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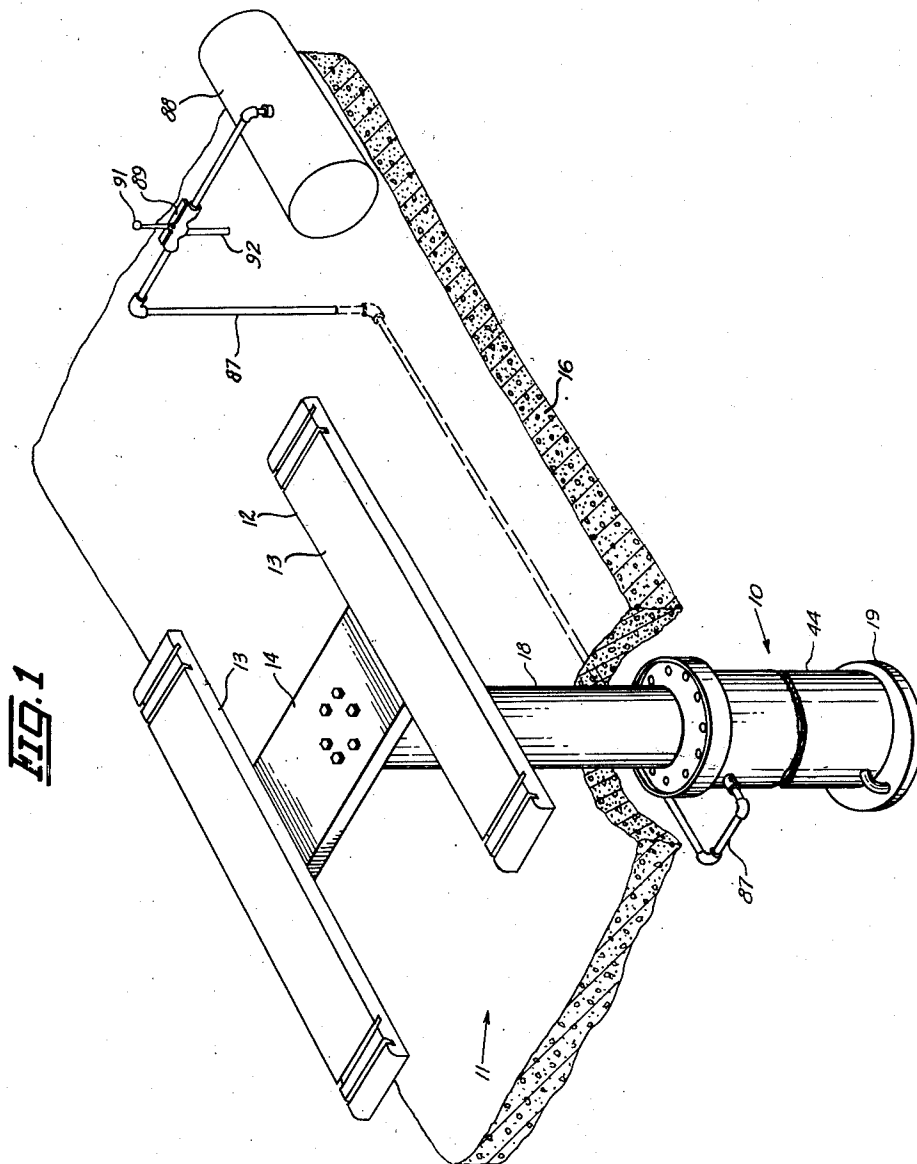
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2,802,457

LIFT APPARATUS

Filed Oct. 19, 1955

3 Sheets-Sheet 1



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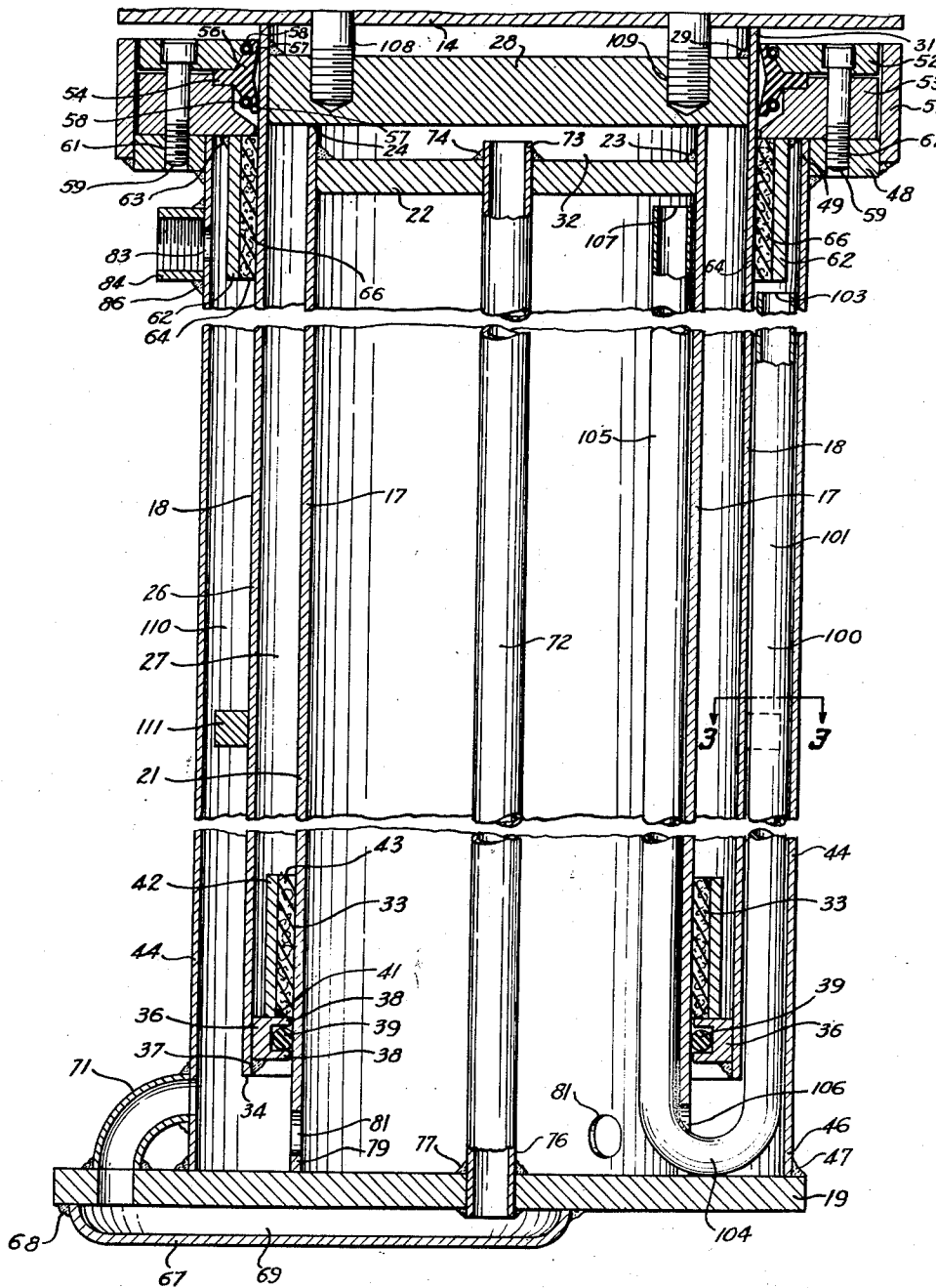


FIG. 2

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FIG. 3

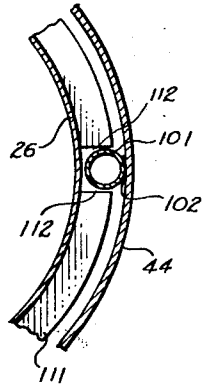


FIG. 5

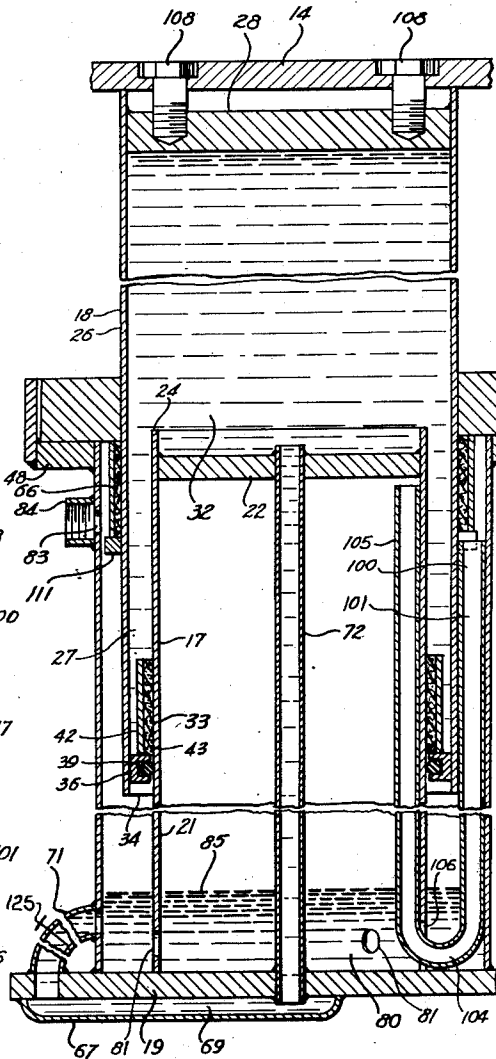
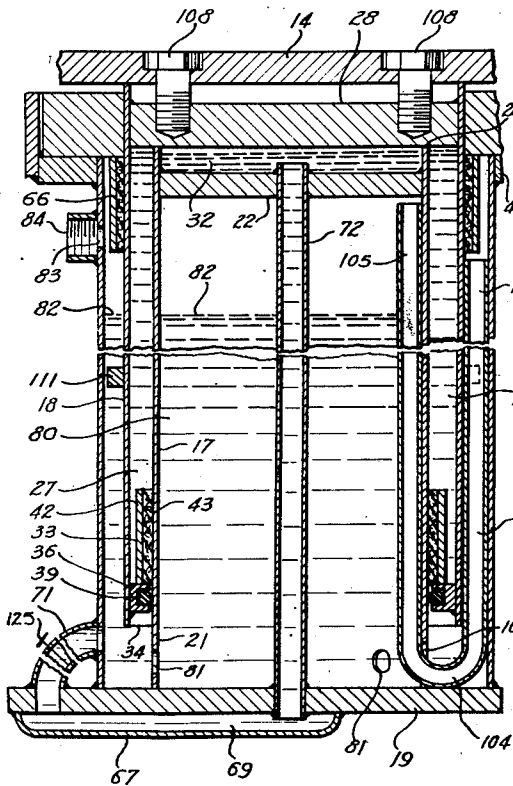


FIG. 4



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2,802,457

LIFT APPARATUS

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9 Claims. (Cl. 121-46)

This invention relates generally to vehicle hoists and more particularly to lift apparatus for raising and lowering a hoist superstructure.

An object of this invention is to provide improved lift apparatus.

A further object of this invention is to provide lift apparatus which is constructed and arranged so as to completely eliminate any leakage of oil about a vertically movable piston unit therefor.

Another object of this invention is to provide a hydraulically actuated lift cylinder and piston assembly in which air under pressure is applied to a predetermined quantity of oil within the assembly to extend the assembly with the air inlet being at all times above the oil level to preclude any oil from entering the inlet.

A further object of this invention is to provide a lift cylinder and piston assembly having coacting stop means therein to confine relative cylinder and piston movement between predetermined stop positions.

Another object of this invention is to provide lift apparatus which includes cylinder and piston units arranged for relative longitudinal movement to extend the lift apparatus, and coacting means on the units to prevent any relative rotation thereof.

Still a further object of this invention is to provide lift apparatus which is simple and rugged in construction, economical to manufacture, and efficient in operation when assembled in a vehicle hoist to raise and lower a vehicle thereon without any oil leakage about the apparatus.

Further objects, features, and advantages of this invention will become apparent from a consideration of the following description, when taken in connection with the accompanying drawing:

Fig. 1 is a perspective view of the lift apparatus of this invention, shown assembled in a vehicle hoist, which is illustrated in a raised position, with some parts being broken away and other parts shown in section for the purpose of clarity;

Fig. 2 is an enlarged foreshortened vertical sectional view of the hoist illustrated in Fig. 1;

Fig. 3 is a fragmentary sectional view looking along the line 3-3 in Fig. 2; and

Figs. 4 and 5 are diagrammatic longitudinal sectional views of the lift apparatus of this invention, showing the lift apparatus in fully lowered and raised positions, respectively, and illustrating the changed oil level in the apparatus for such changed positions.

With reference to the drawing, the lift apparatus of this invention, indicated generally at 10, is illustrated in Fig. 1 in use in a vehicle hoist 11 having a superstructure 12 of the frame engaging type disclosed in my prior Patent No. 2,654,443. The superstructure 12 includes a pair of longitudinally extended frame engaging members 13 connected by a transversely extended plate 14.

The lift apparatus 10 is disposed below a floor surface 16 (Fig. 1) and includes a stationary cylinder unit 17

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(Fig. 2) which cooperates with a vertically movable piston unit 18 to extend the apparatus 10 to raise the superstructure 12. The tubular piston unit 18 is positioned about and arranged in a concentric spaced relation with the smaller cylinder unit 17 which is secured at its lower end to a horizontal base plate 19 extended outwardly of the transverse confines of the piston unit 18. Secured to, as by welding 47, and extended upwardly from the base 19 is a tubular housing 44 arranged in a concentric spaced relation with the piston unit 18. The cylinder unit 17 and the housing 44 are arranged on opposite sides of the piston unit 18 and, as will more clearly appear hereinafter cooperate to form a cylinder assembly for guiding the up and down movement of the piston unit 18.

The cylinder unit 17 includes an upright tubular member 21 having a horizontal plate member 22 positioned within and secured thereto, as by welding 23, at a position slightly below the upper end 24 of the tube 21.

The vertically movable piston unit 18 includes an upright elongated tubular member 26 positioned about and extended above the tubular member 21. As best appears in Fig. 2, the tubular member 26 is arranged in a concentric relation with the tubular member 21 and is of a sufficiently larger diameter than the tubular member 21 to provide an annular space 27 therebetween. An imperforate superstructure supporting plate 28 is positioned within and secured to the tubular member 26, as by welding 29, at a position slightly below the upper end 31 thereof.

As best appears in Figs. 2 and 4, in the lowered position of the lift apparatus 10, the superstructure supporting plate 28 rests on the upper end 24 of the cylinder unit 17. By virtue of the location of the plate 22 for the cylinder unit 17 at a position below the upper end 24 thereof, a space or chamber 32 is formed between the plates 22 and 28 in this position of the apparatus 10.

A combination oil seal and bearing assembly, indicated generally at 33, is mounted on the piston unit 18, adjacent the lower end 34 thereof, to provide for a guided support of the unit 18 on the cylinder unit 17 during up and down movement of the piston unit 18. The assembly 33 includes a substantially U-shape support ring 36 secured as by welding 38 to the lower end 34 of the piston unit 18 so that the legs 38 for the ring 36 extend toward and are spaced from the cylinder unit 17. A resilient sealing ring 39, frictionally engaged with and arranged between the legs 38 is in continued engagement with the cylinder unit 17. Secured, as by welding 41, to the support ring 36 and extended upwardly therefrom is a short tubular member 42 which carries a bearing 43 positioned within the tube 42 and in engagement with the cylinder unit 17.

Positioned about the piston and cylinder units 18 and 17 in a concentric spaced relation therewith is the tubular housing 44 which cooperates with the cylinder unit 17 to provide a cylinder assembly for the piston unit 18. A horizontal ring member 48 secured to and extended outwardly from the upper end 49 of the housing 44 carries an upwardly extended tubular member 51 positioned about the piston unit 18. Arranged within the tubular member 51 and supported on the ring 48 are a pair of vertically spaced clamping plates 52 and 53. The lower plate 53 is of an irregular shape to provide for the reception between the plates 52 and 53 of the end portion 54 of a hat band type oil seal and wiper member 56. A pair of oppositely directed rim portions 57 on the member 56, which is formed of a resilient material such as rubber, are maintained in wiping engagement with the cylinder member 18 by means of a pair of garter

springs 58 corresponding to and extended about the rim portions 57.

In assembling the oil seal and wiper member 56 with the housing 44, a series of vertical bolts 59 are extended through the clamping plates 52 and 53 and are connected to the ring 48, at threaded openings 61 therein, so as to clamp the head portion 54 of the member 56 between the plates 52 and 53. A bearing unit 66 arranged between the housing 44 and the piston unit 18 includes a tubular member 62 secured as by welding 63 to the clamping ring 53 and extended downwardly therefrom at a position within the housing 44. A bearing 64 is positioned within the tubular member 62 and against the piston unit 18. The unit 66 and the member 56 cooperate to provide a combination oil seal and bearing assembly at the top of the piston unit 18 similar to the assembly 33 at the bottom of the unit 18.

It is seen, therefore, that the piston unit 18 is freely movable in up and down directions relative to the stationary cylinder unit 17 and the housing 44. The bearing assemblies 33 and 66 carried on the piston unit 18 and the housing 44, respectively, along with the oil seal and wiper member 56 guide the up and down movement of the piston unit 18.

As best appears in Fig. 2, a pan member 67 is positioned below and secured by welding 68 to the base 19 so as to form an oil chamber 69 below the base 19. The chamber 69 communicates with the interior of the housing 44 through a pipe 71 connected to and extended between the housing 44 and the base 19 at a position to one side of the housing 44. An upright pipe or tube 72, extended axially of the piston unit 17, has its upper end 73 extended through the plate 22 and connected thereto by means of welding 74. At its lower end 76, the pipe 72 extends through the base 19 and is connected thereto by means of welding 77. Thus, the pipe 72 communicates the chambers 32 and 69 which are located at opposite ends of the pipe 72.

As best appears in Fig. 2, the lower end 34 of the piston unit 18 terminates above the lower ends 46 and 79 of the housing 44 and the cylinder unit 17, respectively. As a result, the housing 44 is in fluid communication with the interior of the cylinder unit 17 through a series of openings 81 formed in the unit 17 at a position below the lower end 34 of the piston unit 18.

In the installation of the hoist 11, the lift apparatus 10 is located below the floor 16 so that in the position of the apparatus 10 illustrated in Figs. 2 and 4, the superstructure 12 is substantially at floor level. The housing 44 is filled with fluid 80 (Fig. 4), such as oil, to a level indicated at 82, with the cylinder unit 17 also being filled to this level as a result of the communication of the housing 44 and unit 17 through the openings 81. Also, the chambers 32 and 69 along with the connecting pipe 72 are filled with oil as is the annular space 27 between the units 17 and 18.

An opening 83 (Figs. 2 and 4) in the housing 44 at a position opposite the bearing assembly 66 is surrounded by an outwardly extended internally threaded pipe connection 84, secured as by welding 86 to the housing 44. An air line or pipe 87 (Fig. 1) is secured at one end of its ends to the connection 84 and at its opposite end to an air compressor tank, indicated generally at 88. Interposed in the line 87 at any location convenient to an operator of the hoist 11 is a usual three-way air control valve 89 which includes a control lever 91 and an exhaust port 92. On movement of the lever 91 to one position, air pressure is supplied from the tank 88 through the line 87 to the housing 44; on movement of the lever 91 to a second or neutral position, air is prevented from traveling through the line 87; and on movement of the lever 91 to a third position, air is exhausted from the line 87 through the exhaust port 92.

An upright U-shape tube 101 (Fig. 2) has one leg 100 thereof positioned within and secured by welding 102

(Fig. 3) to the housing 44 at a position substantially diametrically opposite the air inlet opening 83. The end 103 of the tube 101, corresponding to the leg 100, is positioned below the bearing assembly 66 and above the oil level 82. The base or intermediate portion 104 of the tube 101 extends through an opening 106 formed in the cylinder unit 17 at a position below the piston unit 18 so that the other leg 105 of the tube 101 is disposed within the cylinder unit 17 and has its terminal end 107 positioned adjacent the plate 22 and well above the oil level 82 (Fig. 4). By virtue of the provision of the tube 101, the air pressure in the space 110 between the housing 44 and the piston unit 18 and the air pressure in the cylinder unit 17 is equalized.

The superstructure 12 is mounted on the apparatus 10, by extending a series of bolts 108 (Figs. 2, 4 and 5) downwardly through the transverse connecting member 14 into threaded cavities 109 formed in the superstructure supporting plate 28 for the piston unit 18.

In the operation of the apparatus 10, assume that the superstructure 12 is in its lower position corresponding to the position of the apparatus illustrated in Fig. 4. The lever 91 for the valve 89 is manipulated to admit air under pressure through the line 87 to the housing 44. This air results in a downward pressure on the oil 80 in the housing 44 and in the cylinder unit 17. The oil 80 contained in the housing 44 and the cylinder unit 17 is thus forced downwardly out of the housing 44 through the pipe connection 71 to the chamber 69 and thence through the tube 72 to the chamber 32.

By virtue of the air tube 101 the oil levels in the housing 44 and the cylinder unit 17 are at all times the same. The oil under pressure supplied to the chamber 32 exerts an upward force on the plate 28 for the piston unit 18 to continuously raise the piston unit 18. Thus, so long as the valve 89 is maintained in a position supplying air under pressure to the housing 44, the piston unit 18 along with the superstructure 12 carried thereby is continuously moved upwardly. Such upward movement is continued until the piston unit 18 has been moved upwardly to a position in which a stop ring 111 (Fig. 2) secured to and extended about the piston unit 18 at a position intermediate the ends thereof, engages the lower end of the bearing unit 66, as illustrated in Fig. 5. The engagement of the stop ring 111 with the bearing unit 66 positively precludes further upward movement of the piston unit 18. In this position of the piston unit 18, the oil level in the housing 44 and the cylinder unit 17 has been moved downwardly to the level indicated at 85 in Fig. 5.

To return the superstructure 12 to its down or floor level position, the lever 91 for the valve 89 is manipulated to exhaust air in the line 87 through the exhaust port 92. The weight of the superstructure 12 along with the vehicle carried thereby, moves the piston unit 18 downwardly to force the oil in the chamber 32 back through the tube 72, chamber 69 and pipe 71 to the housing 44 and cylinder unit 17. If it is desired to stop the superstructure 12 at a position intermediate the lower and upper positions therefor illustrated in Figs. 4 and 5, respectively, it is only necessary to move the valve lever 91 to a neutral position in which the valve 89 is closed to prevent travel of air through the air line 87. In the fully lowered position of the superstructure 12, the supporting plate 28 engages the top end 24 of the cylinder unit 17.

It can thus be seen that by virtue of the stop ring 111 carried by the piston unit 18, a positive stop is provided for the apparatus 10 in the fully raised position thereof. Further, the engagement of the supporting plate 28 with the upper end 24 of the cylinder unit 17 provides a similar stop position for the apparatus 10 in a lowered position thereof.

As best appears in Fig. 3, the stop ring 111 has the terminal ends 112 thereof arranged on opposite sides of the tube 101. As a result, any relative rotation of the cylinder unit 17 and piston unit 18 is positively prevented.

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From the above description, it is seen that this invention provides lift apparatus 10 which is readily operable to raise and lower a hoist superstructure 12 between positive upper and lower stop positions without requiring any separate stop mechanism. By virtue of the arrangement of the air inlet connection 84 at a position above the oil level 82, there is no possibility that any oil can enter the air line 87. Further, any oil leakage about the upper bearing structure 66 is precluded by the arrangement of the bearing unit 66 at a position well above the oil level 82. However, the bearing unit 66 is continuously lubricated by the oil remaining on the piston unit 18 during the upward movement thereof. The wiper member 56 prevents any foreign material, such as mud and dirt from a vehicle on the hoist 11, which may adhere to the piston unit 18 in a raised position thereof from traveling downwardly with the unit 18 and onto the oil seal and bearing unit 66. Thus, the lift apparatus 10 is continually maintained in a lubricated condition without any danger of oil leakage. Further, the stop ring 111 cooperates with the tube 101 to provide a built-in non-rotating device for the apparatus 10, without requiring any structure which would extend above the floor level 16 and interfere with servicing operations on vehicles supported on the superstructure 12.

The invention has been described above in connection with semi-hydraulic operation of the hoist 11. Such operation is subject to the objection that the superstructure 12 "creeps," due to continued air expansion, after the valve 89 is closed. In some repair work this creeping is undesirable and a full hydraulic operation is required. To convert the apparatus 10 for a full hydraulic operation, therefore, a shut off valve, indicated diagrammatically at 125 in Figs. 4 and 5, is interposed in the line 71, which of course is considerably longer than illustrated to provide for the location of the valve 125 above the level of the floor 16.

In a full hydraulic operation of the apparatus 10 to raise the hoist 11, the valve 125 is initially closed and the valve 89 is opened to apply air pressure to the fluid 80. The valve 125 is then opened to permit fluid under pressure to flow to the chamber 32 and thereby raise the piston unit 18. When the superstructure 12 has been raised the desired amount, the valve 125 is closed and the superstructure remains in a stationary position without any creeping.

It is seen, therefore, that in the installation of a lift apparatus 10, a semi-hydraulic or both semi-hydraulic and full hydraulic operation may be provided for, as desired, depending only on whether a valve 125 is interposed in the pipe 71.

Although the invention has been described with respect to a preferred embodiment thereof, it is to be understood that it is not to be so limited, since changes can be made therein which are within the scope of the appended claims.

I claim:

1. A vehicle hoist comprising lift apparatus having an upright tubular cylinder having a closed upper end, a housing arranged in a concentrically spaced relation with said cylinder, a base member for said cylinder and housing, a tubular piston member closed at its upper end and arranged between said housing and cylinder, said piston having a lower bearing means in guided engagement with said cylinder, upper bearing means on said housing in guided engagement with said piston, said cylinder having fluid openings therein below said lower bearing means fluid connecting the space between said cylinder and housing with the space within said cylinder, means fluid connecting the interiors of said piston and cylinder, said apparatus having fluid therein to a level below the bearing means on said housing, and means for introducing air under pressure into said apparatus at a position above the level of the fluid therein to apply a fluid pressure against the closed end of said piston to raise said piston.

2. A vehicle hoist comprising an upright hollow cylin-

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der unit, an upright piston unit positioned about and in a telescoping relation with said cylinder unit, with said piston unit having the upper end thereof positioned above said cylinder unit, vehicle engaging means carried by the upper end of said piston unit, first combination bearing and fluid sealing means carried by the lower end of said piston unit and positioned in engagement with said cylinder unit, a housing positioned about said units and in fluid communication with said cylinder unit, second combination bearing and fluid sealing means carried by said housing and positioned in engagement with said piston unit, fluid in said housing and said cylinder unit, means for delivering said fluid to a position between said units for raising said piston unit relative to said cylinder unit, and means for introducing air under pressure into said housing at a position above the fluid level therein for forcibly moving said fluid through said delivery means.

3. A vehicle hoist comprising an upright extensible piston and cylinder assembly having vehicle engaging means carried by the upper end thereof, a housing positioned about said assembly, fluid in said housing communicating with said assembly and operable to extend said assembly in response to air pressure in said housing, means for delivering air under pressure to said housing at a position above the fluid level therein, and bearing means carried by said housing at a position above the fluid level therein for guiding engagement with said assembly.

4. A vehicle hoist comprising an upright cylinder unit, a piston unit positioned about and guidably mounted on said cylinder unit for up and down movement relative thereto, means forming a fluid receiving chamber between said units, a housing positioned about and in fluid communication with said chamber, bearing means carried by said housing and engaged with said piston unit for guiding the up and down movement thereof, stop means on said piston unit engageable with said bearing means to limit the upward movement of said piston unit, a predetermined quantity of fluid in said housing and said chamber, and means for delivering air under pressure to said housing at a position above the fluid level therein to move fluid from said housing to said chamber for moving said piston unit upwardly.

5. A vehicle hoist comprising an upright piston and cylinder assembly, said assembly including a cylinder unit and a piston unit positioned about and guidably mounted on said cylinder unit for up and down movement relative thereto, means forming a fluid receiving chamber between said units, a housing positioned about said piston unit, bearing means on said housing arranged in guided engagement with said piston unit, means providing for fluid communication of said housing and said chamber, fluid in said housing below said bearing means, means for delivering air under pressure to said housing at a position above the fluid level therein to force fluid into said chamber to move said piston unit upwardly, and vehicle engaging means on said piston unit.

6. A vehicle hoist comprising an upright stationary cylinder unit, a piston unit positioned about and guidably mounted on said cylinder unit for up and down movement relative thereto, means forming a fluid receiving chamber between said units, a housing positioned about and in fluid communication with said chamber, bearing means carried by said housing and engaged with said piston unit for guiding the up and down movement thereof, a stop member secured to and extended about said piston unit for engagement with said bearing means to limit upward movement of said piston unit, said stop member having the ends thereof spaced apart, an upright member arranged within and secured to said housing at a position between said stop member ends for engagement therewith to prevent rotation of said piston unit, a predetermined quantity of fluid in said housing and said chamber, with the fluid in said housing being at a level below said bearing means, and means for delivering air

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under pressure to said housing at a position above the fluid level therein to move fluid from said housing to said chamber for moving said piston unit upwardly.

7. A vehicle hoist comprising an upright tubular cylinder unit, a piston unit positioned about and in a telescoping relation with said cylinder unit, with said piston unit having the upper end thereof positioned above said cylinder unit, a housing positioned about said units to form a space therebetween, means fluid connecting said space with said cylinder unit, combination bearing and fluid sealing means carried by said housing for engagement with said piston unit, fluid in said housing and cylinder unit, means for delivering said fluid to a position between said units for raising said piston unit relative to said cylinder unit, means air connecting said cylinder unit with said space at positions therein above the level of the fluid in said housing and cylinder unit, and means for introducing air under pressure into said housing at a position above the fluid level therein and below said combination bearing and fluid sealing means for forcibly moving the fluid through said delivery means.

8. A vehicle hoist comprising an upright hollow cylinder unit, an upright piston unit positioned about and in a telescoping relation with said cylinder unit, with said piston unit having the upper end thereof positioned above said cylinder unit, vehicle engaging means carried by the upper end of said piston unit, first bearing means carried by the lower end of said piston unit and positioned in engagement with said cylinder unit, a housing positioned about said units and in fluid communication with said cylinder unit, second bearing means carried

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by said housing and positioned in engagement with said piston unit, fluid in said housing and said cylinder unit, means for delivering said fluid to a position between said units for raising said piston unit relative to said cylinder unit, means for introducing air under pressure into said housing at a position above the fluid level therein for forcibly moving said fluid through said delivery means, and valve means interposed in said delivery means for selectively shutting off the flow of fluid therethrough.

9. A vehicle hoist comprising an upright cylinder unit, a piston unit positioned about and guidably mounted on said cylinder unit for up and down movement relative thereto, means forming a fluid receiving chamber between said units, a housing positioned about and in fluid communication with said chamber, bearing means carried by said housing and engaged with said piston unit for guiding the up and down movement thereof, a predetermined quantity of fluid in said housing and said chamber, means fluid communicating said housing and said chamber, said communicating means having a portion thereof arranged outwardly of said housing, and means for delivering air under pressure to said housing at a position above the fluid level therein to move fluid from said housing to said chamber for moving said piston unit upwardly.

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