

Dec. 20, 1927.

1,653,276

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LIFTING JACK

Filed Dec. 28, 1925

2 Sheets-Sheet 1



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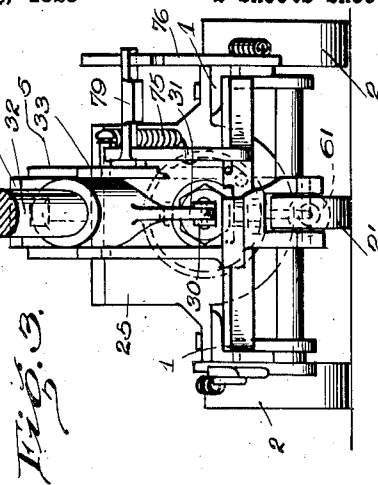
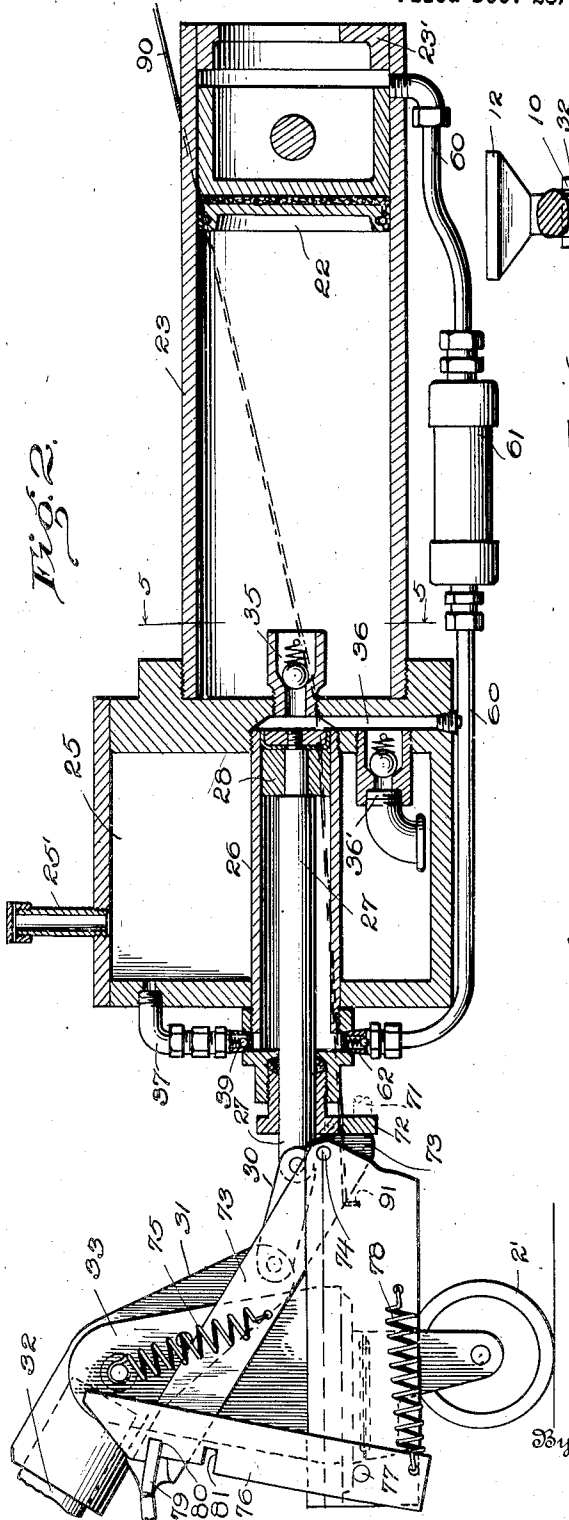
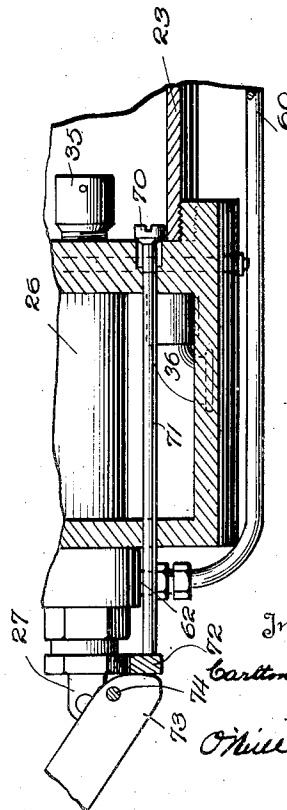


Fig. 4.



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Patented Dec. 20, 1927.

1,653,276

UNITED STATES PATENT OFFICE.

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LIFTING JACK.

Application filed December 28, 1925. Serial No. 78,047.

The invention relates to improvements in portable lifting jacks of the general type shown in my Patent No. 1,555,842, granted October 6, 1925, and has for its object to provide the apparatus with means for conserving the fluid pressure medium, by insuring the return of any of the medium that may leak past the operating pistons to the reservoir; means for providing a slow release of the fluid pressure from the power cylinder to the reservoir, when lowering the load, and a quick release thereof, when the jack is lowered without load; and means for preventing excessive lifting movement of the jack and consequent damage to the apparatus, said means involving mechanism for automatically releasing the fluid pressure, when the lifting element of the jack reaches a predetermined upper limit of movement.

The invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a side elevation of the improved jack.

Fig. 2 is a partial sectional side elevation of the operating mechanism.

Fig. 3 is an end elevation.

Fig. 4 is a fragmentary sectional elevation showing the relation of the main relief valve.

Fig. 5 is a section on the line 5—5 of Fig. 1, with certain of the parts omitted to avoid confusion.

Fig. 6 is a section on the line 6—6 of Fig. 5.

Fig. 7 is a section on the line 7—7 of Fig. 5.

Referring to the drawings, it will be observed that the general construction and arrangement of the jack and its operating mechanism is similar to that shown in my patent aforesaid with the improvements which constitute the instant invention applied thereto, but it will be understood that said improvements are not limited to the specific form of jack illustrated and, therefore, the latter is to be regarded as merely exemplary.

As indicated more particularly in Fig. 1, 1 indicates the generally rectangular metal frame, upon which the mechanism is carried, said frame being provided with forward supporting rollers 2, 2 and a rear swivel castor 2'. Mounted on the side members of the frame 1 are two A frames or brackets 3, in which is pivoted by pintle 4,

a bell crank lever 5 having a forwardly extending arm 6 and a downwardly extending arm 7, the former supporting a sleeve 10 in which is adjustably mounted a shoe 12 adapted to engage the load, the lower end of the sleeve 10 being connected to brackets 3 by reach rods 14 by means of pins 15 and 16. The lower end of the arm 7 is provided with a pawl 7' adapted to engage the teeth of an arc-shaped bar 51, which bar is mounted on a shaft 50 journaled in the downward extensions of the bracket 3, said shaft carrying a crank arm 52, to the upper end of which is attached a helical tension spring 53, which, in turn, is secured to a pull rod 54 connected to a lever 55 pivoted at 56 to the frame 1, said lever 55 being engaged by a stop 57, the several parts being constructed and arranged to operate as described in my patent aforesaid.

Secured between the side members of the frame 1 is a reservoir 25, to the front end of which is attached a cylinder 23 in which operates a piston 22 having a forwardly extending connecting rod 21 pivoted to the lower end of arm 7 of the bell crank 5. The forward end of the cylinder 23 is provided with a ring or annulus 23', which serves as a dam to retain any of the fluid pressure medium which may leak past the piston 22 in the normal operation of the apparatus. Mounted substantially centrally within the reservoir 25 and in axial alignment with the cylinder 23 is a pump designed to force the fluid pressure medium from the reservoir 25 into the cylinder 23 behind the piston 22 and thereby effect the proper elevation of the load engaging member of the jack. The pump comprises a barrel 26 in which reciprocates a plunger 28 connected by rod 27 and link 30 to an operating brake or handle 31, 32 pivotally mounted in brackets 33 on the rear of the frame 1. The forward end of the reservoir 25 is provided with a duct 36, which communicates with the forward end of the pump barrel 26 through the casing of an outwardly opening check valve 35, which constitutes the discharge from the pump into the cylinder 23, and through the casing of an inwardly opening check valve 36', which permits the fluid pressure medium to be drawn by the suction stroke of the pump from the reservoir 25, as will be understood.

When the pump is operated, the fluid

pressure medium is drawn from the reservoir 25 through check valve 36', duct 36 into the barrel of the pump in front of the plunger 28, as the latter is retracted, and upon the forward movement of the plunger, the pressure medium is forced past check valve 35 into the cylinder 23, thereby forcing piston 22 outward and causing the power arm 6 of the bell crank 5 to be elevated, the extent of elevation of the power arm of said bell crank being determined by the number of strokes of the piston 23.

When it is desired to lower the power arm or load engaging end of the bell crank lever, together with the load thereon, it is quite necessary that the lowering movement be gradual and steady to avoid damaging the jack or the load supported thereby. On the other hand, when the power arm is to be lowered without a load, it is desirable that the lowering movement be effected quickly, and, to effect these objects, the apparatus is provided with pressure release mechanism interposed between the cylinder 23 and the reservoir 25, provided with means to permit a gradual lowering of the load engaging member under load and a rapid lowering thereof, when unloaded, said pressure release mechanism being constructed and arranged as follows:

Formed in the partition between the reservoir 25 and the cylinder 23 is a valve chamber 40, the outer rim of which is provided with a seat with which cooperates a valve 70 on the end of a rod 71 traversing the reservoir 25 and having its free end projecting beyond the rear wall of the reservoir, and normally engaging a swinging bail 72 pivoted between the side members of the frame 1. The bail 72 is engaged by the end of a lever 73, which is pivoted on a pin 74 secured to the frame 1, said lever being held in its retracted position by a spring 75, which may be conveniently connected at one end to the pivot pin of the pump brake member 31. The outer end of the lever 73 is provided with a pedal 73' adapted to be engaged by the foot of the operator, and also with a lateral detent 79, which is adapted to be engaged by notches 80 and 81 in a latch member 76 pivoted at 77 to a side member of the frame 1, said latch being held normally in position to engage the detent 79 by a spiral spring 78 connected to the lower end of the latch and to the side member of the frame 1. When the detent 79 is engaged in the upper notch 80, the lever 73 is held in retracted relation, so that the valve 70 remains closed, and, when the detent is engaged in notch 81, the lever 73 is locked in its lower position and valve 70 is held open.

Connected with valve chamber 40 is a duct 41 having a lateral branch 41' opening into reservoir 25, the outer end of said lateral

branch being closed by a suitable screw plug 43, which permits access to the duct. Threaded in the side of the wall of reservoir 25 and in axial alignment with the duct 41 is a screw plug 43, the inner end of which constitutes a throttle valve to regulate the discharge opening between duct sections 41 and 41' and, therefore, to regulate the rate of discharge of fluid pressure from cylinder 23 into reservoir 25, when valve 70 is open. The screw plug 43 is locked in adjusted position by means of a set nut 43'. Also communicating with the valve chamber 40 is a second radial duct 44, which communicates with a lateral duct section 44' opening into reservoir 25 and provided with a screw plug 45 in its open end. A screw plug 46 likewise is provided for closing the open end of radial duct 44 and giving access to the latter for freeing the same of obstructions. The lateral duct section 44' is constricted adjacent the point where it enters cylinder 25 to provide a valve seat 47' adapted to be engaged by a check valve 47, under certain conditions, thereby to close communication between the cylinder 23 and reservoir 25 by way of duct 44, 44', when valve 70 is open, thereby permitting the exhaust of cylinder 23 to be effected past the throttle valve 43 in duct 41' only, so that such exhaust will be relatively slow and steady. The check valve 47 is normally suspended in open relation by means of a stout helical spring 48 on the discharge side of said valve, which is held in position by a set screw 48', the opposite side of the valve being acted upon by a relatively weaker spiral spring 49 interposed between the valve 47 and the plug 45. The tensions of the springs 48 and 49 are so adjusted that the check valve 47 is normally held in open position and will remain open so long as the discharge of fluid pressure medium from the cylinder 23 into the reservoir is initiated gradually and maintained slowly and substantially uniformly, but will close against the tension of spring 48, if the fluid pressure medium is exhausted violently and rapidly from the cylinder 23, as would be the case when valve 70 is opened, while the load is supported by the jack. The closing of the valve 47 by the rush of the fluid pressure medium will immediately check the exhaust of said medium from the cylinder and cause the latter to pass slowly through the constricted opening controlled by the throttle valve 43 in duct 41, so that the load on the jack will be lowered slowly and uniformly without endangering the load or the mechanism of the jack. On the other hand, if it is desired to depress the load carrying member of the jack when the latter is not loaded, this may be done manually, by exercising a relatively steady pressure on the shoe 12 or the arm 6

of the bell crank 5, after the exhaust valve 70 has been opened by depressing lever 73, so that the fluid pressure medium exhausts steadily, but without any preliminary surge through valve chamber 40, duct 41, 41' and duct 44, 44', as the check valve 47 will be held open by spring 48 under such conditions.

It has been found desirable to conserve the fluid pressure medium employed to operate the jack. The ordinary cause of waste is leakage past the piston 22 and in order to recover the fluid which may pass the piston, the forward end of the cylinder 23 is provided with the annulus 23' acting as a dam, and a pipe 60 connected to the bottom of the cylinder behind the annulus 23', said pipe having interposed in its length a suitable filter or cleansing device 61. The other end of the pipe 60 discharges into the barrel 26 of the pump to the rear of the plunger 28 and is provided with a check valve 62 opening toward the pump barrel. In order to deliver the recovered leakage, the pump barrel 26 is connected to the reservoir by a pipe section 37 provided with an outwardly opening check valve 39. Each forward stroke of the pump plunger 28 will draw in liquid from the forward end of cylinder 23 through the pipe 60 into the barrel 26 and the return stroke of the plunger will force the liquid and air drawn into the barrel, into reservoir 25 by way of pipe 37. The excess air will escape from the reservoir by means of a bleeder pipe 25', but the liquid constituting the fluid pressure medium will be retained in the reservoir ready for use with the main body of the fluid pressure medium.

In order to prevent excessive elevation of the load supporting element of the jack, means are provided for operating the exhaust valve 70 as soon as the load carrying end of the bell crank lever reaches a predetermined height, said means comprising a rod 90 attached at one end to the arm 7 of the bell crank lever 5 and the other end of the rod having a sliding connection through an opening in the swinging bail 72, the extreme end of the rod being provided with a hook or detent 91, which engages the bail 72, when the pull rod is moved forward as the arm 6 of the bell crank 5 reaches its maximum height, thereby causing the bail to unseat the exhaust valve 70 and permit the fluid pressure in the cylinder 23 to exhaust sufficiently to lower the load until the abutment on the end of pull rod 90 moves out of engagement with the bail 72. By this means, it is impossible for a careless operator to elevate the load carrying end of the jack beyond a predetermined limit, as will be understood.

What I claim is:

1. A fluid pressure operated jack, comprising a load engaging member, a power

cylinder, a piston therein, a rod connecting the piston and load engaging member, a fluid reservoir, a pump interposed between the reservoir and power cylinder having a cylinder, and means for returning leakage of the fluid pressure medium through the pump cylinder by action of the pump.

2. A fluid pressure operated jack, comprising a load engaging member, a power cylinder, a piston therein, a rod connecting the piston and load engaging member, a fluid reservoir, a pump interposed between the reservoir and cylinder, and means for returning leakage of the fluid pressure medium past the piston to the reservoir, including a pipe connecting the forward end of the cylinder with the rear of the pump barrel, a pipe connecting the pump barrel with the reservoir and check valves in said pipes.

3. A fluid pressure operated jack, comprising a load engaging member, a power cylinder, a piston therein, operatively connected with the load engaging member, a fluid pressure reservoir, a pump having an intake valve connected with said reservoir and a discharge valve connected to said cylinder, and pressure release mechanism interposed between the cylinder and reservoir provided with a yieldably held check valve actuatable by flow of fluid from the cylinder to the reservoir to permit a gradual lowering of the load engaging member under load and a rapid lowering thereof when unloaded.

4. A fluid pressure operated jack, comprising a load engaging member, a power cylinder, a piston therein, a rod connecting the piston and load engaging member, a fluid pressure reservoir mounted adjacent said cylinder, a pump having an intake valve connected with said reservoir and a discharge valve connected to said cylinder, pressure release mechanism interposed between the cylinder and reservoir including a main valve, means for operating the same, a duct connecting the main valve chamber with the reservoir, a throttle valve controlling said duct to effect a slow release of pressure from the cylinder, a second duct connecting the main valve chamber with the reservoir, a check valve interposed in said second duct, and differential springs operating on opposite sides of said check valve, whereby a sudden application of pressure on said check valve due to a descending load will close the check valve and a gradual application of pressure will not affect said valve, but will permit the rapid release of pressure from the cylinder.

5. A fluid pressure operated jack, comprising a load engaging member, a power cylinder, a piston therein, a rod connecting the piston and load engaging member, a fluid reservoir mounted adjacent said cylinder, a pump having an intake valve con-

5 nected to said reservoir, and a discharge
valve connected with said cylinder, and pres-
sure release mechanism interposed between
the cylinder and the reservoir and adapted
to permit a gradual lowering of the load
engaging member under load and a rapid
lowering thereof when unloaded, said mech-
anism including a main valve having a
chamber provided with two ducts opening
10 into the reservoir, a throttle valve control-
ling one duct, a check valve controlling the
other duct, a heavy spring tending to hold
said check valve open, and a light spring
tending to close the check valve.

15 6. A fluid pressure operated jack, com-
prising a load engaging member, a power
cylinder, a piston therein, a rod connecting
the piston and load engaging member, a
fluid reservoir mounted adjacent said cylin-
der, a pump having an intake valve con-
nected to said reservoir, and a discharge
valve connected with said cylinder, pres-
sure release mechanism interposed between
the cylinder and the reservoir adapted to
25 permit a gradual lowering of the load en-
gaging member under load and a rapid
lowering thereof when unloaded, said mech-
anism including a main valve having a
chamber provided with two ducts opening
30 into the reservoir, a throttle valve control-
ling one duct, a check valve controlling the
other duct, a heavy spring tending to hold
said check valve open and a light spring
tending to close the check valve, and a
35 pivoted lever for operating the main valve.

7. A fluid pressure operated jack, com-
prising a load engaging member, a power
cylinder, a piston therein, a rod connecting
the piston and load engaging member, a
40 fluid reservoir mounted adjacent said cylin-
der, a pump having an intake valve con-
nected to said reservoir, and a discharge
valve connected with said cylinder, pressure
release mechanism interposed between the
45 cylinder and the reservoir adapted to permit
a gradual lowering of the load engaging
member under load and a rapid lowering
thereof when unloaded, said mechanism in-
cluding a main valve having a chamber pro-
50 vided with two ducts opening into the reser-
voir, a throttle valve controlling one duct,
a check valve controlling the other duct, a
heavy spring tending to hold said check
valve open and a light spring tending to
55 close the check valve, a pivoted lever for
operating the main valve, a swinging bail
interposed between the lever and the main
valve, and a rod connecting said bail and

the load engaging member to actuate said
bail and open the main valve when the load
engaging member reaches a predetermined
elevation. 60

8. A fluid pressure operated jack, com-
prising a load engaging member, a hori-
zontal power cylinder, a piston therein oper-
atively connected with the load engaging
member, a fluid reservoir, a pump inter-
posed between the reservoir and cylinder
having a cylinder, and means for returning
leakage of the fluid pressure medium to the
70 reservoir through the pump cylinder.

9. A fluid pressure operated jack, com-
prising a load engaging member, a hori-
zontal power cylinder, a piston therein oper-
atively connected with the engaging member,
75 a fluid reservoir, a pump interposed between
the reservoir and cylinder, and means for
returning leakage of the fluid pressure me-
dium past the piston to the reservoir com-
prising a tube leading from the cylinder to
80 the pump cylinder having a check valve, and
a tube leading from the pump cylinder to
the reservoir having a check valve.

10. A fluid pressure operated jack, com-
prising a load engaging member, a hori-
85 zontal power cylinder, a piston therein, a
rod connecting the piston and load engag-
ing member, a fluid reservoir, a pump inter-
posed between the reservoir and cylinder,
and means for returning leakage of the fluid
90 pressure medium past the piston to the reser-
voir by action of the pump comprising a
tube leading from the power cylinder in the
end thereof opposite the cylinder intake to
the pump cylinder at the end thereof op-
95 posite the pump intake having a check valve
and a tube leading from the pump cylinder
at said end to the reservoir.

11. A fluid pressure operated jack, com-
100 comprising a load engaging member, a power
cylinder, a piston therein, operatively con-
nected with the load engaging member, a
fluid pressure reservoir, a pump having an
intake valve connected with said reservoir,
105 and a discharge valve connected to said cylin-
der, and pressure release mechanism inter-
posed between the cylinder and reservoir, in-
cluding a passage between the cylinder and
the reservoir, manually controlled means for
110 permitting return of fluid therethrough and
means controlled by the load on the load
engaging member for regulating the speed
of such flow.

In testimony whereof I affix my signature.

CARLTON G. HARRIS.