Feb. 7, 1961 A. C. SINCLAIR 2,970,577

HYDRAULIC LIFT

Filed Jan. 28, 1958 3 Sheets-Sheet 1

Fig. 1

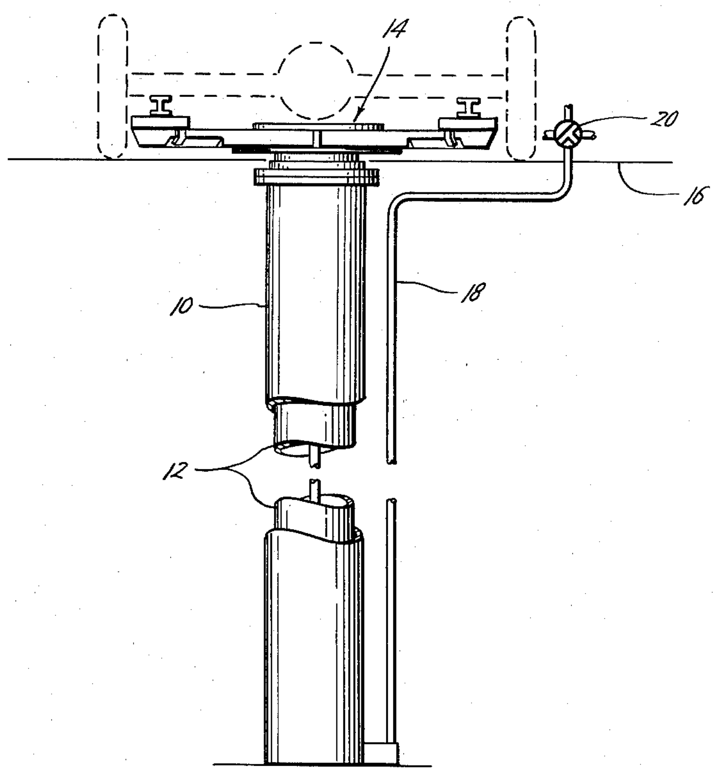

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Fig. 2

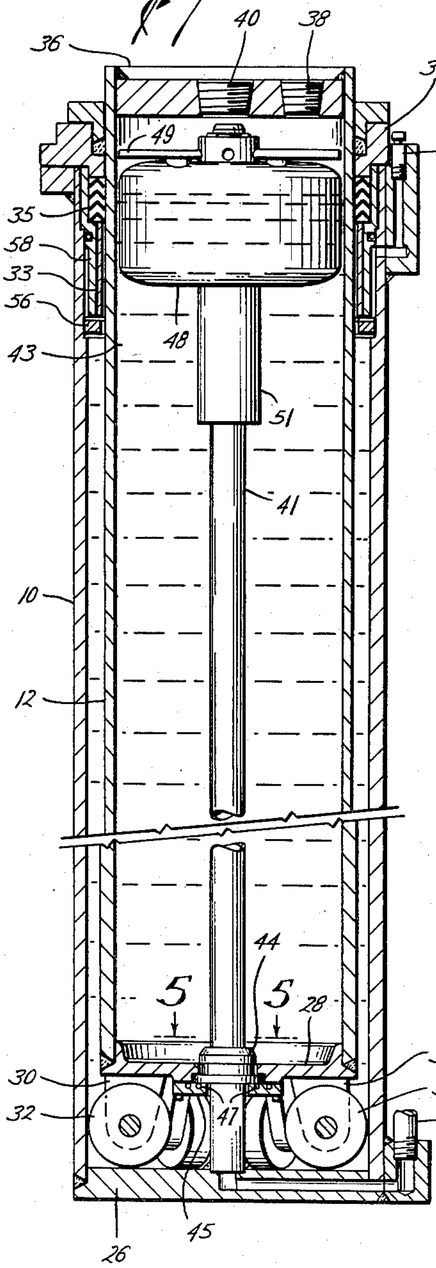

Fig. 3

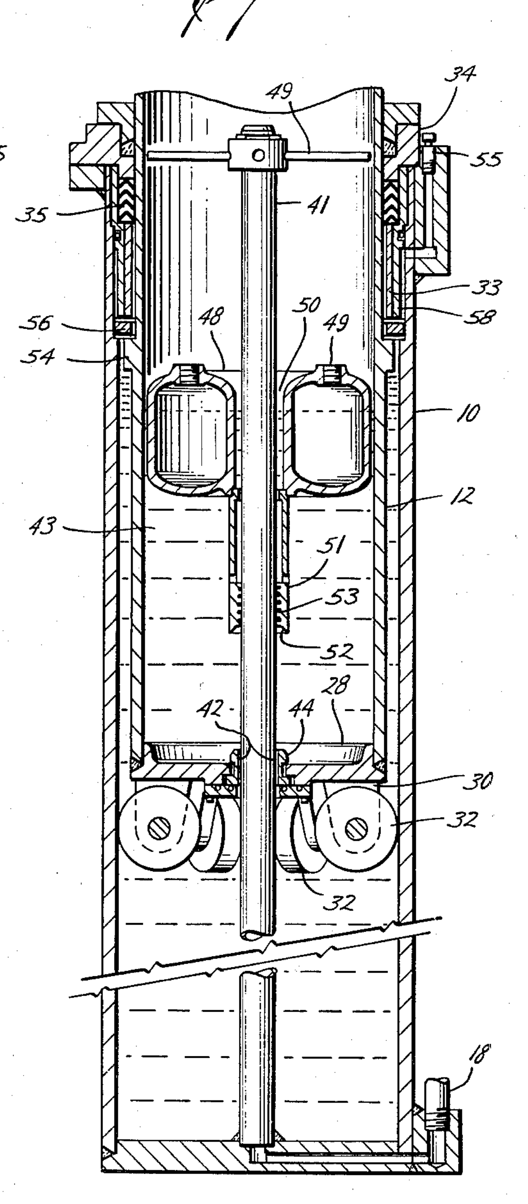

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Fig. 4

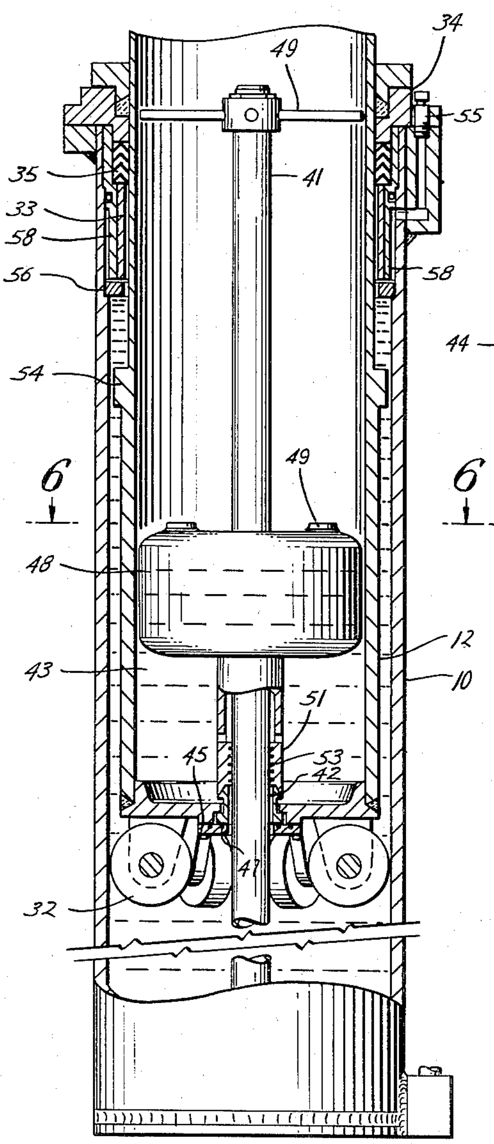


Fig. 5

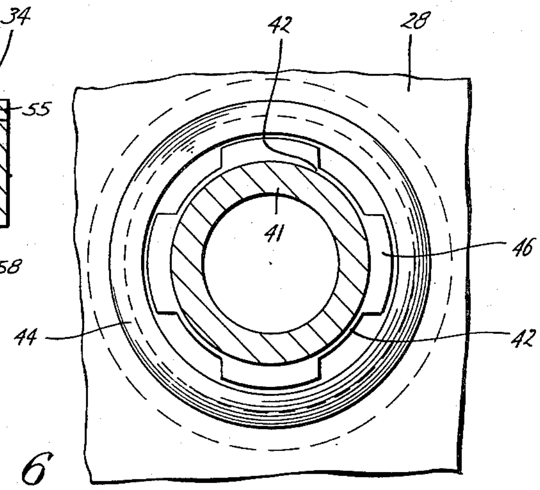
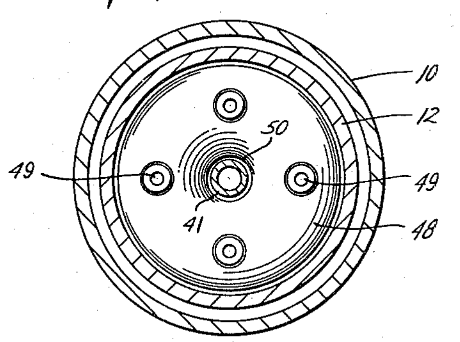


Fig. 6



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HYDRAULIC LIFT

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7 Claims. (Cl. 121—46)

The present invention relates to hydraulic lifts and, more particularly, relates to hydraulic lifts particularly adapted for the elevation of automobiles for underbody servicing. This application is a continuation-in-part of my application for a lift, filed June 1, 1955, Serial No. 512,422.

In lifts of the type frequently referred to as air hydraulic or semi-hydraulic, air pressure is applied to the interior of a plunger or ram above the oil level to force the ram outward to lift a load and comes into direct contact with the oil. To lower the lift, the air pressure is released and expelled from the interior of the plunger.

These lifts have not been wholly satisfactory. For one reason oil subject to direct contact with compressed air absorbs some air and when the air pressure is released rapidly, globules of oil are entrained in the air and are discharged from the lifts resulting in a loss of oil from the lift as well as spraying the area of discharge with oil. Furthermore, a dangerous condition exists when the hydraulic fluid level in the lift becomes too low. This condition may be caused by fluid lost through packing leaks, exhaust spraying as mentioned, insufficient filling or other causes. When this occurs, air enters the cylinder from the ram and because of the compressibility of the air and the inherent mechanical friction of the device, the ram will move upward in jumps instead of a smooth continuous movement.

In addition, it is not infrequent that a lift becomes stuck in an elevated position when the load is off center thereby preventing the lift from being lowered until such time as the load has been centered.

Accordingly, it is an object of the invention to provide an automobile lift in which oil from the lift is not sprayed or lost when releasing air pressure for lowering the lift.

Another object of the present invention is the provision of an automobile lift in which the air pressure is prevented from escaping from the ram into the cylinder thereby preventing jumping of the ram caused by such air.

Yet a further object of the present invention is the provision of an automobile lift which does not stick or become wedged when the load thereon is not centered.

Other and further objects, features and advantages will be apparent as the description of a preferred example of the invention proceeds, given for the purpose of disclosure and taken in conjunction with the accompanying drawings, where like character references designate like parts throughout the several views, and where

Figure 1 is a side elevation, partly in section, illustrating an automobile lift according to the invention,

Figure 2 is an enlarged, cross-sectional elevation illustrating the ram and cylinder assembly of the automobile lift of Figure 1 with a normal oil level and the lift in the down position,

Figure 3 is an enlarged cross-sectional elevation similar to that of Figure 2 but illustrating the ram in an up position with a normal oil level.

Figure 4 is an enlarged elevation, partly in section, similar to Figure 3 but illustrates the ram in its up position when the oil level in the aparatus is below normal,

Figure 5 is a cross-sectional view taken along the line 5—5 of Figure 2, and

Figure 6 is a cross-sectional view taken along the line 6—6 of Figure 4.

Referring now to the drawings, and particularly to Figure 1, the lift includes a cylinder or outside casing **10** sealed at the lower end and open at the top end into which is slidably secured a ram or plunger **12**, the upper end of which is connected to an automobile supporting structure or carriage generally designated by the reference numeral **14**. Usually, as indicated, the cylinder or casing **10** is embedded in the ground with its upper open end slightly below the level of the ground or garage floor **16** and an air line **18** is provided which also is embedded in the ground and extends down into the outer casing **10** at its lower end. The upper end of the air line **18** includes a two-way valve **20** for exhausting and supplying air from a source, not shown, for actuation of the lift.

Referring now to Figure 2, the lower end of the outer casing **10** is sealed, such as by the plate **26**, and a bottom plate **28** is provided on the ram or plunger **12** from which extend the legs **30** to which are secured the wheels **32**. These wheels are positioned to provide engagement with the inner wall of the cylinder or outer casing **10** to provide rolling contact therewith in substantially all directions.

Conventional lifts are provided with an upper guide bearing **33**, as shown, and another similar bearing, not shown, located lower in the cylinder. The function of these bearings is to guide the ram in its vertical rise and resist horizontal thrusts due to loads eccentrically located on the lift. Off center loads are frequently of sufficient magnitude to cause a locking effect between the ram and the associated guide bearings. As a result the lift will not descend until the load is brought more nearly concentric with the ram or other means provided to overcome the locking effect.

In the present invention the wheels **32** at the lower end of the ram are substituted for the lower bearing (of conventional design) to avoid the friction lock inherent in bearings when the static friction load exceeds the driving force.

As mentioned previously, the upper end of the outer casing **10** is open but includes a packing gland or stuffing box **34** for sealing engagement with the outer upper wall of the ram or plunger **12**. Since any preferred stuffing box or sealing arrangement may be used, no further or detailed description thereof is deemed necessary. The upper end of the ram **12** is closed by a head **36** and is secured to and supports the automobile supporting structure or carriage **14**. A passage **38** eccentrically spaced in relation to the vertical center line of the ram is provided in the head **36** for introducing hydraulic fluid or oil into the lift, and another passage **40** is provided to release displaced air when oil is being introduced into the lift. Each of these passages is, of course, closed after filling by any suitable means, such as a plug, not shown.

An air line **41** is connected to the air line **18**, the air line **41** extending upwardly in the central portion of the ram **12** to a point adjacent the upper end of the ram when it is in lowered or down position. Thus, air pressure is supplied to the interior of the ram **12** at its upper point between the head **36** and the body of hydraulic liquid, such as oil **43** within the ram **12**.

As best seen in Figures 2, 3, 4 and 5, an orifice or passageway **42** is provided through the central portion of the lower plate **28** of the ram **12** to accommodate the air line **41**. The size of the annular space left in this orifice or passageway **42** around the air line **41** determines the velocity of the oil flow between the ram and the outside cylinder 10 thereby governing the speed of movement of the ram. A seat 44 is provided above and at the circumference of this orifice or passageway 42 and secured to the lower plate 28, preferably by means of a retainer plate 45. The passageway 42 is vertically grooved as at 46 (Figure 5) to insure an area for liquid flow through the passageway 42 around the air line 41. O-rings 47 may be provided in the retainer plate 45 to provide a suitable seal. At the top of the air line 41 is a tube centering cross 49 to maintain the air line 41 in axial alignment with the ram 12.

In order to prevent entrainment of globules of hydraulic liquid, such as oil, in the air at the upper end of the ram 12, a float 48 is provided which has the opening 50 through which the air line 41 extends. The float 48 may be formed of any material of a size and strength sufficient to withstand the pressures of the order used in the lift, but of a lightness sufficient to permit it to float on the surface of the liquid. For example, wood or a hollow metal ring may be used. The float 48 is vented at 49 (Figures 3 and 6) to equalize the pressure inside and outside the float 48.

Secured to the lower surface of the float 48 is a downwardly directed tubular valve element 51. Valve element 51 is slidably positioned on air line 41 and moves up and down air line 41 as the fluid level in the ram 12 moves the float 48. At the lower end of the valve element 51 is a seating surface 52 adapted to seat on the valve seat 44 and seal off the orifice or passageway 42 when and if the hydraulic fluid level 43 in the ram is too low (Figure 4). Sealing means such as O-rings 53 are provided in the valve element 52 to prevent an escape of fluid between the valve element 52 and the air line 41.

As best seen in Figure 3, an annular stop member 54 is welded or otherwise rigidly secured to the outer wall of the ram 12 and engages the downwardly facing annular stop member 56 to provide a positive stop at the upper end of the stroke of the ram 12. In this connection it is noted that the downwardly facing annular stop 56 is secured by the sleeve member 58 to the upper end of the stuffing box 34. Obviously, the stop member 58 which is provided with the bearing 33 and packing 35 may be secured to the outer casing 10 in any preferred manner.

An air bleeder vent 55 is provided at the top of cylinder 10 in the event that any globules of air may be entrapped in the hydraulic fluid in the cylinder 10.

In operation, the automobile is driven over the automobile supporting structure 14. Assuming that the hydraulic fluid level is normal, the lift is in the down position as shown in Figure 2. The valve 20 is then manipulated so that air pressure through the air lines 18 and 41 is supplied between the upper end of the ram 12 and the upper surface of the hydraulic liquid 43 and the float 48. This forces the hydraulic liquid through the annulus in the orifice 42 between the valve seat 44 and the air line 41 and causes an upward movement of the ram 12, the speed of the movement depending upon the size of this annulus and the amount of pressure. This upward movement of the ram 12 continues until the desired height is reached or until the stop shoulders 54 and 56 engage each other, as best seen in Figure 3. It is to be noted in Figure 3, the up position of the lift with a normal oil level, that there is still sufficient hydraulic fluid in the ram 12 to support the float 48 in a position so that the valve element 52 has not been seated on the valve seat 44.

It is noted that at all times the ram 12 at its lower end engages the inner wall of the outer casing 10 with the wheels 32 thereby preventing any wedging action in the event the load is not properly centered.

When it is desired to lower the lift, the valve 20 is manipulated thereby permitting a release of air pressure through the air lines 41 and 18. The float 48 prevents any hydraulic liquid from being entrapped in the escaping air and being expelled therefrom. During the lowering the hydraulic fluid re-enters the ram from the outside cylinder 10 through the annulus between the valve seat 44 and the air line 41. It is noted that during this descent the ram 12 at its lower portion is in rolling contact at all times with the interior wall of the outer casing 10 thereby preventing wedging due to any off center loading.

The above operation was performed assuming that the hydraulic fluid level in the apparatus was in its normal high level. However, because of hydraulic fluid lost through packing or other leaks or to insufficient filling the hydraulic fluid level may drop below normal. The major factor of resistance to the upward movement of the ram consists of the resistance to the flow of the hydraulic fluid through the annulus between the valve seat 44 and the air line 41. If it were not for the valve element 52 and valve seat 44 and if the oil level were below normal, the ram would start moving up at a uniform rate as in the normal situation of high level fluid, but as soon as all of the oil in the ram 12 should run through the orifice 42 then the resistance of the orifice to the flow of air would be a nullity compared to the resistance of the flow of oil. In that case there would be a tendency of the ram to spring upwardly until the compressibility or elasticity of the air had been exhausted by movement of the ram whereupon the ram would have a tendency to stop. Once the ram has stopped its inertia requires more force to overcome than it does to keep it moving. Any time that the ram stops, whether it is because air has just broken through the orifice or there is already air below the orifice, an increase of pressure on the air will compress it building up an elastic force until the inertia causing the stoppage is overcome whereupon the compressed air will cause the ram to jump and to stop again. Such a discontinuous movement of the ram is dangerous and is prevented by the present invention as best seen in Figure 4 where the ram is shown moving to the up position with a below normal supply of hydraulic fluid. As the ram has moved up the hydraulic fluid has left the ram 12 and entered the casing 10 and the float 48 has consequently moved downwardly. When the float 48 reaches the position shown in Figure 4, the valve element 52 contacts and seats upon the valve seat 44 closing the annulus at the orifice 42 thus preventing the flow of any more hydraulic fluid or air through this passageway 42. This prevents any air from escaping into the cylinder from the ram and stops the upward movement of the lift. The operator notes the fact that the lift does not attain its full up position and can then lower the left and replenish the hydraulic fluid.

An automobile lift constructed according to the invention provides for a relatively quick elevation and descent at the same time insures that the movement of the lift will be smooth and continuous. In addition, hydraulic liquid, such as oil, is not sprayed or removed from the lift when releasing the pressure for descent.

While the examples of the invention have been directed particularly for use as an automobile lift, other uses and adaptations will suggest themselves to those skilled in the art which are encompassed within the invention. The present invention, therefore, is well suited to carry out the objetcs and attain the ends and advantages mentioned as well as others inherent therein.

Numerous changes and rearrangement of parts will suggest themselves to those skilled in the art which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A lift comprising a cylinder closed at its lower end and open at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, liquid sealing means between the cylinder and

ram, an air pressure line extending from the lower end of the cylinder and having an air pressure inlet opening into the ram above the level of hydraulic liquid therein, air pressure acting upwardly on the upper closed end of the ram and downwardly on the hydraulic liquid to elevate the ram and force the hydraulic liquid through the restricted passage into the cylinder, and a valve assembly for closing the restricted passage, said valve assembly including a valve seat positioned about the restricted passage and a valve element so arranged and constructed to seat on said valve seat and close the restricted passage when the hydraulic fluid in the ram reached a predetermined low level thereby preventing air from escaping into the cylinder from the ram.

2. A lift comprising a cylinder closed at its lower end and open at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, sealing means between the cylinder and ram, an air pressure line extending from the lower end of the cylinder through the restricted passage and having an air pressure inlet opening into the ram above the level of hydraulic liquid therein, air pressure acting upwardly on the upper closed end of the ram and downwardly on the hydraulic liquid to elevate the ram and force the hydraulic liquid through the restricted passage into the cylinder, a float in the ram floating on the surface of and preventing direct contact of the air pressure with the hydraulic liquid whereby on release of said air pressure hydraulic liquid is prevented from being discharged from said cylinder and ram, and means connected to the float for closing said restricted passage when the hydraulic fluid level reaches a predetermined low level in the ram thereby preventing air frm escaping into the cylinder from the ram.

3. The improvement in a hydraulic lift including a cylinder closed at its lower end and opened at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, sealing means between the cylinder and ram, said ram having hydraulic liquid therein, an air pressure inlet opening into the ram above the level of the hydraulic liquid, air pressure acting upwardly on the upper closed end of the ram and downwardly on the hydraulic liquid to elevate the ram as the hydraulic liquid is forced through the restricted passage into the cylinder comprising, a float in the ram floating on the surface of the hydraulic liquid thereby preventing direct contact of the air pressure with the hydraulic liquid whereby on release of the air pressure the hydraulic liquid is prevented from being discharged from said ram.

4. The improvement in a hydraulic lift including a cylinder closed at its lower end and opened at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, sealing means between the cylinder and ram, said ram having hydraulic liquid therein, an air pressure inlet opening into the ram above the level of the hydraulic liquid, air pressure acting upwardly on the upper closed end of the ram and downwardly on the hydraulic liquid to elevate the ram as the hydraulic liquid is forced through the restricted passage into the cylinder comprising, a float in the ram floating on the surface of the hydraulic liquid, and means connected to the float arranged and constructed to close said restricted passage when the hydraulic fluid reaches a predetermined low level in the ram thereby preventing air from escaping into the cylinder from the ram.

5. The improvement in a hydraulic lift including a cylinder closed at its lower end and opened at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, sealing means between the cylinder and ram, said ram having hydraulic liquid therein, an air pressure inlet through the restricted passage opening into the ram above the level of the hydraulic liquid, air pressure acting upwardly on the upper closed end of the ram and downwardly on the hydraulic liquid to elevate the ram as the hydraulic liquid is forced through the restricted passage into the cylinder comprising, a float in the ram floating on the surface of the hydraulic liquid, and a valve assembly for closing the restricted passage, said valve assembly including a valve seat positioned about the restricted passage and a valve element connected to the float arranged and constructed to seat on said valve seat and close the restricted passage when the hydraulic fluid in the ram reaches a predetermined low level thereby preventing air from escaping into the cylinder from the ram.

6. A lift comprising, a cylinder closed at its lower end and open at its upper end, a hollow ram slidably mounted in the cylinder, the upper end of the ram being closed and its lower end having a restricted passage into the cylinder, liquid pressure-tight packing between the cylinder and ram, an air pressure line extending from the lower end of the cylinder through the restricted passage and having an air pressure inlet opening into the ram above the level of hydraulic liquid therein whereby air pressure from said air line may provide air pressure acting upwardly on the upper closed end of the ram and force the hydraulic liquid through the restricted passage into the cylinder, a float in the ram floating on the surface of the hydraulic fluid, and a valve assembly, a valve seat in said valve assembly positioned circumferentially around the periphery of the restricted passage, a valve element connected to the float and so arranged and constructed as to seat on the valve seat and close the restricted passage when the hydraulic fluid reaches a predetermined low level in the ram thereby preventing air from escaping into the cylinder from the ram.

7. The invention of claim 6 including a float in the ram floating on the surface of and arranged and constructed to substantially cover the surface of the hydraulic liquid preventing direct contact of the air pressure with the hydraulic liquid whereby on release of said air pressure the hydraulic liquid is prevented from being discharged from said cylinder.

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