generally parallel with the torque tube 30.

Each fork arm 50 is mounted to the torque tube 30 by a sleeve member 60 (FIGS. 2, 3 and 5). The leg portion 56 of the fork arm 50 is connected rigidly with the sleeve 60 by suitable plate members 62. The inside diameter of the sleeve member 60 is slightly larger than the outside diameter of the torque tube 30 and in this manner the sleeve member 60 may slide easily along the torque tube 30. A pair of bars 64 are fixed along opposite sides of the torque tube 30 for a short distance adjacent the ends thereof. The inside of the sleeve member 60 has cut-away portions or key-ways 66 which receive the bars 64. Cooperation between the bars 64 and the key-ways 66 prevents rotation of the sleeve member 60 with respect to the torque tube 30 but allows the sleeve member 60 to slide lengthwise along the torque tube 30 in guided fashion. This bar and key-way arrangement affords considerable strength for resisting the forces which tend to rotate the fork arms 50 with respect to the torque tube 30 during a container dumping operation.

Each fork member 50 can be moved transversely with respect to the vehicle due to the sliding engagement of the sleeve members 60 and the torque tube 30. The fork arms 50 are moved towards or away from each other to adjust the spacing therebetween by a hydraulically actuated power device 70 which includes a cylinder member 72, a pair of piston rods 74 and piston assemblies 76 mounted on the inside end of the respective piston rods 74. The cylinder member 72 and the piston rods 74 are of suitable length to extend generally through the length of the torque tube 30.

Each of the piston assemblies 76 includes a pair of seal members 80 on opposite sides of a backup disc 82. The seal members 80 are held against the disc 82 by retaining rings 84. The seal members 80, the disc 82 and the rings 84 fit over a reduced end portion 86 of the piston rod 74. A nut member 88 which is threaded on the end of the reduced portion 86 cooperates with a shoulder portion 90 to hold the seals 80, disc 82 and rings 84 in the assembled relationship shown in FIG. 6.

The piston rods 74 extend in opposite directions longitudinally out of the cylinder member 72 through end cap assemblies 96 which seal the ends of the cylinder 62. Each end cap assembly 96 includes a cap member 98 and a sleeve 100 which cooperate to retain suitable packing elements 102 around the piston rod 74.

The free end of each piston rod 74 has a reduced portion 104 with a hole 106 therethrough. The reduced portion 104 fits between a pair of spaced-apart plate members 110 which are secured rigidly to the corresponding sleeve member 60. A pin device 112 fits through aligned holes 114 in the plate members 110 and through the hole 106 in the reduced portion 104. In this manner, the free end of piston rods 74 are connected with the corresponding sleeve members 60 and fork arms 50.

The power device 70 is provided at its opposite ends with suitable fluid inlet assemblies 116 through which fluid under pressure may be introduced into the ends of the power device 70. At the midportion of the cylinder 72 there is provided a fluid supply connection 118 for introducing fluid under pressure into the midportion of the cylinder between the two piston assemblies 76.

Fluid under pressure may be introduced into the power device 70 through the inlet assemblies 116 to act on the piston assemblies 76 in order to move the piston rods 74 toward their extreme retracted or closed position, as illustrated in FIG. 6. Fluid under pressure may be introduced through the inlet assembly 118 to act on the piston assembly 76 to move them apart and thereby move the piston rods 74 to an extended position. By proper operation of the device 70, the fork arms 50 can be moved simultaneously to adjust the spacing between the fork arms. Various positions of one of the fork arms 50 are illustrated in FIG. 2.

The power device 70 is attached to the torque tube 30 by means of a tongue member 120 fixed to the cylinder member 72 and extending between a pair of clips 122 fixed onto the torque tube 30. A pin device 124 extends through aligned holes in the tongue member 120 and the clips 122. The entire power assembly 70 can pivot about the pin device 124 in order to allow a slight shift to prevent binding between the sleeve members 60 and the torque tube 30 when the sleeve members 60 slide back and forth.

Segment-shaped bumper plates 128 may be fixed to the torque tube 30 in position to contact the bumper of the vehicle 2 when the lifting arms 10 are lowered. Gussetts 130 may be provided for strengthening the bumper plates 128. The power device 70 passes through suitable holes 132 in the bumper plates 128. These plates 128 serve to support the lower end of the lifting arms 12 against undesirable movement toward the vehicle when the lifting arms are lowered and contact is made with a container.

In FIG. 7 there is illustrated diagrammatically the power device 70 and a fluid pressure supply line arrangement which may be employed for actuating the power device. A line 134 from a suitable source of fluid pressure connects with a T 135. Two lines 136 and 137 extend from the T 135 to opposite ends of the power device 70 where connection is made at the inlet assemblies 116. Fluid under pressure from the line 134 is distributed equally through the T 135 and into the lines 136 and 137 and then into opposite ends of the cylinder 72. The fluid pressure acting on the piston assemblies 76 in this manner retracts the piston rods 74 with an equalizing force.

A second line 138 from a suitable source of fluid pressure is connected to the midportion of the cylinder 72 at the inlet assembly 118. Fluid pressure from the line 138 may enter the cylinder 72 to act on both piston assemblies 76 to extend the piston rods 74 and spread apart the fork arms 50. Suitable valves, as necessary, may be

provided for controlling the flow of fluid pressure in the lines 134 and 138. These valves may be located within the cab 4 of the vehicle so that the operator may adjust the spacing between the fork arms 50 without leaving the cab.

The double-acting, duplex type power device 70 may be replaced by two conventional double-acting hydraulic cylinders positioned in relationship with the torque tube assembly 28 as described with respect to the power device 70, if desired.

A container which may be used with the lifting mechanism 10 is illustrated in FIG. 1 and designated by reference numeral 140. The sides of the container are provided with pairs of bar members 142 spaced apart and disposed substantially horizontally for receiving therebetween a fork arm 50. Channel-shaped sleeve members may be provided along the sides of the container instead of the bar member 142. Such channel-shaped sleeve members present horizontally extending pockets for receiving the fork arms 50.

It not infrequently happens that the containers to be handled by the lifting mechanism are of different capacities, and the side-to-side dimensions of the containers vary. Accordingly, the fork arms 50 must be adjusted to accommodate such variances so that the torque tube assembly 28 may effect a releasable connection with any one of the containers.

The lifting mechanism is operated as follows to dump the contents of the container 140 into the body 6. In order to effect a connection between the lifting mechanism 10 and the container 140, the vehicle 2 is maneuvered so that the front of the vehicle is adjacent the container 140. The power device 70 of the torque tube assembly 28 is actuated by the operator while located in the cab 4 to spread apart or close the fork arms 50 so that they may pass along the sides of the container 140. The power devices 36 may be actuated under the control of an operator to rotate the lever arms 32 which in turn rotate the torque tube 30 so as to properly align the fork arms 50 for entrance between the pair of bar members 142, or a channel-shaped sleeve member, connected to the sides of the container 140. The leg members 56 of the fork arms 50 serve to provide a rest or bearing surface for the container and to protect the torque tube 30.

After a connection between the lifting mechanism and the container 140 has been established, the power devices 22 may be operated to swing the arms 12 upwardly to hoist the container 140 over the cab and into dumping position above the hopper 8 of the body 6. Simultaneously, the fork arms 50 may be actuated by the power devices 36 to rotate slightly in a counterclockwise direction, with reference to FIG. 1, so that the container 140 may be kept tilted slightly toward the vehicle but substantially upright during its swinging movement over the body 6. Once the container 140 is above the hopper 8, the fork arms 50 may be rotated in a clockwise direction far enough so that the container 140 is inverted to dump the contents thereof through the hopper 8 and into the body 6.

After the container has been emptied, the power devices 36 are operated to rotate the fork arms 50 so that the container 140 will be returned to a generally upright position. Then, the lifting arms 12 are lowered by actuation of the power devices 22 to set the container down in front of the vehicle 2. The vehicle then may be backed up so that the fork arms 50 will move out of engagement with the container 140. The vehicle may then be driven to another container similar to the container 140 and the dumping operation may be repeated.

Customarily, the vehicle and lifting mechanism 10 may be used to empty several containers in one day. Frequently, the containers encountered are of different sizes. Considerable time may be saved because the operator does not have to leave the cab in order to adjust the spacing between the fork arms to accommodate containers of various sizes. The hydraulically adjusted fork arms may be applied to various types of existing loading apparatus which previously have had fixed type fork arms.

While the invention has been illustrated and described in a certain embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

We claim:

1. In container handling equipment of the character described, the combination of a pair of lifting arms pivotally mounted at one end to a vehicle for raising and lowering movement with respect to the vehicle, a torque tube extending between the other ends of the lifting arms and journaled to the lifting arms for rotational movement with respect to the lifting arms, sleeve members movable along the torque tube, means between the torque tube and the sleeve members for guiding the sleeve members along the torque tube and for preventing rotational movement of the sleeve members with respect to the torque tube, a fork arm attached to each sleeve and extending away from the torque tube, and power means on the torque tube for moving the sleeve members along the torque tube, said power means including a fluid actuated cylinder device pivotally mounted to the torque tube.

2. In container handling equipment of the character described, the combination of a pair of lifting arms pivotally mounted at one end to a vehicle for raising and lowering movement with respect to the vehicle, a torque tube extending between the other ends of the lifting arms and journaled to the lifting arms for rotational movement with respect to the lifting arms, sleeve members movable along the torque tube, means between the torque tube and the sleeve members for guiding the sleeve members along the torque tube and for preventing rotational movement of the sleeve members with respect to the torque tube, a fork arm attached to each sleeve and extending away from the torque tube, and power means on the torque tube for moving the sleeve members along the torque tube, said power means including a fluid actuated cylinder device pivotally mounted to the torque tube, and piston rods extending from the cylinder device and pivotally mounted to the sleeve members.

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