CONTROL APPARATUS FOR A HOISTING TRUCK

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CONTROL APPARATUS FOR A HOSTENG TRUCK
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The present invention relates to a hoisting system and has particular reference to improvements in hydraulic hoists, such as often used on dump trucks and the like.

It is one of the objects of the invention to provide means for subjecting the operating liquid of said device to different pressures in various stages of the hoisting operation as it is desirable in operating a hydraulic telescoping piston type hoist.

Another object of the invention is to provide compressed air as the primary power of the hydraulic hoisting means.

Another object of the invention is to provide the hoist with a plurality of cylinders and plungers and a pneumatically actuated piston, said arrangement being operated as a plurality of intensifiers which come into consecutive operation.

In a preferred form of the invention the intensifying effects are achieved by having a large-size piston driven by compressed air and by causing the latter to operate at least one plunger or and one cylinder of smaller cross section than the cylinder in which said piston reciprocates.

It is another object of the invention to provide an automatic hoisting means, the automatic operation being achieved for instance by the motion of the piston.

The present invention in its broadest aspect consists of a method and apparatus for producing a plurality of different pressure stages for the purpose of liquid-operating said apparatus, said pressure liquid being used for a hydraulic telescoping piston-type hoist in several consecutive stages.

Preferably the apparatus comprises a liquid pressure producing means for operating a hydraulic telescoping piston-type hoisting device, said means having a source of compressed air, a cylinder connected to said source of compressed air, a piston for reciprocating in said cylinder through the action of said compressed air, a first liquid-cylinder, a first plunger forced by said piston into said first liquid-cylinder, a second liquid-cylinder rigidly connected to said piston, an open type second plunger rigidly connected to the cylinder of the piston and disposed inside the latter, on which the piston may reciprocate.

In a preferred embodiment of the invention the first liquid-cylinder is substantially attached in the direction of the piston-cylinder with the first plunger detachably arranged in said piston and the second liquid-cylinder is provided for moving together with the first plunger during the forward stroke of the reciprocating motion.

In another preferred form of the invention a valve is provided in the liquid pressure system adapted to be opened during the forward stroke of the piston and closed during the backward stroke of the piston whereby the system operates as an intensifier in both directions of the movement of the piston, the ratio of intensity being greater during the backward stroke than during the forward stroke.

The invention both as to its construction and to its method of operation together with additional objects and advantages thereof will be best understood from the following specification and the drawing relating thereto in which:

Fig. 1 is a diagrammatic side elevation of the hoist mechanism showing the dump body of a vehicle during the first stage of the hoisting operation, and

Fig. 2 is the side elevation of Fig. 1 showing the second stage of the hoisting operation.

Referring now to Figs. 1 and 2, 21 indicates a base plate of a vehicle (not shown) the base plate having a joint 20 on the one end and a hydraulic hoisting device 12 connected to said plate by means of a ball joint 22.

The hoisting device 12 is of the hydraulic telescoping piston type, in which various pistons of different diameters telescope into each other. Mounted on the joint 20 is a dump body 13 adapted to be tilted by swinging it about the horizontal pin of joint 20, the upper end of the hoisting device 12 being connected to the dump body by means of ball joint 23, so that the hoisting device may swing in any direction. This is particularly important, because the angle of inclination of said device will change as the dump body is tilted and secondly because no injury should be caused to the operating mechanism 12 by an inadvertent sidewise deflection of the dump body during loading or unloading.

For raising and lowering the hoisting device a special arrangement is provided which is conveniently located below the base plate 21 so as to make the necessary pipe connections as short as possible. This arrangement comprises a main cylinder 8 in which a piston 1 is slidably disposed. From the right and left chamber of said cylinder 8, pipe lines 14 and 26 communicate with a control unit 10 having an inlet 21 communicating with an air supply line and an outlet 25 connecting the unit 10 with the atmosphere. The various positions of said control unit are hereinafter described in detail. In case the necessary movement of the piston is shorter than the inside space of cylinder 8, filling discs 16 may be inserted into the cylinder and attached to the piston in order to reduce the space adjacent piston 1. So, the amount of compressed air required for the complete cycle of the hoisting device is correspondingly reduced.

Cylinder 8 has an extension 3 in which a plunger 2 is carried by a cylinder 7 rigidly connected to piston 1. Plunger 2 is guided by its right inwardly bent end flange when sliding on cylinder 7 and by an annular seal 24 mounted at the right end of cylinder 3 and is detachable from piston 1. A stationary plunger in tube 6, open on both ends, extends axially along the inside of cylinder 7 through piston 1 and the filling discs, if any, and is rigidly combined at the right side end of cylinder 8. A seal 25 secures the main space of cylinder 8 against the inside space of cylinder 7.

Mounted on the end plate of cylinder 8 is a T-shaped pipe 5 which communicates with plunger 6 and also, through two pipe lines 4 and 4', with the hollow inside space of the hoisting device and the inside space of cylinder 3. The communication line 4' is joined to a valve 9 which may be automatically actuated by means not shown, for instance by operation of piston 1.

When the dump body is in its lowermost position, that is when the bed of said body is practically horizontal, the entire hollow space of the pipe lines 4 and 4' with T-shaped pipe 5 and the inside spaces of cylinder 3, cylinder 7 and plunger 6 are filled with a liquid, for instance oil, while the inside space of cylinder 8 as well as the pipe lines 26 and 14 are filled with air.

The operation of the hoisting device and of the pressure producing mechanism will now be described in detail. To start the hoisting device, control unit 10 is actuated by suitable means, for instance by a linkage or a conduit and cable not shown. This may be operated from any convenient place, such as from the driver's seat. Control unit 10 is mounted so that the supply of compressed air entering said unit through inlet 11 com-
communicates with the right chamber of cylinder 8 through line 14, while the left chamber is connected through line 26, by control unit 10 and outlet 15. Piston 1 together with filling discs 16 moves now to the left in the direction of arrow 30, Fig. 1, and slides thereby along the inside of cylinder 8 and the outside of plunger 6. During this operation plunger 2 with its right flanged end portion 17 and piston 1 has forced itself into the oil filled space of cylinder 3. During this motion of piston 1 valve 9 is opened automatically through the operation of said piston. The oil inside cylinder 3 is thus forced through lines 4 and 4' to the hoisting device, part of this oil branching off at T-shaped pipe 5 and entering, through plunger 6, into the inside space of cylinder 7 which is enlarged during the leftward stroke of piston 2. The pressure producing mechanism operates as an intensifier in a way that the pressure in the oil filled system and thus in the hollow pistons of the hoisting device is increased proportionally to the compressed air pressure acting on piston 1 according to the ratio of the cross sections of piston 1 and plunger 2. This permits a step up of the pressure of the compressed air of 85 lbs./sq. in. to a pressure of 1700 lbs./sq. in. in the oil pressure system. The large piston or pistons of the hoisting device are thereby raised and the body formed accordingly. When piston 1 has completed its leftward stroke at least the first telescoping piston of the hoist will be completely raised, said piston requiring the largest volume of pressure liquid and having besides the largest diameter. Now control unit 10 and valve 9 are automatically actuated in a way that the latter is closed and the source of compressed air is connected through line 26 to the left chamber of cylinder 8, while the right chamber is combined with the outside air through line 14, control unit 10 and outlet 15.

During the leftward stroke, plunger 2 and cylinder 7 have moved in unison, plunger 2 remaining during the right stroke of piston 1, as shown in Figure 2, inside cylinder 3 due to its frictional contact with seal 24. When piston 1 moves to the right together with cylinder 7 rigidly fixed to the piston, the arrangement operates as an intensifier, the pressure of the compressed air now rising according to the ratio of the cross sections of piston 1 and cylinder 7. As this ratio is materially greater than that of the first described intensifier, due to the smaller cross section of cylinder 7, the pressure in the oil system is correspondingly higher and may easily reach twice that produced by the first.

The oil is now forced through plunger 6, through T-shaped line 5 and through line 4 to the telescoping pistons of the hoisting device 12. This increased pressure is used for raising the remaining piston or pistons of smaller diameters, so that the total force available for hoisting may be practically the same as before, when the diameter of the piston was larger and the pressure available, smaller.

Hoisting may be stopped at any time by cutting off the compressed air supply, or it may be terminated automatically according to the position of the dump body.

The dump body is lowered by connecting both chambers of cylinder 8 with the outside air, the weight of the dump body being then sufficient, to force the oil from the telescoping pistons of hoisting device 12 back into cylinder 3, whereby plunger 2 is taken back into its initial position, adjacent the left side of piston 1, as shown in Figure 1.

We have in the foregoing illustrated and described the invention in one particular embodiment, but we do not wish to be limited to the exact constructions shown, since various modifications and structural changes may be made within the scope of the invention.

Without further analysis, the foregoing will so fully reveal the objects and features of our invention, so that others can, by applying current knowledge, readily refer to it for various applications. Features that, from the standpoint of prior art, fairly constitute essential characteristics of the general or specific aspects of this invention should be respected hereby. Such adaptations should comprehend the meaning and range of equivalence of the following claims.

What we claim as new and want to secure by Letters Patent is the following:

1. A control apparatus for a hoisting truck having a hydraulic hoisting device for a main body of the truck, comprising a main cylinder, a piston slidably mounted in the cylinder, an extension cylinder having a hydraulic fluid medium therein and adjacent to the main cylinder, a cylinder connected to the piston at one end with the other end thereof closed and extending into the extension cylinder, a hollow plunger of lesser diameter than the extension cylinder and slidably mounted over the cylinder connected to the piston and extending into the extension cylinder, a fluid control unit in communication with the main cylinder at both ends thereof, by pipe means and conduit means providing hydraulic communication between the latter, the hoisting device and the internal space in the cylinder of the extension cylinder, in which a seal is provided in the space between the extension cylinder and the plunger.

2. A control apparatus according to claim 1, in which a control valve is provided in the conduit means between the extension cylinder and the internal space in the cylinder connected to the piston.

3. A control apparatus according to claim 1, in which the medium for operating the piston and plunger is compressed air and the medium in the extension cylinder, hoisting device and conduit means is a hydraulic fluid.

4. A control apparatus according to claim 1, in which the cylinder connected to the piston telescopes into the plunger and the latter telescopes into the extension cylinder, and in which a seal is provided in the space between the extension cylinder and the plunger.

5. A control apparatus according to claim 1, in which the conduit tube is secured to one end of the main cylinder the other end opening into the interior space of the cylinder which is connected to the piston, and by which in the said conduit means from the cylinder is connected with the interior space of the cylinder connected to the piston and the hoisting device to intensify the pressure of the hydraulic medium to the hoisting device relative to the medium in the control unit and the main cylinder.

6. A control apparatus according to claim 1, in which the extension cylinder, the plunger and the cylinder connected to the piston telescope one within another.

7. A control apparatus according to claim 1, in which a conduit tube is secured to one end of the main cylinder the other end opening into the interior space of the cylinder which is connected to the piston, whereby hydraulic communication is effected between the interior of said cylinder connected to the piston, the extension cylinder and the hoisting device to intensify the pressure of the hydraulic medium to the hoisting device relative to the medium in the control unit and the main cylinder, said tube also extending centrally through the piston, the latter piston being slideable on the tube.

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