Sept. 19, 1933. J. P. HEIL 1,927,031

HOIST

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Fig. 1.

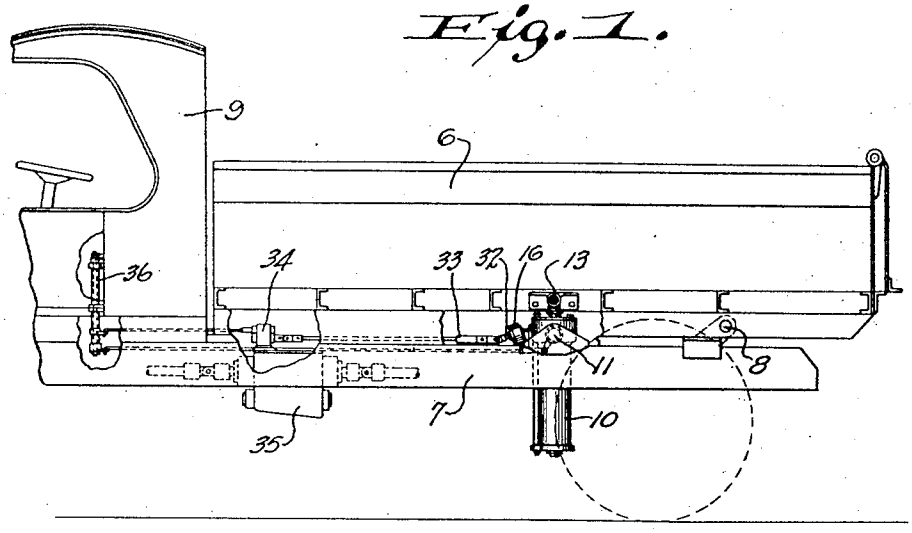
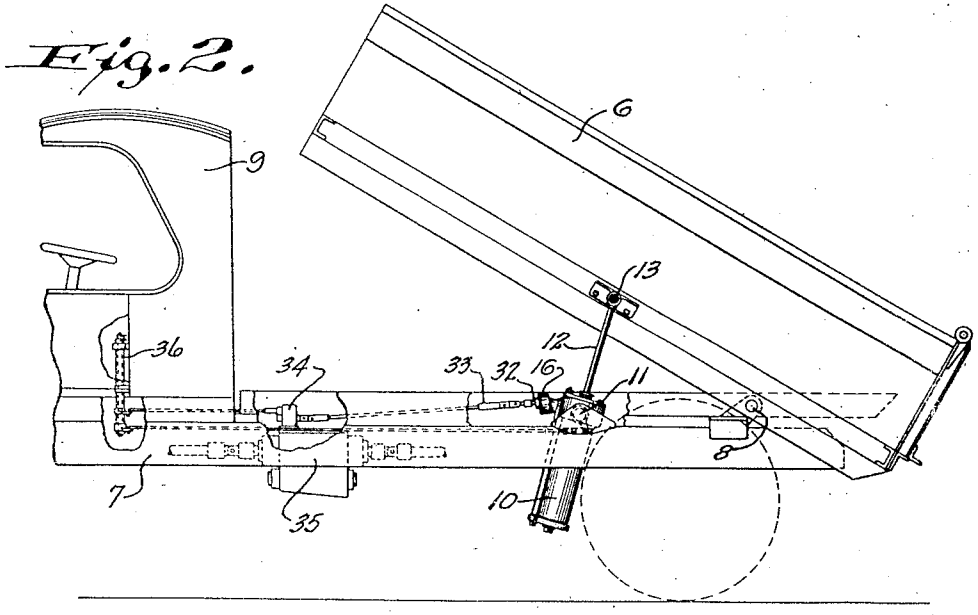


Fig. 2.



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Fig. 4.

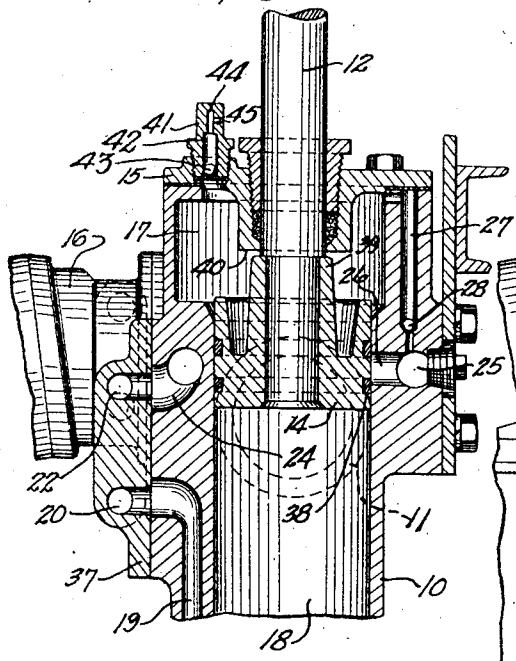


Fig. 3.

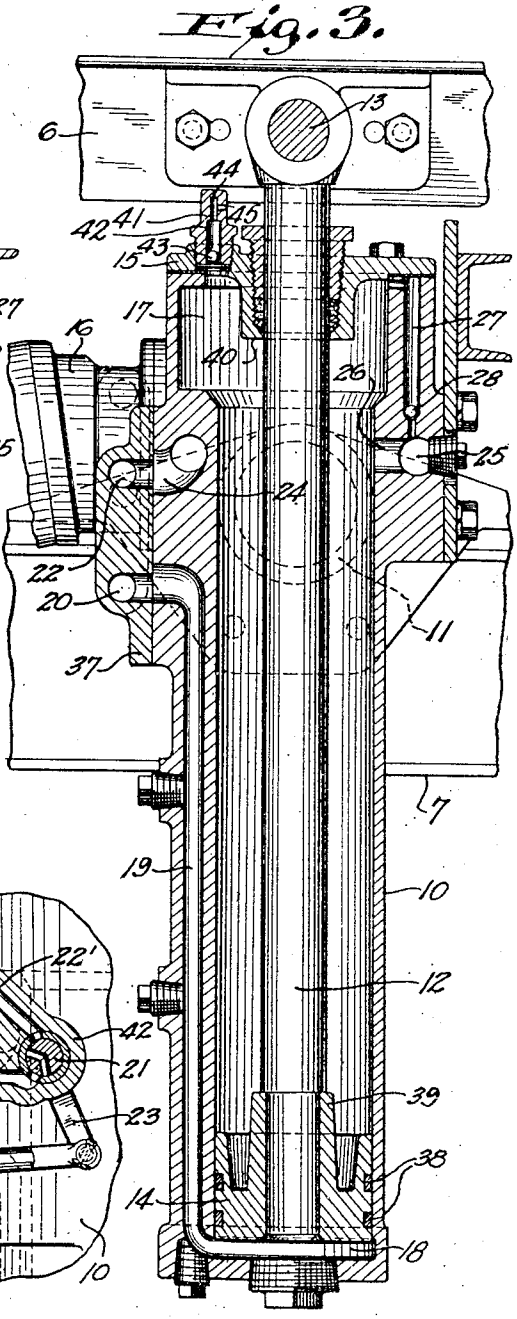
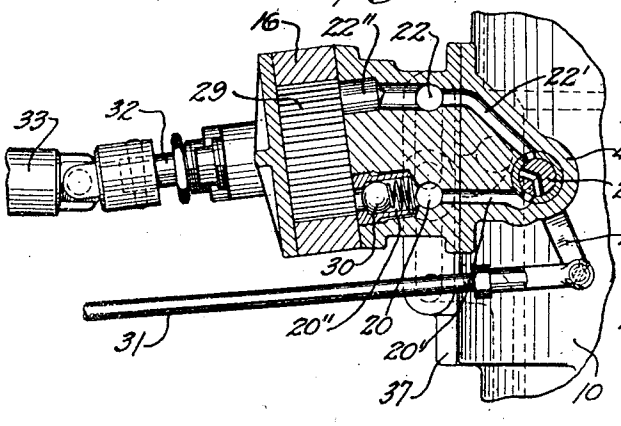


Fig. 5.



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HOIST

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Application October 11, 1930. Serial No. 487,982

1 Claim. (Cl. 138—9)

The present invention relates in general to improvements in the art of raising and lowering objects, and relates more specifically to improvements in the construction and operation of hoists of the fluid pressure actuated type.

Generally stated, an object of the invention is to provide an improved fluid pressure operated hoist which is simple and compact in construction, and which is moreover highly efficient in operation.

As shown and described in Patent No. 1,594,728, granted August 3rd, 1926, it has heretofore been proposed to utilize one or more hoisting devices, each comprising a cylinder having an upper end head and a piston movable within the cylinder by oil under pressure, and having a rod slidable through an opening in the cylinder head, for various purposes such as raising and lowering the tiltable body of a dump truck. The prior hoisting devices of this type employ a pump for forcing a predetermined quantity of oil beneath the piston in order to raise the latter, and a stop sleeve embracing the piston rod closely adjacent to the piston, is cooperable with the cylinder end head for the sole purpose of preventing the piston sealing rings from leaving the upper end of the cylinder bore, in case the piston is excessively elevated by some extraneous force other than the oil pressure thereunder.

In these prior hoists the maximum oil pressure obtainable by the pump for delivery beneath the piston is insufficient to raise the latter so that the stop sleeve will engage the cylinder head, and a port which should not be exposed during normal lifting of the piston, communicates with the upper interior of the cylinder and with a passage formed within the pump so as to permit return of oil from beneath the piston to the space thereabove during lowering operation. In order to reduce the length of the cylinder to a minimum, the return port has heretofore been so positioned, that under certain abnormal conditions of operation such as sudden shifting of the load in the truck body during dumping, the piston and its stop sleeve might be lifted to bring the latter into direct engagement with the head, thereby in some cases momentarily slightly exposing the lower portion of the return port, to the space beneath the piston, and allowing a small quantity of oil to leak into the pump. Such leakage of oil due to unintentional exposure of the return port, is undesirable, since it interferes with maintaining the piston in fixed position after the elevating stroke has been completed, and also because it permits rather violent impact between the stop sleeve and the cylinder head under abnormal operating conditions such as hereinabove described.

It is a more specific object of the present invention to provide means for effectively overcoming these defects of the prior art hoists of this type, by positively preventing any tendency toward free escape of oil from beneath the piston when elevated, and until the operator is ready to lower the hoist.

Another object of the invention is to provide a fluid pressure operated hoist of the type generally described wherein the use of a special stop sleeve for the piston is avoided, thereby simplifying the structure without sacrificing efficiency in operation.

These and other objects and advantages will appear from the following detailed description.

A clear conception of an embodiment of the novel features constituting the present invention and of the mode of constructing and of operating hoists built in accordance therewith, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views:

Fig. 1 is a side elevation of a truck having a tiltable dump body operable by hoisting mechanism of the improved type, the body being shown in loading position;

Fig. 2 is a side elevation of the dump truck, the body being shown in tilted or unloading position;

Fig. 3 is a central vertical section through one of the improved hoisting cylinders, the piston being shown in lowered position;

Fig. 4 is a fragmentary central vertical section through the hoist cylinder, the piston being shown in normal elevated position; and

Fig. 5 is a central vertical section through the pump for supplying fluid pressure beneath the piston of the hoist for elevating purposes.

Referring to Figs. 1 and 2 of the drawings, the tiltable truck body 6 is pivotally mounted upon the rear portion of the truck chassis or frame 7, by means of a pivotal support 8, the forward portion of the body 6 being swingable about the rear pivotal support and in close proximity to the driver's cab 9, by means of one or more fluid pressure actuating hoists coacting with a medial lower portion of the tiltable body 6.

Each of the hoists shown in detail in Figs. 3 and 4, comprises in general a cylinder 10 having side trunnions pivotally supported in saddles 11 secured to the truck frame 7, and a piston 14 and rod 12 movable along the cylinder bore. The pis-

ton rod 12 of each hoist is slidable through a packing associated with the removable upper end head 15 of the cylinder 10, and has its upper end secured directly to the body 6 by means of a pivotal connection 13. With this assemblage and mounting of the elements, the introduction of fluid such as oil under pressure, beneath the lower face of the piston 14, causes the upwardly moving rod 12 to swing the truck body 6 upwardly about the rear pivotal support 8, as shown in Fig. 2, whereas release of the fluid pressure will cause the body 6 to move back into horizontal position as shown in Fig. 1, the saddle supports and the pivotal connection 13 serving to permit lateral tilting of the hoist during tilting of the truck body relative to the frame.

The displacement chamber 18 beneath the piston 14, communicates with the lower end of an elongated port 19 formed directly in the wall of the cylinder 10, and the upper end of the port 19 communicates with a conduit 20 formed in a manifold 37 secured to the upper portion of the cylinder head. The fluid storage and receiving space 17 above the piston 14, communicates with an annular conduit or passage 25 formed in the cylinder 10, through a port 26 and a conduit 27 having a check valve 28 therein and connecting the passage 25 with the extreme upper end of the space 17. The annular passage 25 communicates with a conduit 22 formed in the manifold 37, through a port 24 disposed on the side of the cylinder 10 opposite to the port 26.

As shown in Fig. 5, the manifold 37 also forms the base of a gear pump 16, and has a set of ports 20', 22' extending laterally from the conduits 20, 22 respectively, into a casing 42 having a rotary by-pass valve 21 therein. The valve 21 is operable by a lever 23 and actuating rod 31 to either establish direct communication between the conduits 20, 22 through the ports 20', 22' in order to permit fluid to flow from the chamber 18 to the space 17, or to cut-off such communication. The manifold 37 is moreover provided with a set of ports 20'', 22'' extending laterally from the conduits 20, 22 respectively, to the displacement chamber of the pump 16, the port 20'' constituting the pump discharge passage and the port 22'' being the pump suction. Located within the discharge passage or port 20'', is a discharge valve 30, past which the fluid is delivered by the rotors 29 of the pump 16, when the control valve 21 is positioned as shown in Fig. 5. One of the intermeshing pump rotors 29 is rotatable by means of a drive shaft 32 which is operable from the transmission mechanism 35 of the truck, through a telescopic driving connection 33 and control mechanism 34, the latter being operable from within the cab 9 by means of suitable controlling devices 36 which also serve to control the operation of the by-pass valve 21.

The piston 14 is provided with resilient sealing rings 38 of usual construction, and the hub 39 of the piston may be extended beyond the upper end of the bearing surface to provide a stop for the piston 14 under certain abnormal conditions of operation. During normal operation, the upward travel of the piston 14 within the bore of the cylinder 10, is limited to the position indicated in Fig. 4, but under abnormal conditions of operation such as shifting of the load within the body 6 during dumping, the piston rod 12 and the piston 14 associated therewith may be pulling upwardly within the cylinder 10 and away from the oil body in the displacement chamber 18. During such abnormal conditions of operation, the hub 39 of the piston 14 will be brought into direct engagement with an abutment 40 formed on the cylinder head 15, thus providing a stop for limiting the upward travel of the piston 14. The cylinder head 15 may also be provided with a vent 41 for permitting escape of air from the fluid storage and receiving space 17, and the apron of the piston 14, which surrounds the hub 39, should not be of sufficient height to interfere with the vent 41 or to seal the passage 27. The vent 41 comprises a casing having a large lower bore 42 in which a ball check 43 is freely vertically movable, and also having a reduced upper bore 44 which communicates with the atmosphere through a lateral hole 45. The ball check 43 which is confined within the lower bore 42 is of somewhat less diameter than this confining bore, but is of greater diameter than the upper bore 44, so that any oil attempting to escape with the air will automatically cause the ball check 43 to seat against the lower end of the bore 44 to thereby close the vent and prevent loss of oil from the system.

During normal operation of the truck, the body 6 is in lowermost position as shown in Fig. 1, while being loaded and also while being transported by the vehicle, but the body 6 may at any time be tilted to the position shown in Fig. 2 by operation of the hoist. In order to tilt the body 6 relative to the frame 7, it is only necessary for the operator to place the truck propelling motor in operation and to manipulate the control devices 36 within the cab 9. After the gear pump 16 has been drivingly connected to the transmission mechanism 35, the rod 31 and lever 23 may be actuated to position the valve 21 as shown in Fig. 5, whereupon the pump 16 will withdraw oil from the space 17 through the port 26, passage 25, port 24, conduit 22 and port 22'', and will force the oil past the discharge valve 30 and through the port 20'', conduit 20 and port 19 into the displacement chamber 18 beneath the piston 14. This introduction of oil under pressure beneath the piston, causes the same to rise and to simultaneously tilt the truck body 6, and continues until the piston 14 reaches its upper position as shown in Fig. 4, whereupon the supply of oil from the space 17 above the piston through the port 26, has been cut off by the annular apron surrounding the piston hub 39, thus preventing the pump 16 from withdrawing any more oil from above the piston. While this supply of oil from the space 17 is cut off immediately as the piston apron passes the port 26, the pump continues to withdraw oil from the passage 25, port 24 and conduit 22 and to force this oil beneath the piston 14, thus causing the upper end of the piston to travel some distance beyond the port 26, but not to a sufficient extent that the hub 39 will engage the abutment 40 of the cylinder head 15. Such engagement between the hub 39 and the abutment 40, occurs only when the piston is moved upwardly beyond its normal stroke by some extraneous force, and even when thus abnormally elevated, the lower end of the piston 14 will not uncover the port 26. During such normal or abnormal upward movement of the piston 14, excess air confined within the space 17 above the piston 14, will be discharged through the vent 41 in the manner previously described, but the ball check 43 prevents escape of oil with the air. Due to the fact that the pump 16 cannot discharge all of the oil from within the conduits and passages at the inlet side thereof, while the piston 14 is elevated and maintained in elevated

condition, there will be a small quantity of oil constantly circulated within the pump, and this retained oil will serve to lubricate the pump rotors 29 and will prevent overheating of the pump.

If it becomes desirable to lower the truck body 6, it is only necessary to move the actuating lever 23 of the valve 21 toward the left as viewed in Fig. 5, whereupon the valve 21 establishes communication through the ports 20', 22', between the conduits 20, 22 respectively, in the pump base. The weight of the truck body 6 and of the elements carried thereby, will then cause the piston 14 to move downwardly within the cylinder bore and to force the oil from the displacement chamber 18 through the port 19, conduit 20, passage 20', valve 21, passage 22', conduit 22, port 24, annular passage 25, passage 27 and port 26, into the storage space 17 above the piston 14. The descent of the piston 14 will continue until the piston reaches the position shown in Fig. 3, and the pump 16 may obviously be maintained in operation, if so desired, while the piston 14 is being lowered. The check valve 28 serves to permit initial introduction of oil to the space 17 above the piston 14 during the lowering operation, but this check valve will not permit air to be withdrawn from the space 17 by the pump 16.

It should be borne in mind that the purpose of providing the elongated hub 39 and the abutment 40 cooperable therewith during abnormal upward travel of the piston 14, is not merely to stop the piston 14 and the rod 12 during their upward travel, but is primarily for preventing the piston 14 from being lifted sufficiently to permit the upper packing ring 38 to leave its retaining groove. The quantity of oil which the pump 16 is permitted to force into the displacement chamber 18 should never be sufficient to cause the piston hub 39 to strike the abutment 40, but should only be sufficient to cause the piston 14 to travel upwardly to the limiting position indicated in Fig. 4. The bearing face of the piston 14 should moreover be of sufficient length to positively prevent uncovering of the port 26 by the lower portion of the piston during lifting thereof, thereby avoiding any possibility of having oil or fluid under pressure circulate through the port 26 past the lower face of the piston. By forming the conduits 20, 22 directly in the pump base and as an integral part of the pump 16, the construction is simplified and it becomes unnecessary to provide means other than the pump 16 and the piping which connects the pump with the cylinder 10, for establishing communication between portions of the cylinder 10 above and below the piston 14.

Hoists manufactured in accordance with the present improvements have proven highly successful and efficient in commercial operation, and while the actuating fluid has been described herein specifically as oil, it will be apparent that other fluids may be substituted. The improved hoist structure has entirely overcome the objectionable features encountered in prior hoists of this type, and the construction has been considerably simplified by the elimination of the stop sleeves heretofore employed and the substitution of the elongated piston hub 39, therefor.

It should be understood that it is not desired to limit the invention to the exact details of construction herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

In a hoist, an upwardly extending cylinder having upper and lower ports communicating with the opposite extreme ends thereof and also having an intermediate port communicating therewith near said upper port, said cylinder being provided with a bore extending downwardly from said intermediate port and with an enlarged space above said bore, a piston movable within said bore, a pump for removing liquid from said space and for delivering said liquid under pressure below said piston through said lower port to cause movement of the piston toward said intermediate port, the quantity of liquid available from said space being only sufficient to cause said piston to seal said intermediate port without sealing said upper port and said piston being additionally upwardly movable after complete elevation by said available liquid, means for positively preventing upward travel of said piston at any time sufficiently to seal said upper port and to unseal said intermediate port from below, and vent means for effecting free escape of air from said space while positively preventing escape of liquid with said air.

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