

June 27, 1944.

E. R. KIRKLAND

2,352,390

HYDRAULIC JACK

Original Filed Nov. 19, 1940

2 Sheets-Sheet 1

FIG. 2.

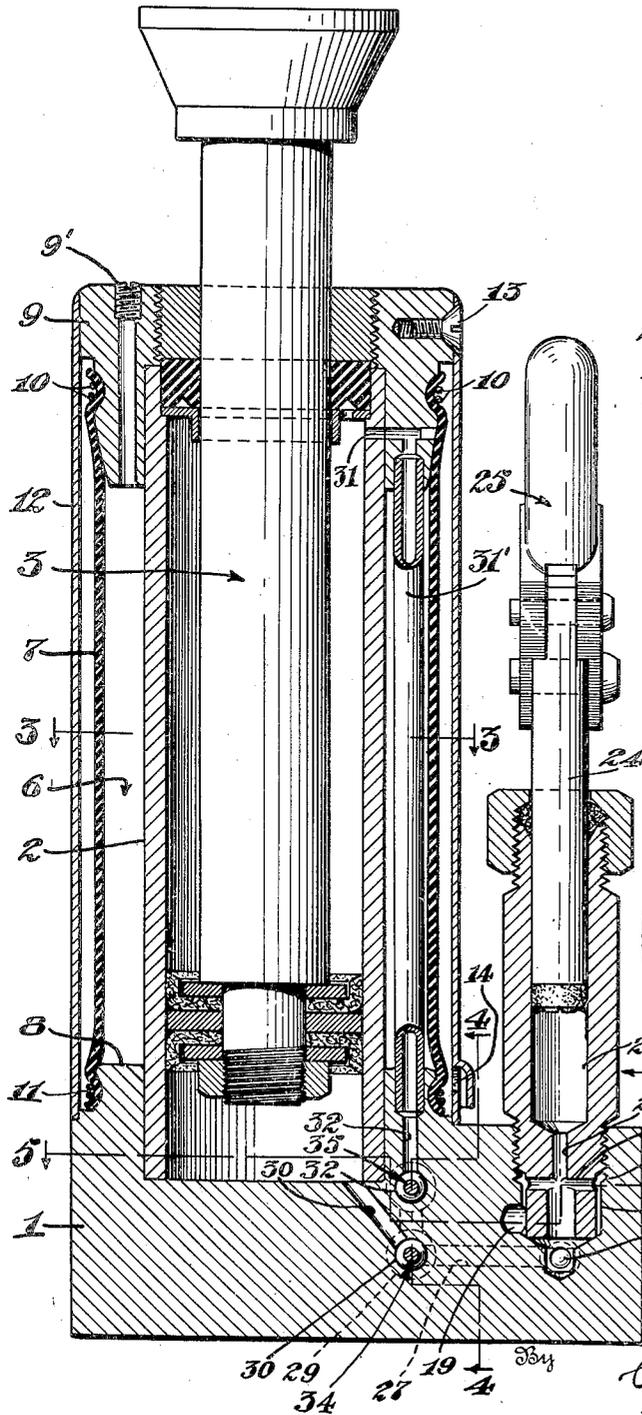


FIG. 1.

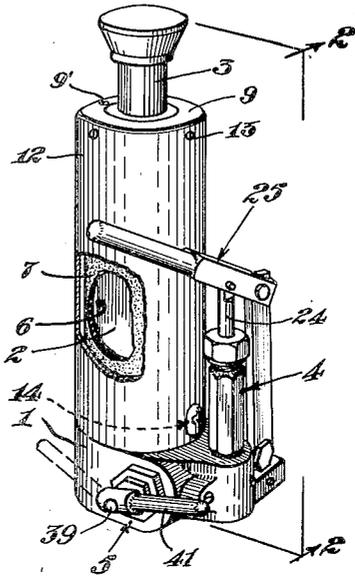
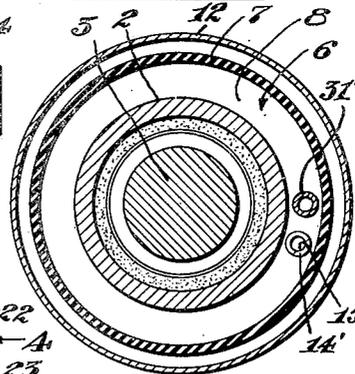


FIG. 3.



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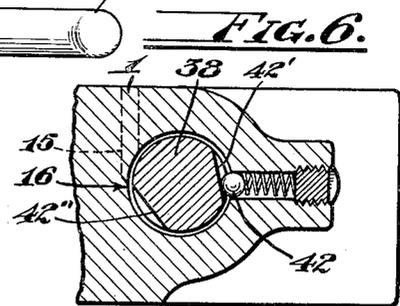
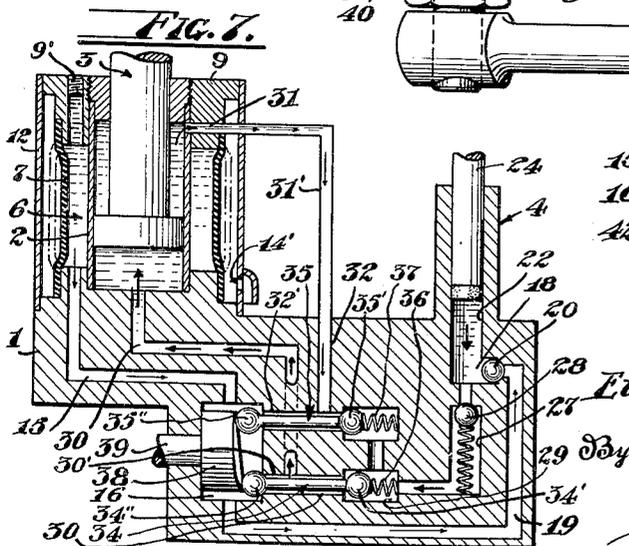
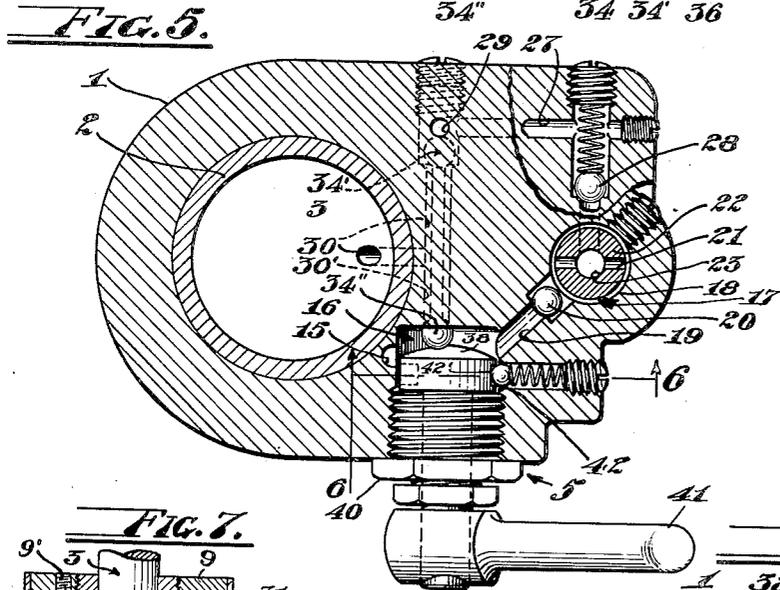
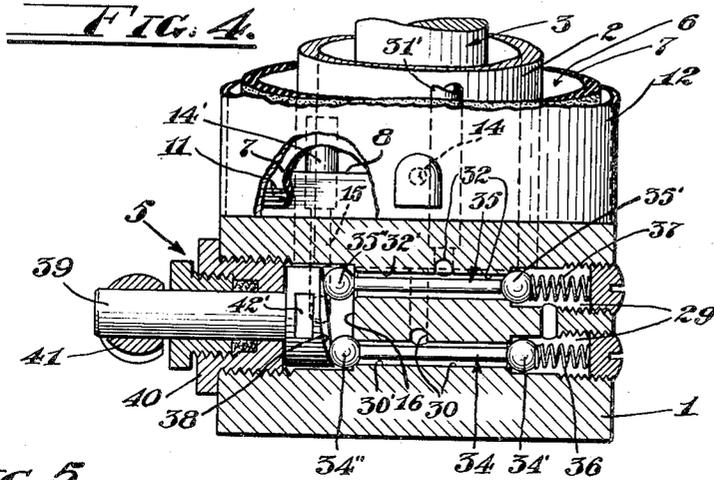
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HYDRAULIC JACK

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,352,390

HYDRAULIC JACK

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Substituted for abandoned application Serial No. 366,225, November 19, 1940. This application May 13, 1943, Serial No. 486,890

1 Claim. (Cl. 60—52)

This invention appertains to pushing and pulling implements and more particularly to a jack of the hydraulic type and this application is a substitution for my abandoned application, Serial No. 366,225, filed on November 19, 1940.

In hydraulic jacks and similar implements difficulty is experienced in the operation thereof due to the failure of the feeding of fluid from the reservoir to the pump. This is generally caused by a so called "vacuum lock." It has been proposed to utilize a spring pressed piston or follower in the reservoir to bear against the fluid, see the Liddell et al. Patent #2,170,029, issued August 22, 1939. Constructions of this kind are open to objection in that after the jack has been in use for a length of time, the piston or follower tends to stick in the reservoir. This is principally caused by the intake of dirt with the air through the atmospheric port in the chamber above the piston or follower.

Therefore it is one of the primary objects of my invention to provide a hydraulic jack or similar implement wherein a novel form of fluid reservoir will automatically vary its cubic capacity by expansion and collapse of at least a part thereof, responsive to variation in the fluid content of the reservoir as effected in operating the pump and ram of the jack, whereby to prevent "vacuum lock" of and failure of feed of the fluid from the reservoir to the pump, and at the same time insure the feed of the requisite amount of fluid to the pump and jack cylinder regardless of the position of the jack with respect to horizontal and vertical planes.

A further purpose is to provide a jack such as described wherein a flexible and elastic jacket or tube may be disposed to surround the jack cylinder to form with suitable end enclosures an annular reservoir sealed to the atmosphere and communicated with the pump and cylinder so that as the pump is operated, fluid is drawn from the reservoir and then discharged by the pump into the cylinder to operate the ram while the fluid displaced from the cylinder by the ram is returned to the reservoir, the flexible jacket or outer wall of the reservoir collapsing or contracting as the fluid is withdrawn into the pump and expanding or inflating when the fluid is returned from the cylinder to the reservoir.

Yet another purpose of my invention is to provide a hydraulic jack such as described, having a novel and highly efficient valve means affording the desired control of the jack for extending and retracting the ram and insuring a reliable performance of the jack under manual control

at all times and in any position or angle in which set up for operation.

A still further object of my invention is the provision of a hydraulic jack which will operate in a most reliable manner per each pump stroke, regardless of the position or angle of the jack and without leakage or impairment of the feed of the requisite amount of operating fluid and consequent failure of the pump to create the necessary fluid pressure for operating the jack as intended, per pump stroke.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into effect as illustrated by way of example in the accompanying drawings in which:

Figure 1 is a perspective view of a hydraulic jack embodying my invention with the body thereof broken away to show the flexible reservoir.

Figure 2 is a vertical sectional view taken on the plane of the line 2—2 of Figure 1, with certain parts broken away for clarity of illustration.

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a fragmentary vertical sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 2.

Figure 6 is a fragmentary sectional view taken on the line 6—6 of Figure 5.

Figure 7 is a schematic view showing the fluid system and illustrating diagrammatically the workings of the control valves, the flexible reservoir, the pump and the ram.

One form of hydraulic jack embodying my invention, as shown on the accompanying drawings generally comprises a base 1, a hydraulic cylinder 2 thereon, a reciprocable fluid operated piston or ram 3 in said cylinder, a hydraulic pump 4 supported on the base, valve means 5 for controlling the operation of the ram, and a reservoir 6 in communication with the pump and cylinder, including a flexible elastic tube or jacket 7 forming the outer wall of the reservoir and adapted to inflate and collapse responsive to variations in the fluid content of the reservoir as occasioned during operation of the pump.

While I have here shown a particular form of "flexible," inflatable and collapsible fluid reservoir, it is to be understood that it is within the scope of my invention to provide any form of reservoir in which at least a part of the fluid contacting or fluid retaining walls or portions thereof will operate to decrease and increase the

capacity of the reservoir, like a diaphragm responsive to the operation of the pump, and in a manner to prevent a "vacuum lock" and any other impairment of feed of fluid to the pump; as well as for the purpose of insuring that the desired feed of the fluid to the pump will take place without leakage with the jack in any position or angle between the vertical and the horizontal.

Herein the tube or jacket is made of flexible elastic material such as synthetic rubber, which will not deteriorate in the presence of oil or other hydraulic fluids which ill affect rubber. As best shown in Figure 2 the jacket surrounds the cylinder so as to define an annular reservoir space closed at its lower end by means of an annular nipple or head 8 on said base and at its upper end by means of an annular member or ring 9 mounted on the upper end of the cylinder. A filling opening in the ring 9 is normally closed by a plug 9'. The ends of the jacket are held on the nipple and ring by means of wire or other clamping rings 10 and 11 so as to seal the reservoir to the atmosphere and against leakage. For protection of the flexible jacket 7, it is housed in a metal shell 12 which affords adequate space for the expansion or inflation of the jacket and is engaged with the base and ring 9 and held in place by means of a suitable fastening 13. An opening 14 in the shell 12 affords communication of the interior of the shell with the atmosphere so that the exterior of the jacket 7 is subjected to atmospheric pressure, whereby it will collapse and expand incident to creating sub-atmospheric and above atmospheric pressures in the reservoir as when withdrawing fluid from and returning it to the reservoir as effected by the pump.

As shown in Figures 3 and 4, fluid is withdrawn from and returned to the reservoir by means of a small stand pipe 14' extending from a passage 15 leading through nipple 8 and base 1 to a low pressure chamber 16 in said base and also shown in Figures 5 and 7. From the chamber 16, fluid will be drawn to an annular chamber 17 in a pump socket on depression 18 in the base, through a passage 19 having a non-return check valve 20 therein.

Radial intake parts 21 are formed in the pump cylinder 22 which is screwed into the socket 18. Fluid from the ports 21 enters the cylinder 22 through an axial passage 23 therein, on the up stroke of the pump plunger 24, which latter is operated by a suitable lever 25 best shown in Figures 1 and 2.

On the working stroke on the pump plunger, fluid is forced under pressure, down through the passage 23 into the lower end of the socket 18. A high pressure passage 27 having a non-return check valve 28 therein conducts the high pressure fluid from the pump socket 18 into a high pressure chamber 29 formed in the base 1 as best shown in Figures 4, 5 and 7.

A passage 30 leads from the lower side of the high pressure chamber 29 through the base to the lower end of the jack cylinder 2, for conducting operating fluid beneath the ram in order to raise it. As the ram descends the fluid displaced returns to the reservoir through passage 30, an axial extension or branch passage 30' of passage 30 leading to the low pressure chamber 16, and thence through passage 15.

Fluid is conducted to and from the upper side of the jack cylinder 2, above the ram by means of a passageway 31 including a conduit 31' which

latter is disposed in the reservoir and is connected with the upper side of the high pressure chamber 29 through the medium of a passage 32. An axial branch or extension 32' of passage 32 leads into the low pressure chamber 16 whereby fluid displaced as the ram ascends will be returned to the reservoir through the passage 15.

The valve means 5 as here provided for controlling the flow of fluid to and from the cylinder 2 and reservoir 6, comprises double check valves 34 and 35 mounted in the passages 30-30' and 32-32' respectively. At one end of the valve 34 is a ball head 34' which is urged to position closing passage 30 by means of a spring 36. The corresponding end of a valve 35 has a ball head 35' likewise urged to close passage 32 by means of a spring 37. At the other ends of the valves 34 and 35 are ball heads 34'' and 35'' respectively for controlling the passages 30' and 32'. A cam 38 is rotatable in the low pressure chamber 16 for engaging the outer faces of said ball heads 34'' and 35'' to operate the valves, said cam being mounted on a shaft 39 rotatable in a bearing 40 on the base 1 and having a handle 41 on its outer end.

A spring loaded detent 42 is carried by the base 1 and cooperates with flat sides 42' and 42'' on the cam to hold the cam in its operative position as shown in Figure 6.

When the cam 38 is in the position shown in Figures 4, 5, and 6, the handle then being in forward position as shown in full lines in Figures 1 and 5, the high point on the cam engages the ball head 34'' and the low point, the ball head 35''. This causes the head 34'' to be seated, and head 34' to be unseated, while the spring 37 urges valve 35 to position, seating the head 35' and unseating valve 35'', as particularly shown in Figure 7.

The jack is now ready to operate so that the ram will be extended and when the pump plunger is raised fluid will be drawn into the pump from the reservoir through passage 15, chamber 16, around the cam 38, passage 19, past check valve 20, annular chamber 17, intake ports 21, and passage 23 into pump cylinder 22. As the fluid is withdrawn from the reservoir the flexible jacket 7 will collapse and thus prevent a "vacuum lock" in the reservoir and insure proper feed of the fluid to the pump.

On the working stroke of the pump, fluid under pressure discharges through passage 23 into the high pressure passage 27, past valve 28 into high pressure chamber 29, and as valve heads 34'' and 35' are closed and head 34' is open, the operating fluid will flow through passage 30 to the lower end of the jack cylinder 2 as particularly shown in Figure 7, and thereby raise or extend the ram.

As the ram is extended, the fluid ahead of it in the cylinder 2 will be forced out through passageway 31 to conduit 31' to the passage 32 and out through branch 32' past the then open valve head 35'' into the low pressure chamber 16 and thence back to the reservoir through passage 15.

To release the ram, the cam 38 is operated so that the high point moves clear of the valve 34'' sufficiently to allow the valve to open and the pressure or operating fluid in the cylinder 2 to be forced into low pressure chamber 16 and return to reservoir thereby allowing the ram to descend or move inwardly. This release and return of the ram may thus be controlled to nicety by appropriate manipulation of the cam 38.

With further reference to Figure 7, it is seen

that to retract the ram hydraulically, the cam 38 is reversed from the position shown in Figure 7, so that the valve head 35'' is closed and valve head 35' is opened while valve head 34'' is opened and head 34' is closed. When the valves are thus set, fluid will pass from high pressure chamber 29, past open valve 35' into passageway 32 and then through conduit 31' and passage 31 to the upper end of the cylinder 2, thereby to force the ram inwardly relative to the cylinder. As the ram is moved inwardly, the fluid in the lower end of the cylinder 2 is forced out through passage 30 into branch passage 30', past open valve 34'' into the low pressure chamber 16 and thence to the reservoir through passage 15.

It should be noted that the jack of this invention is particularly adapted for straightening the frames of automobiles, bodies, fenders, etc., and for various other purposes in that it will operate with full efficiency in any position or angle.

Attention is called to the fact that the hydraulic system of the jack is full of oil at all times and that the "flexible" reservoir affords the feed of the requisite amount of fluid to the pump to insure a reliable performance at all times. The fluid system is therefore completely filled and if desired an excess amount of fluid may be contained in the system due to the inflatable and collapsible reservoir.

While the invention hereof primarily appertains to improvements in hydraulic jacks, it is to be understood and it is obvious from the accompanying drawings and foregoing description that the "flexible" reservoir and associated parts are subject to use in any similar hydraulically operated device or apparatus wherein a fluid filled system includes a cylinder, a ram or piston

adapted to reciprocate in the cylinder, and a pump or the like for directing fluid under pressure into the cylinder for actuating the ram or piston.

5 While I have shown and described a specific embodiment of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claim.

I claim:

15 In a hydraulic jack, an elongated cylinder, a reciprocable ram in said cylinder, a pump for operating said ram, cylinder heads connected to the ends of the cylinder and extending radially beyond the outer face of said cylinder, said cylinder heads each having spaced inner and outer stepped shoulders formed thereon, an elastic jacket surrounding and circumferentially spaced from said cylinder and extending substantially the full length thereof and having its terminals fitted on the inner shoulders of the heads, means securing the terminals of said elastic jacket on said inner shoulders, said heads, cylinder and elastic jacket forming a fluid reservoir around the cylinder, a protecting casing shell open to the atmosphere surrounding the jacket in spaced relation thereto and having its terminals fitted on the outer shoulders of the cylinder heads, said jacket being adapted to inflate and collapse radially responsive to variations in the volume of fluid in the reservoir, conduit means for communicating the reservoir, pump and cylinder with one another, and valve means for controlling the flow of fluid through said conduit means.

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