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HOIST

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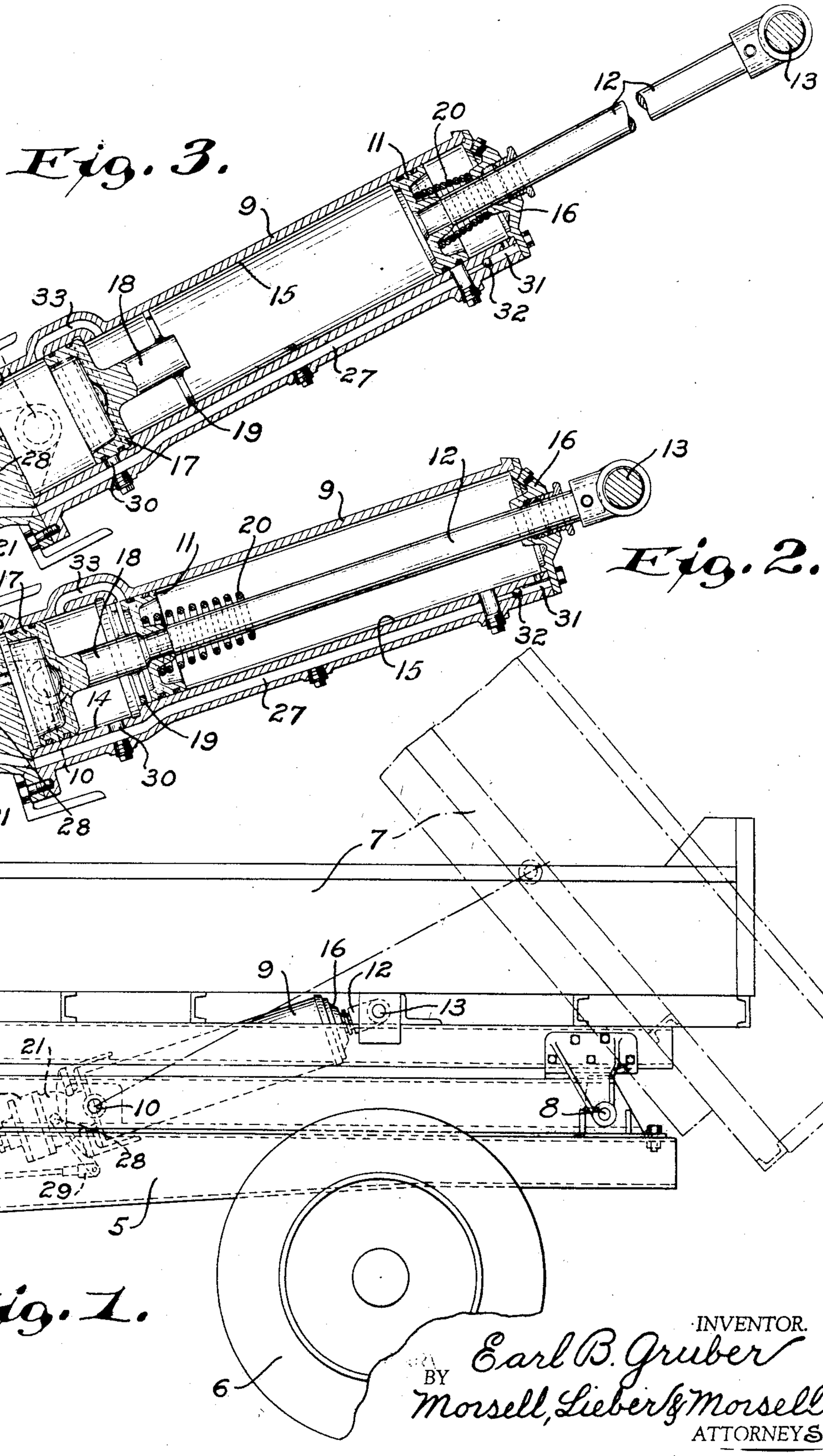

Fig. 3.

Fig. 2.

Fig. 1.

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HOIST

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My present invention relates in general to improvements in hoists, and relates more specifically to improvements in the construction and operation of fluid pressure actuated hoisting mechanism.

Generally defined, an object of my present invention is to provide an improved fluid pressure actuated hoist which is simple and compact in construction, and which is also highly efficient in operation.

It is common commercial practice in the art of transporting material in bulk, to utilize so-called dump trucks each having a tiltable body adapted to be elevated or swung into dumping position with the aid of one or more hydraulic hoists. The type of hydraulic hoist or jack ordinarily employed for this service, comprises a cylinder pivotally suspended from the chassis of the transporting vehicle, and a piston slidable within the cylinder and having a rod pivotally attached to a swinging portion of the body; the cylinder being supplied with fluid, such as oil under pressure, by means of a pump which is operable from the propelling motor of the vehicle. Due to the fact that these trucks are usually provided with a conglomeration of other equipment such as wheel driving mechanism, it is necessary to make the hoists as compact as possible in order to retain the center of gravity of the dump body desirably low while avoiding interference with the truck equipment and dump body. It is also well known, that maximum force is required to start the loaded dump body during tilting or hoisting thereof, and that the fluid pressure in the hoists diminishes rapidly as the body approaches its uppermost position. The hoists must however be of sufficient size and capacity to meet the starting requirements, and this fact makes it necessary under the prior practice to provide hoisting cylinders having relatively large diameter throughout their lengths so that the upper ends thereof make it difficult to produce a desirably compact assemblage without interference or obstruction.

My present invention therefore contemplates provision of a new and useful hydraulic hoist assemblage wherein the starting power is greater than that required during the subsequent piston stroke, and which is extremely compact as compared to other hoists of like capacity.

Another specific object of the invention is to provide improved fluid pressure actuated hoist structure which is especially adapted for use in conjunction with vehicular dump bodies where limited space for the installation of hoisting equipment is available.

A further specific object of my invention is the provision of an improved starting appliance for hydraulic hoists, which while greatly augmenting the starting pressure available, does not interfere with the normal operation of the motion transmitting member or piston of the hoist.

Still another specific object of the invention is to provide a starting plunger which is cooperable with a motion transmitting piston of a hoist in such a way, that after the starting force has been applied, the piston will automatically leave the zone of action of the plunger and may proceed for the remainder of its stroke in a normal manner.

An additional specific object of my invention is to provide an improved hoisting appliance which is conveniently applicable to fluid pressure hoists of various types, and which may be manufactured at moderate cost.

These and other objects and advantages of my present invention will be apparent from the following detailed description.

A clear conception of one embodiment of my invention, and of the mode of constructing and of utilizing hydraulic hoists built in accordance with the improvement, may be had by referring to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the several views.

Fig. 1 is a fragmentary side view of a typical vehicular dump body hydraulic hoist installation, showing the dump body lowered in solid lines, and elevated or tilted in dot-and-dash lines;

Fig. 2 is an enlarged central longitudinal section through one of my improved hoists, showing the starting plunger and piston thereof in lowermost position; and

Fig. 3 is a similar view of the hoist, showing the plunger and piston in extreme elevated position.

While I have shown the invention by way of illustration, as being applied to a single cylinder, single acting, trunnion suspended hydraulic hoist especially adapted for cooperation with a tiltable dump truck body, it is not the intent to thereby unnecessarily restrict the scope, since the improvement is obviously more generally applicable to other types of hoists or jacks otherwise suspended.

Referring to the drawing, the assemblage shown in Fig. 1 comprises in general a vehicle having a chassis 5 ordinarily supported upon rear

driving wheels 6 which are adapted to be driven through the usual transmission mechanism from a propelling motor ordinarily supported upon the front portion of the vehicle chassis 5; a dump body 7 swingably mounted upon the rear portion of the chassis 5 by means of bearings coacting with a pivot pin 8; and one or more hoists each having a cylinder 9 swingably suspended from the chassis 5 by means of trunnions 10, and a piston movable in the cylinder and provided with a rod 12 the outer end of which is pivotally attached to the body 7 by a pin 13. All of these elements are of well known construction, and while the hoist herein shown is of the single cylinder, single acting type similar to that shown in the prior Heil and Eisenberg Patent No. 1,798,469, granted March 31, 1931, this hoist may be of the well known double acting type, or of the telescopic piston type, or of the twin cylinder type.

My present improved hoist with the new starting appliance associated therewith, is shown somewhat diagrammatically in Figs. 2 and 3, and in this showing, some of the fluid conducting ports and passages have been displaced or thrown into the planes of the sections in order to clarify the disclosure. This hoist has a relatively large but short cylindrical bore 14 in the lower portion of the cylinder 9 near the trunnions 10, and has a concentric smaller cylindrical bore 15 of greater length above the bore 14, the piston 11 being slidable only within the upper small bore 15. The piston rod 12 is rigidly secured to the piston 11 and projects through a stuffing box carried by the upper end bead 16, and a starting plunger 17 is slidable within the lower enlarged bore 14 and has a stem 18 adapted to abut against the lower face of the piston 11, the stem 18 being guided at its abutment end within the small bore 15 by means of a spider ring 19. The piston rod 12 directly above the piston 11 is embraced by a helical spiral compression spring 20 which is adapted to engage the upper end head 16 when the piston is fully elevated, and the lower extremity of the cylinder 9 beneath the plunger 17 is enclosed by a lower end head 21 to which a gear pump 22 is attached. This pump 22 is swingable with the hoist, and is adapted to be driven from the vehicle propelling motor through universal joints and a driving shaft 23, in a well-known manner.

The lower end head 21 is provided with a non-return pump discharge valve 24 and with a port 25 which connects this valve with the lower end of the cylinder bore 14 beneath the plunger 17. The end head 21 is also provided with a through port 26 one end of which communicates with the suction side of the pump 22, and the opposite end of which is in open communication with a passage 27 formed in the wall of the cylinder 9 and leading into the upper portion of the bore 15. A rotary control valve 28 is mounted in the lower head 21 between the ports 25, 26 and is operable by linkage 29 to either connect these ports as shown in Fig. 2, or to close off communication therebetween as shown in Fig. 3. The medial portion of the cylinder passage 27 is communicable with the upper end of the bore 14 through a port 30, and the extreme upper end of the passage 27 is connected by a port 31 with the space above the piston 11 at all times, the port 31 having a non-return check valve 32 therein. The medial portion of the large bore 14 is moreover connected with the lower end of the small bore 15 by a by-pass passage 33, thereby completing the fluid distribution system.

During normal use of the dump truck, the body 7 will be in lowered or horizontal position as shown in full lines in Fig. 1, and the control valve 28 will be positioned as shown in Fig. 2, so that the ports 25, 26 will be directly connected. The pump 22 is normally idle, but if this pump is placed in operation and the control valve 28 remains in the position shown in Fig. 2, liquid will merely be circulated from the port 26 through the pump, past the discharge valve 24 and through the port 25 and valve 28 to the suction port 26. If the valve 28 is subsequently adjusted by manipulation of the linkage 29 to position the same as shown in Fig. 3, communication between the ports 25, 26 is cut off and the liquid will thereafter be drawn by the pump from the space within the bore 15 above the piston 11 through the passage 27 and port 26, and will be delivered past the valve 24 and through the port 25 into the lower bore 14 beneath the plunger 17. The liquid under pressure acting upon the lower face of the plunger 17 will cause this plunger to move upwardly, thereby simultaneously moving the piston 11 upwardly by virtue of the contact between the stem 18 and the lower face of the piston. The rod 12 will then be urged forwardly under the influence of the pressure acting upon the relatively large lower face of the plunger 17, and this action will continue until the plunger 17 moves beyond the lower end of the passage 33. The liquid under pressure will then escape through the passage 33 and will act directly upon the lower face of the smaller piston 11, and will continue to elevate this piston 11 and its rod 12 until the body 7 has been fully tilted as indicated in the dot-and-dash lines in Fig. 1. The pump 22 will then continue to create fluid pressure within the lower chambers of the bores 15, 14, and the spring 20 will be compressed as shown in Fig. 3, thus maintaining the body 7 in tilted position.

During the forward or upward motion of the piston 11 and plunger 17, the piston 11 will displace liquid from within the bore 15 above this piston, and the plunger 17 will likewise displace liquid from within the bore 14 above the plunger through the port 30, but the displacement of liquid by the plunger will continue only until the lower edge thereof uncovers the passage 33.

In order to lower the body 7, it is only necessary to restore the control valve 28 to the position shown in Fig. 2. The spring 20 will then become effective to initially move the piston 11 away from the upper head 16, and liquid from within the passage 27 will flow through the port 31 and past the valve 32 into the space within the bore 15 above the piston. As soon as the piston 11 has uncovered the upper end of the passage 27 where this passage communicates directly with the bore 15, the weight of the body 7 and of the piston 11 and rod 12 will cause these elements to drop by gravity and will also cause the piston 11 to ultimately return the plunger 17 to the position shown in Fig. 2. The passage 33 will then be connected through the displacement chamber above the plunger 17 and through the port 30 with the suction passage 27 and suction port 26 of the pump, and it will be noted that the displacement chamber above the piston 11 merely serves as a liquid storage reservoir for supplying the pump 22 with liquid. The liquid normally utilized in systems of this type is oil, and this oil besides constituting the

actuating fluid, also maintains the working parts well lubricated.

Due to the fact that the lower face of the plunger 17 is of considerably greater area than the lower face of the piston 11, it must be apparent that the pressure initially applied to this plunger 17 to move the piston 11 will be much greater than if this same unit pressure were applied to the piston direct. After the starting load has been taken care of by the enlarged plunger 17, the inertia of the body 7 and its load combined with the release of material from the body, will materially decrease the pressure necessary in order to effect further tilting of the body 7. This subsequent movement of the body can therefore be readily taken care of by the smaller piston 11. While the ideal condition in a hoist of this type would be the provision of a conical gradually decreasing bore with a piston adapted to gradually diminish in diameter and coacting with this conical bore, such a structure would be difficult to construct. Substantially the same action may, however, be secured by providing a series of plungers 17 of gradually diminishing diameter and coacting in series with the piston 11, the successive plungers being released as the requisite lifting force diminishes. In the case of a simple hoist such as shown in the present application, only one of these booster plungers 17 would be necessary, but in longer hoisting units a series such as hereinabove referred to may be desirable.

From the foregoing detailed description it will be apparent that my invention provides simple, compact and highly efficient mechanism for effecting quick starting of a fluid pressure actuated hoist, while permitting normal functioning of the hoist after sufficient starting momentum has been created. The accessory may be formed integral with or separable from an ordinary hoist, and the plunger 17 after having served its function is merely allowed to lie dormant and in no manner interferes with the completion of the piston stroke in the ordinary manner. With the present improvement, the diameter of the upper portion of the cylinder 9 may be materially reduced below that of the lower portion of this cylinder, thereby providing maximum clearance between the hoist and the body 7 and permitting lowering of the center of gravity of the body 7 to a desirable point. My present improvement also permits reduction of the working pressure within the system to a minimum, thereby reducing the danger of leakage, and augmenting the safety. The improved assemblage is obviously simple and compact in construction and may be readily manufactured at moderate cost, and the invention has actually demonstrated its superiority in starting a hoist of this type while permitting reduction in the cylinder diameter to a minimum.

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

I claim:

1. In a hoist, a cylinder having small and large contiguous bores, a piston slidable along one of said bores, a plunger slidable along the other of said bores, said plunger having integral portions slidably coacting with both of said bores and said piston being initially movable by said plunger until the latter has reached the end of its stroke and being thereafter movable away from said plunger, a fluid conducting passage connecting the medial portion of one of said bores with the adjacent end of the other bore, means for admitting fluid under pressure into one of said bores and through said passage into the other, and a port for effecting free escape of fluid from the space between said plunger and piston when said piston is being initially moved by said plunger, said port being closed by said plunger when said plunger reaches the end of its stroke remote from said fluid admission means.

2. In a hoist, a cylinder having small and large alined bores in open end communication with each other, a piston slidable directly within said small bore, a plunger slidable directly within said large bore and having a guiding portion slidable directly within said small bore and adapted to abut the adjacent end of said piston, a fluid pressure passage connecting an intermediate portion of said large bore with the adjacent end of said small bore, means for introducing fluid under pressure into said large bore remote from said small bore, and a port adapted to effect free escape of fluid from the space between said plunger and piston when said piston is being initially moved by said plunger, said port being adapted to be closed by said plunger when said plunger reaches the end of its stroke remote from said fluid admission means.

3. In a hoist, a cylinder having small and large bores, a piston slidable in said small bore, a plunger slidable in said large bore and having a portion directly engageable with said piston to initially move the latter, a liquid conducting passage connecting the medial portion of said large bore with the adjacent end of said small bore, means for admitting liquid under pressure into the end of said large bore remote from said small bore, and means for effecting free escape of liquid from the space between said plunger and piston when said piston is being initially moved by said plunger, said plunger being formed to close said escape means when disposed at the end of its stroke remote from said liquid admission means.

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