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CONTROL SYSTEM FOR PREVENTING THE OPENING OF A CLAMP DEVICE ON A LIFT TRUCK WHEN THE TRUCK IS IN MOTION

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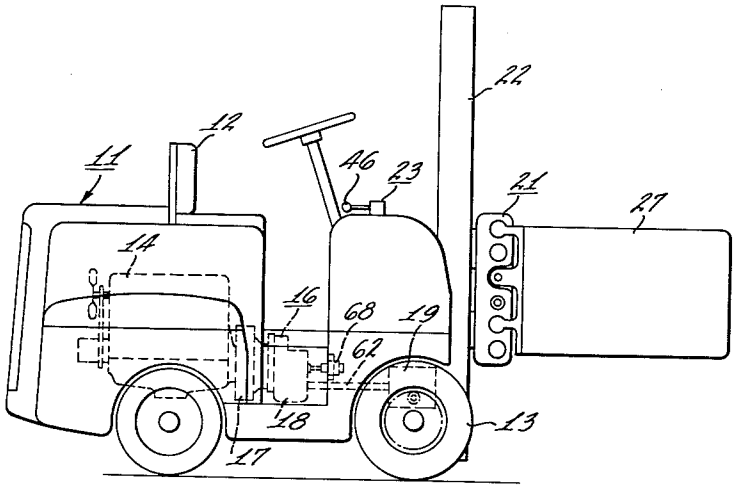


Fig. 1

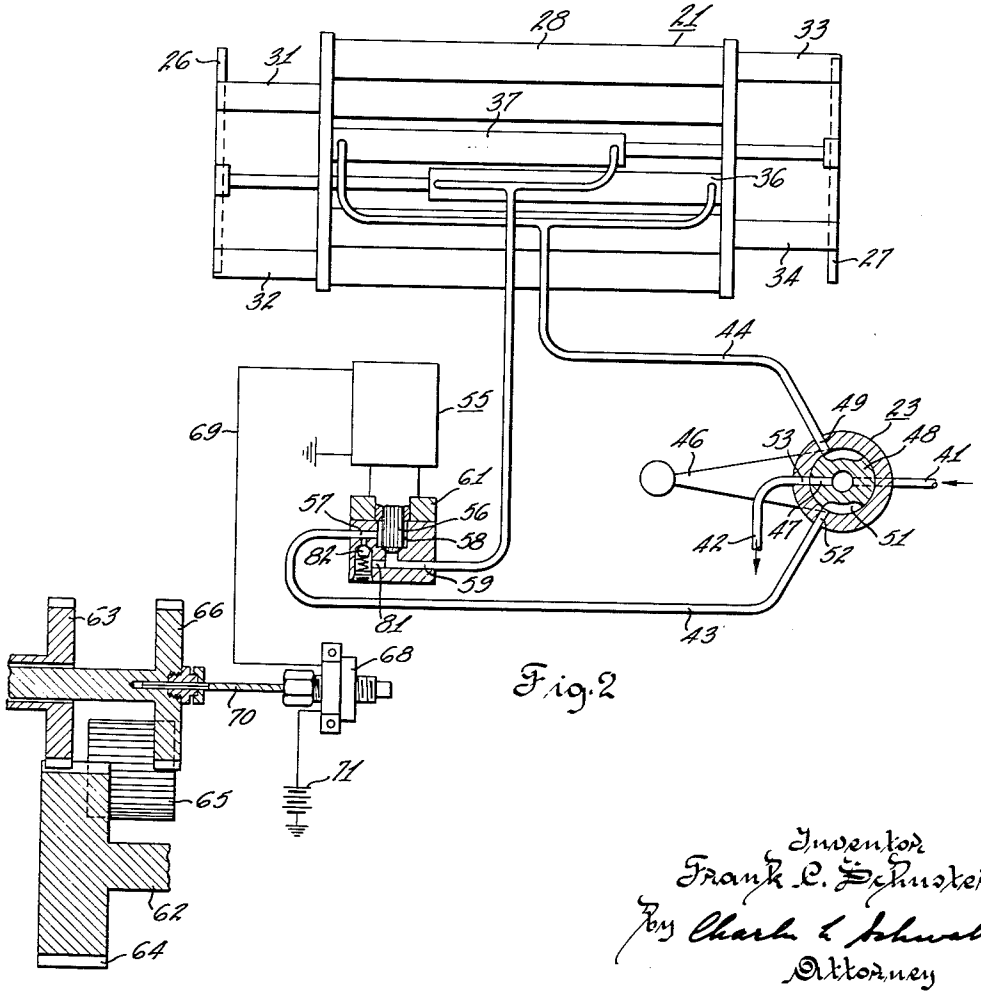


Fig. 2

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CONTROL SYSTEM FOR PREVENTING THE OPENING OF A CLAMP DEVICE ON A LIFT TRUCK WHEN THE TRUCK IS IN MOTION

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This invention relates to a control system for a lift truck attachment and particularly to a means for insuring safe operation of a gripping type attachment.

Attachments available for lift trucks include special devices for handling materials other than by the lift fork method. Among the special devices available are clamp arms with grip the item handled by hydraulically operated arms which grip the item handled by hydraulically operated side arms. When the load is transported, it is possible for the operator to accidently move the control valve which regulates the motion of the arms, and therefore it is possible to accidently drop the load while the truck is in motion.

It is an object of this invention to provide a hydraulic control system for a lift truck attachment of the gripping type wherein means are provided to automatically prevent release of the gripping arms of the attachment when the vehicle is in motion.

More specifically, it is an object of this invention to provide automatically operated shutoff means in the hydraulic control circuit for the hydraulically operated jack of the lift truck clamp attachment which prevents flow of fluid from the clamping side of the hydraulic jack when the vehicle is in motion.

As beforementioned, it is desirable to provide means to prevent the clamp attachment from being opened while the vehicle is in motion. However, in order to provide the shortest possible working cycle in operating the lift truck, it is desirable to be able to close the clamp arms after the load has been deposited and while the lift truck is moving.

Accordingly, it is an object of this invention to provide a safety system of the hereinbefore outlined type wherein the clamp arms may be closed while the truck is in motion.

These and other objects and advantages of this invention will be apparent from the following description when read in conjunction with the drawings in which:

FIG. 1 is a side view of a material handling vehicle having a hydraulically operated clamp attachment mounted thereon, and

FIG. 2 is a schematic view of the control system for the clamp attachment of FIG. 1 incorporating the safety system of this invention.

Referring to FIG. 1, the lift truck 11 includes an operator's station 12 and a pair of driving wheels 13 which are driven by the engine 14 through a power train 16 including a torque converter 17, change speed transmission 18 and final drive mechanism 19. A gripping or clamp attachment 21 is reciprocally carried on a conventional lift mast 22, and a hydraulic control valve 23 is provided at the operator's station for convenient manual operation by the operator.

Referring to FIG. 2, the clamp attachment 21 has gripping arms 26, 27 secured to slides 31, 32 and 33, 34 which in turn are slidably supported on a carriage 28. Double

acting hydraulic jacks 36, 37 are operatively interposed between the carriage 28 and the arms 26, 27, respectively. A hydraulic control system is provided on the truck for the clamp attachment which includes an engine driven pump, not shown, supplying pressure fluid to the control valve 23 through a supply conduit 41. The control valve 23 as illustrated in FIG. 2 is in a hold position wherein fluid from the pump passes to a sump through a return conduit 42 and hydraulic jack supply conduit means in the form of conduits 43, 44 are blocked at the control valve 23. Conduit means 43 is connected to the rod end of jacks 36, 37 and conduit means 44 is connected to the closed end of jacks 36, 37.

When the manual lever 46 secured to the shiftable valve element 48 is moved upwardly, as viewed in FIG. 2, until delivery port 47 is aligned with jack supply port 49, the jacks 36, 37 will be expanded by delivery of fluid through conduit means 44 and fluid will be exhausted from the rod end of the jacks 36, 37 to sump through conduit means 43 by way of recess 51 of the rotor element 48 which will bridge jack supply port 52 and exhaust port 53. The exhausting of fluid through conduit means 43 presupposes that the electrically controlled shutoff valve 55 in the conduit means 43 is in an open position rather than the closed position illustrated in FIG. 2. The electrically controlled shutoff valve 55 is a solenoid valve having a valve plunger 56 which is electrically shiftable upwardly from its illustrated closed position to the open position in which fluid will flow through passages 57, 58 and 59 in the shutoff valve housing 61.

Rotation of the driving wheels 13 will always be attended by rotation of rotary power transmitting elements of the power train 16 which are in constant driving relation to the wheels, such as transmission output shaft 62 and transmission gears 63, 64, 65, 66. These elements are known as ground driven elements since they rotate when the vehicle is in motion even though the engine or transmission clutches are disengaged. This indicia of vehicle motion is used to control the electrically operated shutoff valve means 55 by providing an electrical control circuit 69 including a rotary motion sensitive switch 68 connected to ground driven gear 66 by flexible shaft 70. The electric control circuit 69 includes a battery 71 which is the usual battery provided for internal combustion engine driven lift truck illustrated in FIG. 1.

As illustrated in FIG. 2, the vehicle is in motion and the switch 68 is open thereby deenergizing the solenoid valve 55 thus permitting the biased plunger 56 to move to its closed position. When the vehicle is not moving, the switch 68 closes thereby energizing the solenoid valve 55 thereby moving the plunger 56 to its open position.

Thus if the operator should accidently move the control lever 46 upwardly as viewed in FIG. 2 to a clamp open position in which supply port 47 is aligned with jack supply port 49, the clamping arms will not open because the fluid is blocked in the opposite ends of the equal diameter jacks by valve plunger 56 of the solenoid valve means 55.

Inasmuch as it is not dangerous to cause the clamp arms to move toward each other when the vehicle is in motion, I have provided means which will permit such action. Specifically, I provide a one way valve means in the form of a check valve 82 which permits closing the clamp even when the vehicle is in motion. The one way valve means is dispossed in a bypass passage 81 interconnecting pas-

sages 57 and 59 in bypassing relation to valve means 55. One of the advantages of being able to close the clamps while the vehicle is in motion is that of saving time during the work cycle. For instance, it is desirable to close the clamps while moving away from a deposited load, thus saving work cycle time. It is often desirable to close the clamp after load deposit to provide greater driving maneuverability.

From the foregoing description, it is apparent that I have provided a novel safety system which automatically prevents opening of a gripping attachment, but permits closing thereof, while the lift truck is in motion.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a self-propelled vehicle having an operator's station and a pair of wheels driven by a power train including rotary ground driven elements, the combination comprising:

an attachment operatively supported on said vehicle having

load gripping elements and

a hydraulic jack for operating at least one of said load gripping elements, and

a control system on said vehicle for operating said hydraulic jack including

a hydraulic control valve at said operator's station having open, close and hold positions,

fluid conduit means connecting said hydraulic jack to said control valve,

electrically operated shutoff valve means in said conduit means having an open position in which free flow of fluid in said conduit means is permitted and having a close position in which fluid flow in said conduit means from said jack is prevented, and an electrical control circuit for operating said shutoff valve means including a rotary motion sensitive switch connected to one of said ground driven elements, said shutoff valve means being moved to its closed position when said vehicle is in motion.

2. The structure set forth in claim 1 and further comprising means permitting actuation of said hydraulic jack to cause a load gripping function when said shutoff valve means and control valve are in their close positions.

3. In a lift truck having a pair of driving wheels and a power train for said wheels including rotary power transmitting elements in constant driving relation to said wheels, the combination comprising:

a clamp attachment,

a hydraulic jack for opening and closing said attachment,

a hydraulic control system for operating said hydraulic jack including a control valve, and

a safety mechanism for preventing opening of said attachment while said driving wheels are rotating including automatically operated shutoff valve means.

4. The structure set forth in claim 3 wherein said shutoff valve means includes a solenoid valve in said hydraulic control system between said control valve and jack having open and closed positions and electric means for causing said solenoid valve to assume its closed position when said driving wheels are rotating.

5. The structure set forth in claim 4 wherein said electric means includes a rotary motion sensitive switch connected to one of said rotary power transmitting elements.

6. The structure set forth in claim 5 and further comprising means permitting said jack to close said clamp when said driving wheels are rotating.

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