June 4, 1957 V. A. TYLER 2,794,425

HOIST

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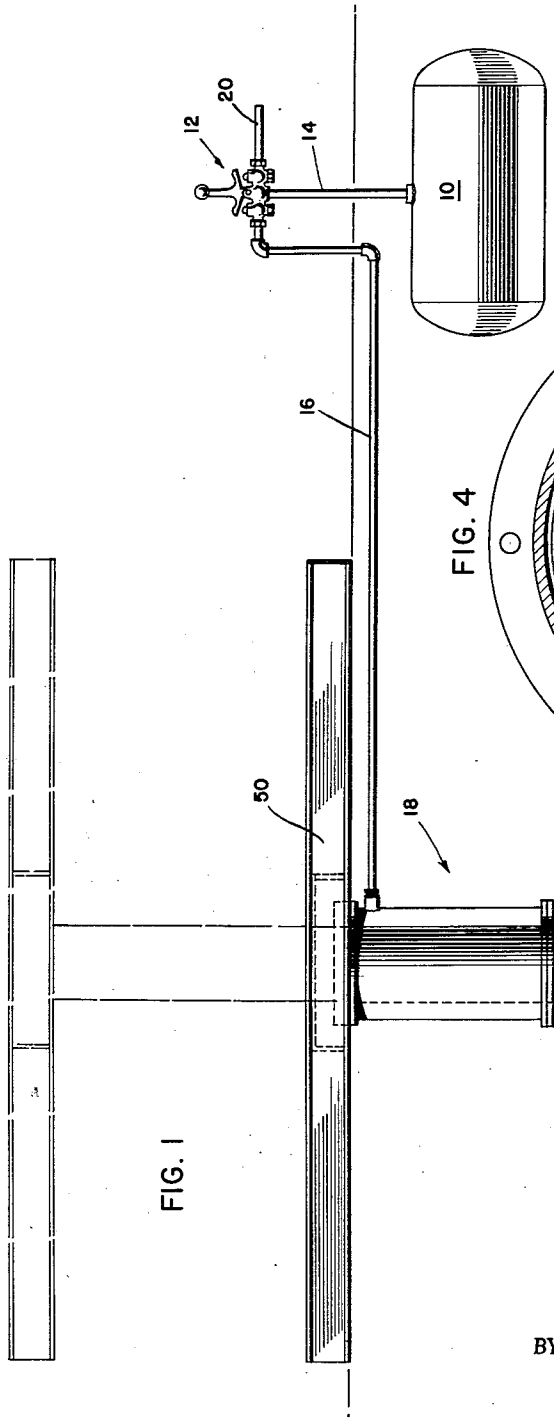


FIG. 1

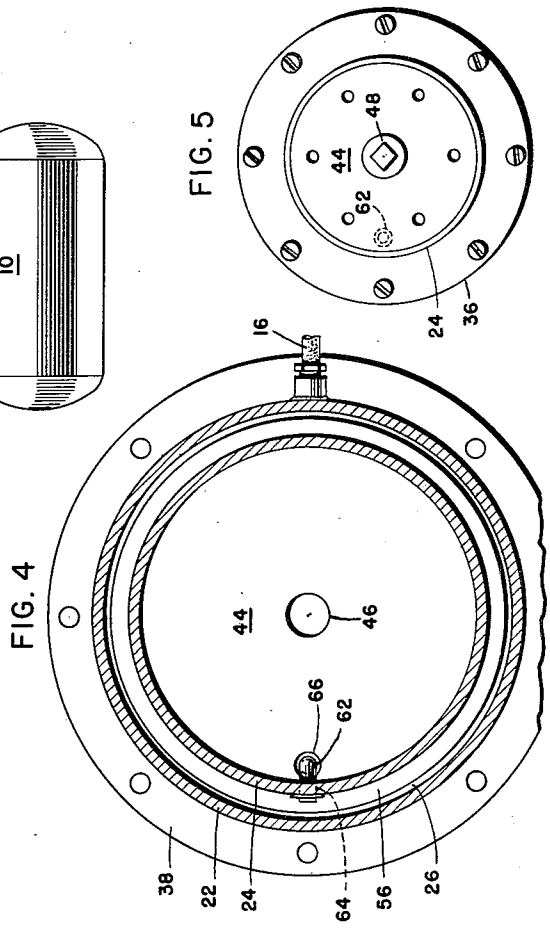


FIG. 4

FIG. 5

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HOIST

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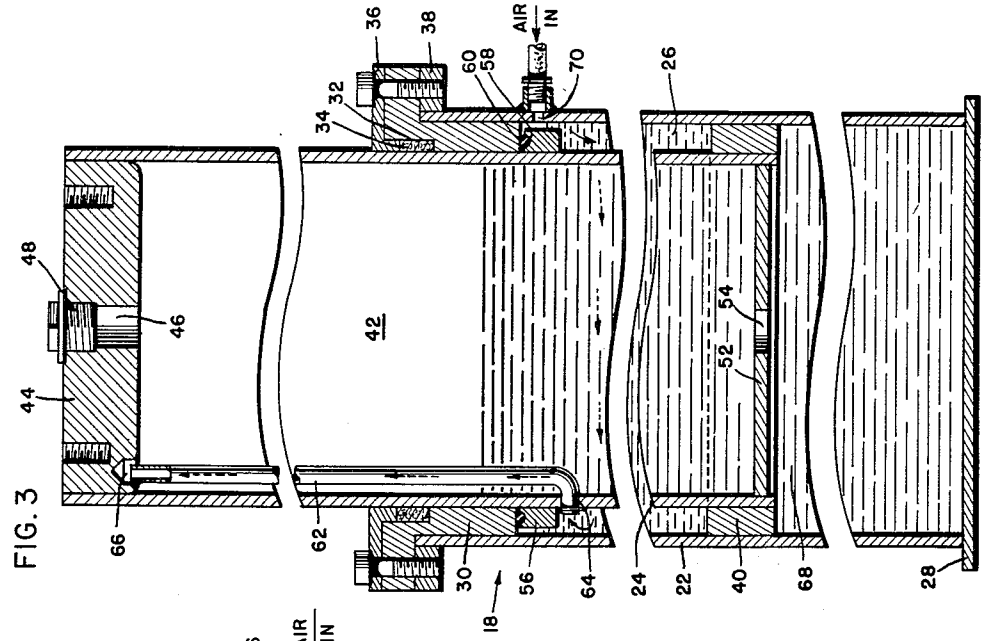


FIG. 3

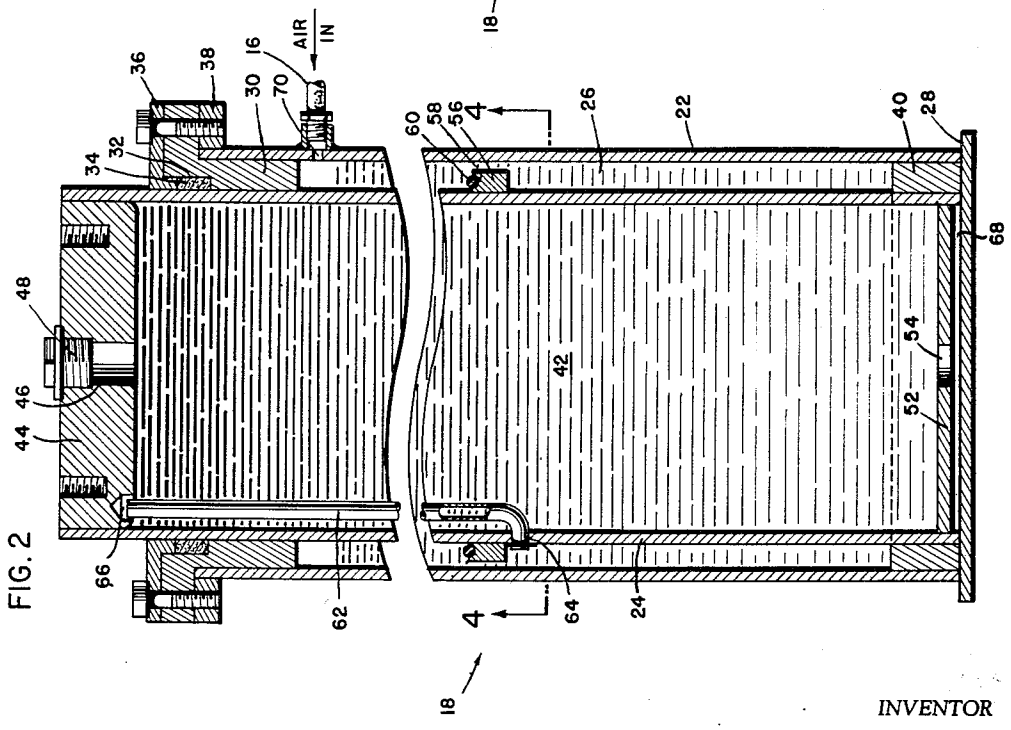


FIG. 2

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HOIST

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8 Claims. (Cl. 121—46)

This invention relates to a vehicle hoist and more particularly to a hoist of the hydraulic and pneumatic type with improved means for preventing leakage of the pneumatic fluid therefrom.

Vehicle hoists usually include a cylinder having a piston guidably supported therein so as to leave an annular space between the piston and the cylinder. This space is normally closed by a fluid type packing mounted at the upper end of the cylinder. In most hoists now on the market, hydraulic fluid within the annular space comes into contact with this packing with subsequent objectionable leakage of fluid at this point.

An object of the present invention is to provide an improved hoist wherein pneumatic pressure is applied on the hydraulic fluid in such a manner that the hydraulic fluid will exert pressure on the piston while only pneumatic pressure is exerted on the packing.

Another object of the present invention is to provide an improved hoist preventing the loss of hydraulic fluid through the packing.

A still further object of the present invention is to provide an improved hoist which prevents the accidental lowering of the piston from the extreme extended position.

Another object of the present invention is to provide a hoist wherein the pneumatic fluid is completely discharged from within the piston during the lowering operation.

Another object of the present invention is to provide a hoist wherein the passage of pneumatic fluid to the area below the piston is prevented at all times.

These and other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view showing the improved hoist forming the subject of this invention with a source of pneumatic pressure, piping, control valve and fittings; further showing the hoist in the extended position in dotted lines;

Fig. 2 is a vertical longitudinal cross sectional view taken through the piston and cylinder in the lowered position;

Fig. 3 is a vertical longitudinal cross sectional view taken through the piston and cylinder in the extended position;

Fig. 4 is a cross sectional view taken along the line 4—4 of Fig. 2; and

Fig. 5 is a top plan view of the piston and cylinder with the hoist and piping removed.

Referring to the drawings, Fig. 1 is a diagrammatic view showing the environment with which the hoist may be employed and which includes a suitable source of compressed air, such as the tank **10**, and a three-way control valve **12** of any suitable type. The control valve controls the flow of fluid from the tank **10** through supply pipe **14**, valve **12**, and pipe **16** to the hoist **18**, and also

from the hoist **18**, pipe **16**, valve **12** and discharge outlet **20**.

The construction of the hoist **18** is best shown in Fig. 2, wherein a hollow cylinder **22** is embedded in the ground, and an associated lift piston **24** is mounted in spaced relation therein so that an annular space **26** is formed between the piston and the cylinder. The lower end of the cylinder **22** is permanently sealed or capped with a cover plate **28**. The piston **24** is guidably supported for up and down movement within the cylinder by a suitable bearing **30**, stuffing box **32**, packing **34** and packing gland **36**, all of which are attached to a common flange **38**, which flange is an integral part of the cylinder **22**. The bearing and packing unit closes the top of the annular space **26**. The lower end of the piston **24** carries a bearing **40** which is permanently attached to the extreme end thereof and is in guidable engagement with the inner peripheral surface of the cylinder **22**.

The piston **24** is a cylindrical hollow casing or tube having an internal bore or chamber **42**, and is permanently sealed or capped at one end with a cover plate **44**. The cover plate **44** has a threaded opening **46** therethrough, and a threaded plug **48** which fits therein. A super-structure or vehicle supporting frame **50** is suitably secured to the top of the piston. The lower end of the piston **24** is capped by a cover plate **52** which has an opening or orifice **54** therethrough. Attached to the outer surface of the piston **24** at a point intermediate its ends is a stop ring **56** having a circular groove **58** therein, in which is inserted an O-ring **60**. A hollow tube or pipe **62** is attached to the piston **24** extending from a point below stop ring **56**, where it extends through an opening **64** and is in communication with the annular space **26**, upwardly within the piston to a point slightly below the cover plate **44** or into a recess **66** therein.

As so far described, it will thus be seen that the construction of this hoist differs in general principle from hoists of already known construction and principle in several novel and useful ways. Compressed air, or other means of applying pneumatic pressure, is injected into the top of cylinder **24** at a point just below bearing **30**, thus exerting pneumatic pressure on hydraulic fluid contained in the annular space **26** and exerting only pneumatic pressure on the packing **34**. Secondly, the tube or pipe **62** is so placed that hydraulic fluid under pneumatic pressure flows through tube **62** and the recess **66** into the inner chamber **42** within the piston **24**. Since chamber **42** is completely filled with hydraulic fluid, the additional fluid flowing from the annular space **26** through tube **62** causes a further flow of fluid to flow through orifice **54** into the area **68** below cover plate **52**, thus causing the piston **24** to move outward through top bearing **30** until stop ring **56** contacts the bottom of upper bearing **30**. It will be noted that tube **62** is permanently affixed to the interior wall of piston **24** and therefore moves with piston **24**. Finally, bearing **40** is constructed and fit into cylinder **22** so as to effectively seal off the flow of hydraulic fluid from annular space **26** into the area **68** when piston **24** is moving outward and to further seal off the flow of fluid from area **68** into the annular space **26** when the piston is moving inward.

The operation of the hoist will now be readily understood from the following detailed description.

The apparatus is first entirely filled with hydraulic fluid by removing the plug **48** and inserting the liquid through the opening **46** until the chamber **42**, area **68**, pipe **62** and annular space **26** are filled. The plug is then reinserted in the threaded opening **46**, thereby sealing off the interior of the hoist except for the opening **70** in the cylinder **22** at the upper end of the annular space **26**. Compressed air is now released from air tank **10** by actuating control

valve 12, causing a flow of compressed air through air supply pipes 14 and 16 and inlet 70 into the annular space 26 of the hoist. The pneumatic pressure now exerted on the hydraulic fluid within the annular space in the hoist causes a flow of hydraulic fluid from the annular space 26 through the tube 62 and recess 66 into the inner chamber 42. Since the inner chamber 42 is already filled with hydraulic fluid, the pressure causes it to flow through the orifice 54 in the bottom of the piston so that pressure is exerted on the bottom of the cylinder, thereby causing the outward or upward movement of piston 24 from the cylinder 22.

It should be noted that only pneumatic pressure has been applied to the bearing and packing at the upper end of the cylinder and no hydraulic pressure has been applied thereon. The flow of hydraulic fluid continues as above described and the piston continues to move outward until the bottom opening of the tube 62, which extends through the wall of the piston 24, emerges from the hydraulic fluid in the annular space 26. It will be further noted at this point that the chamber 42 within the piston 24 has remained completely filled with hydraulic fluid, but that the fluid level in the annular space 26 has been lowered. Pneumatic pressure is now induced at the top of chamber 42 in piston 24 by reason of compressed air flowing through tube 62 from the annular space 26. Thus, the pneumatic pressure developed in the chamber 42 causes the hydraulic fluid to continue to flow from chamber 42 through opening 54 into the area 68, thereby causing a continued hydraulic pressure to be exerted on the bottom of cover plate 28 until piston 24 has reached an extreme outward or upward position and stop ring 56 has arrested further movement by contacting the lower portion of bearing 30. When piston 24 reaches the maximum stop position, stop ring 56 contacts the bottom of top bearing 30, thereby compressing O ring 60 against the bottom of top bearing 30 and thus completely sealing any possible air passage from the annular space 26 through packing 34, thereby effectively preventing the accidental lowering of piston 24.

It is to be particularly noted that throughout the entire operation as herein described, no hydraulic pressure has been exerted on packing 34, packing gland 36 nor bearing 30, and that only pneumatic pressure has been so exerted, and due to this construction and operation, there can be no loss of hydraulic fluid in the operation of the hoist. It is also to be noted that by reason of the controlled flow of the hydraulic fluid between the several areas within the hoist that a certain minimum fluid level is maintained in all areas and that no air is permitted to enter the area 68 below the piston cover plate 52.

The operation of the hoist, as so far described, has dealt only with movement of the piston outward or upward, which movement is the power or lifting stroke of the piston. The following description pertains to the inward or downward movement of the piston and its return to the original position in the cylinder.

Compressed air is released and discharged from the hoist 18 in Fig. 1 by actuating control valve 12 which permits the discharge of air through pipe 16, valve 12 and outlet 20. When pneumatic pressure is released from areas 26 and 42, piston 24 tends to return to its original inward or lowered position. This downward motion of the piston 24 causes hydraulic fluid to re-enter chamber 42 of the piston through opening 54 in the bottom thereof, thereby forcing all air from chamber 42 through tube 62 into the annular space 26 and thence out through inlet 70 to discharge outlet 20 to atmosphere. This flow of hydraulic fluid and air continues until all air has been discharged from chamber 42 which at this point is again completely filled with fluid. As the downward movement continues, hydraulic fluid now flows through tube 62 from chamber 42 into annular space 26 until the piston has reached the extreme down or lowered position.

Similar to operation on the power or upward stroke, it is to be again particularly noted that no hydraulic pressure has been exerted on the packing; consequently no hydraulic fluid has contacted the packing and no loss of hydraulic fluid will occur. It is also to be particularly noted that the same movement of compressed air and hydraulic fluid on the downward or return stroke of the piston will completely release all air from the chambers of the hoist. This same movement of air and hydraulic fluid will also release all air which may be entrained in the fluid while the hoist is being operated.

From the foregoing, it is believed that the manner of construction and operation of the hoist will be readily understood. Although, in Fig. 1, the hoist cylinder and piston assembly has been shown as applied to an automobile hoist or service station lift, it is to be understood that the principles of the invention are not limited thereto, since the device is of general application and may be employed wherever a piston within a cylinder is used for the purpose of lifting loads or otherwise causing movement of connected or attached parts.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A hoist construction comprising a relatively movable cylinder and a piston having an annular space therebetween, said cylinder having a closed end at the bottom thereof and an open end at the top thereof through which said piston extends, packing means at the top of the annular space between said cylinder and piston, a sealing means attached to the lower outer surface of said piston sealing the lower end of said annular space, said cylinder and piston together with said packing and sealing means defining a closed annular space, said piston being hollow and providing a fluid chamber therein, means for introducing fluid under pressure into the upper end of said annular space, means connecting said annular space and said fluid chamber, an expansion chamber beneath said piston within said cylinder, and an opening in the bottom of said piston connecting said fluid chamber and said expansion chamber, whereby as fluid under pressure is introduced into said annular space the piston is raised out of said cylinder.

2. In a hoist in accordance with claim 1, wherein said means connecting the annular space and fluid chamber is a tube attached to said piston and opening at one end into an intermediate portion of said annular space and opening at the other end into the uppermost portion of said fluid chamber.

3. In a hoist in accordance with claim 1, wherein liquid is contained within said annular space, said fluid chamber and said expansion chamber, and as fluid under pressure is introduced into said annular space, the liquid therein is displaced into said fluid chamber, and thence through said opening in the bottom of said piston into said expansion chamber.

4. In a hoist in accordance with claim 1, further comprising stop means attached to the outer surface of said piston at an intermediate point and extending into said annular space to limit the travel of said piston in said cylinder, and a sealing member attached to the upper surface of said stop means whereby as said sealing member contacts said upper sealing means a seal is provided preventing the leakage of fluid therebetween.

5. In a hoist in accordance with claim 2, further comprising stop means attached to the outer surface of said piston at an intermediate point and extending into said annular space to limit the travel of said piston in said cylinder, and a sealing member attached to the upper surface of said stop means whereby as said sealing member contacts said upper sealing means a seal is provided preventing the leakage of fluid therebetween, said tube opening into said annular space at a point below said top means.

6. A hoist construction of the type having a piston movable within a closed bottom hollow cylinder, with packing at the upper end of said cylinder enclosing the space between said cylinder and said piston and wherein fluid pressure admitted to said cylinder acts on the lower surfaces of said piston to cause said piston to be elevated with respect to said cylinder, characterized by a stop means attached to the outer surface of said piston at an intermediate point thereon to limit the upward travel of said piston, and a sealing member attached to the upper surface of said stop means whereby as said sealing member contacts said packing at the end of the travel of the piston, a seal is provided preventing the leakage of fluid therebetween.

7. A hoist construction of the type having a relatively movable cylinder and hollow piston defining an annular space therebetween with packing between said cylinder and piston at the upper end and lower end of said annular space and wherein fluid pressure acting on the level of a liquid contained in said annular space, said piston and

said cylinder causes the piston to be elevated with respect to the cylinder by flow of the liquid from said annular space to said piston and from said piston through an opening therein to said cylinder beneath said piston, characterized by a tube attached to said piston opening at one end into an intermediate portion of said annular space and opening at the other end into the uppermost inner portion of said hollow piston.

8. A hoist construction in accordance with claim 7, further characterized by a stop means attached to the outer surface of said piston at an intermediate point thereon to limit the travel of said piston, and a sealing member attached to the upper surface of said stop means whereby as said sealing member contacts said upper packing at the end of the travel of the piston a seal is provided preventing the leakage of fluid therebetween, said tube opening into said annular space at a point below said stop means.

No references cited.