

Oct. 9, 1934.

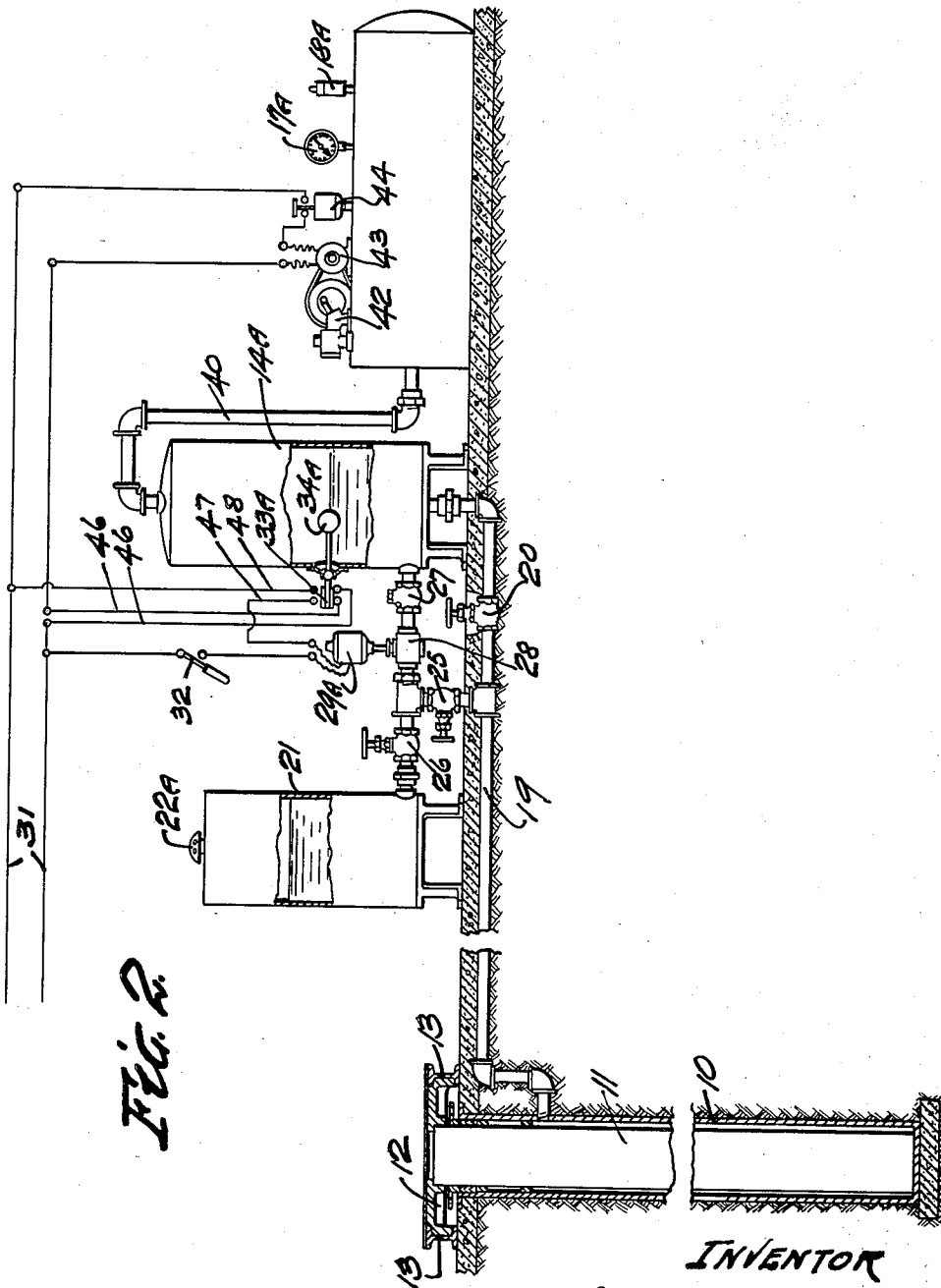
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1,976,129

MEANS FOR OPERATING A HYDRAULIC JACK

Filed Dec. 12, 1932

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UNITED STATES PATENT OFFICE

1,976,129

MEANS FOR OPERATING A HYDRAULIC JACK

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Application December 12, 1932, Serial No. 646,744

3 Claims. (Cl. 60—51)

This invention relates to means and methods for operating jacks in which the raising of the load is accomplished through the agency of a liquid, usually oil, the pressure on the liquid being provided through the medium of compressed air, and the device preferably being electrically operated.

The operation cycle of such a jack, as applied, for example, to a vehicle lift, may be divided into three periods, namely, the drive-on and raising period, the sustaining period, and the lowering and drive-off or clearing period. The first and last of these periods inherently involve loss of time, only the duration of the second period being devoted to useful work. It is essential, therefore, that the first and last of these periods shall each be minimized, if speed and economy of operation are to be effected.

At the present time, there are numerous jacks in which a piston or plunger is forced from a cylinder by the action of a liquid on which the pressure is established by compressed air. In these devices the liquid is contained in a reservoir from which it is forced by the air pressure into the cylinder beneath the plunger. Compressed air for this use is usually furnished by an electrically-driven air compressor, a part of the air usually being initially stored in a tank in which the supply is replenished from time to time by the compressor. It is inherent, therefore, in such structures that the speed at which the jack acts is largely dependent upon the size of compressor tanks and the pressure maintained therein. Also, in such a device, in order to accomplish the descent of the plunger it is necessary to release liquid into the compressed air reservoir, and to release the compressed air into the atmosphere, each such operation not only wasting a large amount of useful energy, but also, because the fluid must be released against the opposition of compressed air, retarding the descent and increasing the time element.

There are also hydraulic lifts used in raising automobiles, in which the liquid is pumped usually by a rotary pump. In these the size of motor required in order to obtain even a reasonably satisfactory rate of raising speed, is such as to necessitate heavier circuit wiring than is employed for the ordinary lighting circuit usually available, and in some instances a starting device of some sort which will build up the speed of the motor without excessive shock

on the line. In other words, these devices must be excessively powered or be slow in action.

The present device contemplates the use of a closed tank of such capacity as to contain a full raising charge of liquid and a charge of compressed air adapted to expel such liquid without excessive initial pressure and without the pressure dropping below that required by the jack, together with suitable piping to lead the liquid into the cylinder and means to cut off or control the flow of the liquid to the cylinder. It further contemplates a supplementary tank, open to atmospheric pressure, into which tank the liquid may be discharged by the descent of the plunger with means for cutting off or controlling flow of the liquid from the cylinder thereto. And it still further contemplates the use of a charge of the liquid, substantially double that required to raise the plunger the intended distance, an electrically-driven pump for transferring the liquid from the atmospheric tank to the pressure tank, and means for automatically starting the operation of the pump whenever the level of the liquid in the pressure tank is lowered by the use of the jack.

The invention also contemplates optionally cutting off the secondary tank, and establishing a circuit for returning the raising liquid directly from the pump to the compression tank, so that the weight of the load, and that of the plunger and associated parts, may be effective to assist the pump in restoring said liquid to the compression chamber.

The primary object of the present invention is to overcome various objections to the jacks known heretofore, and to improve thereupon, particularly in the following respects.

By providing means for utilizing compressed air in a closed cycle to establish pressure upon a liquid for raising a jack-plunger.

By providing means for permitting the discharge of the raising liquid against atmospheric pressure at all times while lowering the load.

By providing means for establishing working pressures during the sustaining period, preparatory to a successive raising cycle.

By providing an air-actuated jack operable without loss or waste of air pressure, thus promoting efficiency.

By providing a lift actuated by compressed air and automatically controlled by electric means, and in which no loss of compressed air is necessary in the operation of the lift.

By providing means for automatically ini-

tiating reestablishment of the power means during operation and use of the device.

By optionally providing means for utilizing the weight of the descending load and plunger in reestablishing the power medium.

The means by which the foregoing and other objects are accomplished by my present invention, and the manner of their accomplishment, readily will be understood from the following specification on reference to the accompanying drawings, in which—

Fig. 1 is a diagrammatic side elevation, partly in section, showing a preferred embodiment of my lifting device.

Fig. 2 is a similar view showing a preferred arrangement form combining the usual station air equipment with such a lifting device.

Referring now to the drawings, in which the various parts are indicated by numerals, 10 indicates the cylinder of a hydraulic lift. 11 is a plunger; 12 is a head carried by the plunger, and 13 are rails of what is ordinarily designated as a free-wheel lift table. 14 is a closed tank which may be charged with compressed air in any usual or desired manner. 16 is an air cock. 17 indicates an air gauge, and 18 is an overload or safety valve. Connected to the lower portion of the tank 14 is a pipe line 19, which leads to the cylinder 10. 20 is a control valve in this line, by which flow from the tank 14 to the cylinder 10 may be turned on or off, or regulated. 21 is an auxiliary tank directly in communication, as through an opening 22, with the atmosphere. Preferably this opening is protected by a breather cap, 22A shown only in Fig. 2. The tank 21 is connected by a pipe line 23, with the tank 14, and said line is connected with the pipe line 19 by a pipe line 24. 25 is a cutoff valve in the pipe line 24, which valve may be opened or closed, to establish or cut off flow from the pipe line 19 through the line 23 to the tank 21. 26 is a cutoff valve which normally remains open, but which may be closed should it be desired to eliminate the tank 21 from the circuit. Disposed in the pipe line 23, between the pipe line 24 and the tank 14, is a check valve 27 which permits flow through the line to the tank 14, but prevents return flow therefrom. Also disposed in the pipe line 23, and between the pipe line 24 and the check valve 27, is a pump 28. This pump 28 is actuated by a motor 29 preferably of the electric type. 30 is the shaft connecting the motor and pump. 31 is a power circuit leading to the motor 29, and controlled by a manually-operable switch 32. One leg of the circuit 31 leads through a normally open switch 33, which switch is adapted to be closed by the lowering of a float 34 within the tank 14, and to be reopened on reestablishment of the float level.

It will be understood that the float control, the switch, the motor, the pump and the valves are such as may be purchased in the open market; and that the details thereof are not pertinent, and therefore need not be shown.

Preferably an opening 35 is cut in one side of the tank 14 at the desired level, to permit the insertion of the float, the opening being closed and sealed by a closure member 36 which may form a support for the float-and-switch assembly.

The size of the tank 14 is preferably so fixed relative to the displacement of the plunger 11, as between its fully raised and fully lowered positions, that somewhat in excess of a full

charge of liquid necessary for such displacement may be placed in said tank, and an air space be left which ordinarily is about twice as large as the liquid space. The capacity of the tank 21 is in excess of the volume of an equivalent charge of the liquid.

In Figure 2, an identical layout is shown, except that the tank 14A is connected by a pipe line 40 with an auxiliary air tank 41, such as is ordinarily used as a part of air compressor equipment, on which latter tank the pressure gauge 17A and safety valve 18A are usually mounted.

42 indicates a typical air compressor, and 43 an electric motor by which the compressor is driven. 44 is the usual pressure-controlled switch which causes actuation of the compressor to fill the tank 41 when the pressure drops. In this form of the device, a double acting switch 33A is used. The float 34A when in raised position maintains a closed circuit through this switch and the wires 45 and 46 to the pressure-controlled, switch 44, and an open circuit through the wires 47 and 48, as initially, to the motor 29A. When the float 34A descends, as a result of operation of the lift, the circuit through the wires 45 and 46 is broken, thus rendering the circuit to the motor 43 inoperative, and, when the float is returned to predetermined position, the circuit for that motor is re-established, thus making starting of the motor possible on pressure drop.

From the foregoing description, the advantages attained by my improved means and method and for operating hydraulic jacks, the means I preferably employ, and the preferred manner of utilizing such means, readily will be understandable to anyone having even general familiarity with this art.

I have illustrated and described herein, as typifying the commercial use of my invention, its application to a vehicle lift, but it is to be understood that such illustration and description are not intended to limit my inventive rights in any way. As illustrated and described herein, the requisite pressure upon the liquid employed as a power medium is established in the main tank 14 in any preferred manner, and, in the case of vehicle lifts, ordinarily would be initiated through the medium of compressed air. The level of the liquid in said tank, and the position of the float 34, are so predetermined that, almost simultaneously with the opening of the valve 20 to admit liquid from the main tank 14 into the lift cylinder 10, the level of the liquid in said tank will drop sufficiently to lower the float 34 below its predetermined level, and thereby initiate operation of the motor 29 by which the pump 28 is driven; such operation of said pump causing liquid from the auxiliary tank 21 to be transferred to the main tank 14. Such transfer continues during the lifting movement of the plunger, and during such portion of the load sustaining or now movable status of the plunger as may be necessary to enable the pump to restore the level of liquid in the main tank 14 to such a height as to return the float 34 to position to terminate the operation of the motor 29, and thus of the pump 28. Thus, since, particularly in a vehicle lift, the plunger remains in its elevated, or "servicing", position, very much longer than the time required for the lifting movement of such plunger, a relatively small pump and motor are adequate for the liquid-transfer operation, and excessive demands on

the wiring circuit to such motor are largely obviated.

In charging the device; with the plunger 11 in lowered position, the surrounding spaces and piping are filled with liquid usually oil, additionally a quantity of the liquid somewhat in excess of the plunger displacement volume, is placed in the tank 14 and an equal or greater amount in the tank 21. The valves 20 and 25 are closed, the valve 26 normally being left open, and air is forced into the tank 14, until an initial pressure is established on the liquid, such that when by expansion of the air liquid from the tank 14 into the cylinder to raise the plunger therein, sufficient pressure will remain at the end to complete the lift of the plunger. Thereafter, to use the device, with the valve 25 still closed, the valve 20 is opened and expansion of the air in the tank 14 forces liquid into the cylinder 10, raising the plunger rapidly. When the desired raise is accomplished the valve 20 is closed and the plunger thereby held in raised position.

As the liquid level drops in the tank 14, the float 34 drops, starting the motor 28 and pump 29 and transferring liquid from tank 21 to tank 14. This pumping action usually continues during the lift movement and part, at least, of the servicing period and may extend into, or even beyond the lowering period in exceptional cases. Transfer of liquid thus accomplished, continues until the float 34 reaches its initial level, at which time the motor and pump are cut off with the original pressure and other conditions re-established in the tank 14. Independently, at the end of the servicing period, the valve 25 is opened to lower the plunger, the liquid released flowing into the tank 21, to replenish the supply therein.

Manifestly, if the valve 26 be closed during the lowering movement of the plunger, the pump 29 will serve to promote movement of the liquid into the tank 14, so long as the float 34 remains below the level at which it terminates actuation of said pump and consequent re-establishment of the pressure in said tank, and will require for its operation only sufficient power to overcome the difference in pressure between that created by the plunger and its load and that built up in the tank.

Having now fully disclosed the invention, what is claimed is:

1. A hydraulic jack and operating means therefor comprising a cylinder; a plunger slidable therein; a load-support carried by said plunger; a main receptacle for liquid, and for compressed air effective thereupon; an auxiliary receptacle for such liquid, open to the atmosphere; a connection between said main receptacle and said cylinder; a connection between

said main receptacle and said auxiliary receptacle; a pump for transferring liquid from said auxiliary receptacle to said main receptacle through the connection therebetween; a motor for operating said pump; means for supplying compressed air to said main receptacle; a float in said main receptacle; means operable by said float for initiating the operation of said pump motor, and simultaneously rendering inoperative said means for supplying compressed air to said main receptacle.

2. A hydraulic jack and operating means therefor, comprising a cylinder; a plunger slidable therein; a load-support carried by said plunger; a main receptacle for liquid, and for compressed air effective thereupon; an auxiliary receptacle for such liquid, open to the atmosphere; a connection between said main receptacle and said cylinder; a connection between said main receptacle and said auxiliary receptacle; a pump for transferring liquid from said auxiliary receptacle to said main receptacle through the connection therebetween; a motor for operating said pump; a wiring circuit leading to said motor; an air-compressor for supplying compressed air to said main receptacle; a motor for operating said compressor; a wiring circuit leading to said compressor motor; a float in said main receptacle; and a switch operable by said float to close said circuit leading to said pump motor, and concurrently to open said circuit leading to said compressor motor.

3. A hydraulic jack and operating means therefor, comprising a cylinder; a plunger slidable therein, a load-support carried by said plunger; a main receptacle for liquid, and for compressed air effective thereupon; an auxiliary receptacle for such liquid, open to the atmosphere; a connection between said main receptacle and said cylinder; a connection between said main receptacle and said auxiliary receptacle; a pump for transferring liquid from said auxiliary receptacle to said main receptacle through the connection therebetween; a motor for operating said pump; a wiring circuit leading to said main receptacle; an air-compressor for supplying compressed air to said tank; a motor for operating said compressor; a wiring circuit leading to said compressor motor; a float in said main receptacle; a switch operable by said float to close said circuit leading to said pump motor, and concurrently to open said circuit leading to said compressor motor; a switch in said compressor circuit near said compressed air tank; and means operable by changes of pressure in said tank for opening and/or closing said last-named switch.

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