

March 18, 1969

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3,433,458

PNEUMATIC AND HYDRAULIC JACK FOR GARAGE USE

Filed Jan. 25, 1967

Sheet 1 of 2

Fig-4-

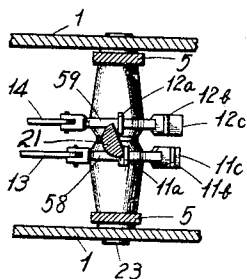


Fig-3-

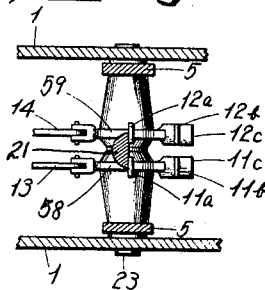


Fig-6-

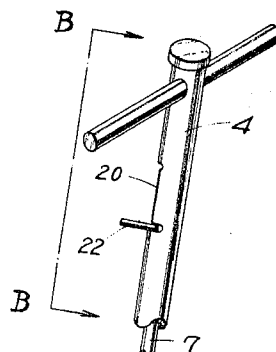
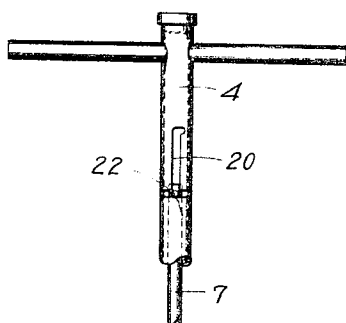
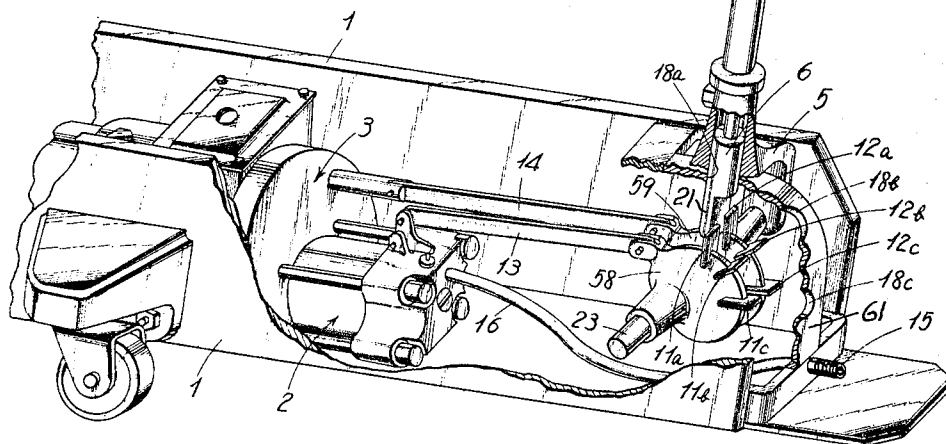


Fig-1-



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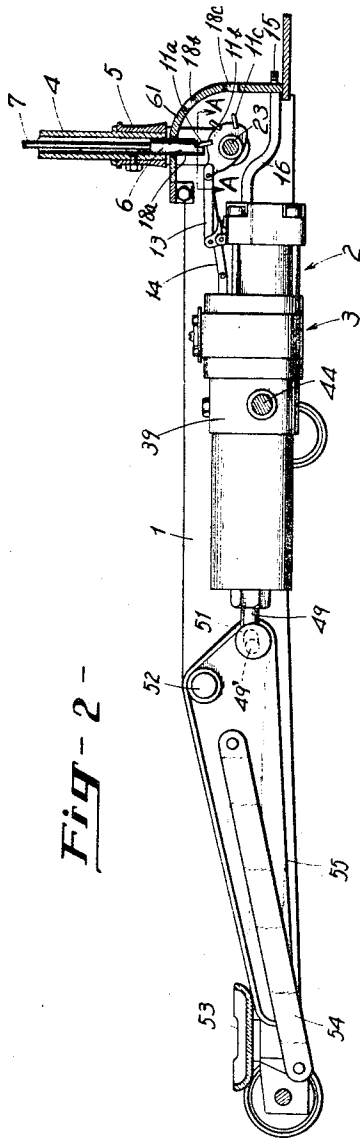


Fig. 2 -

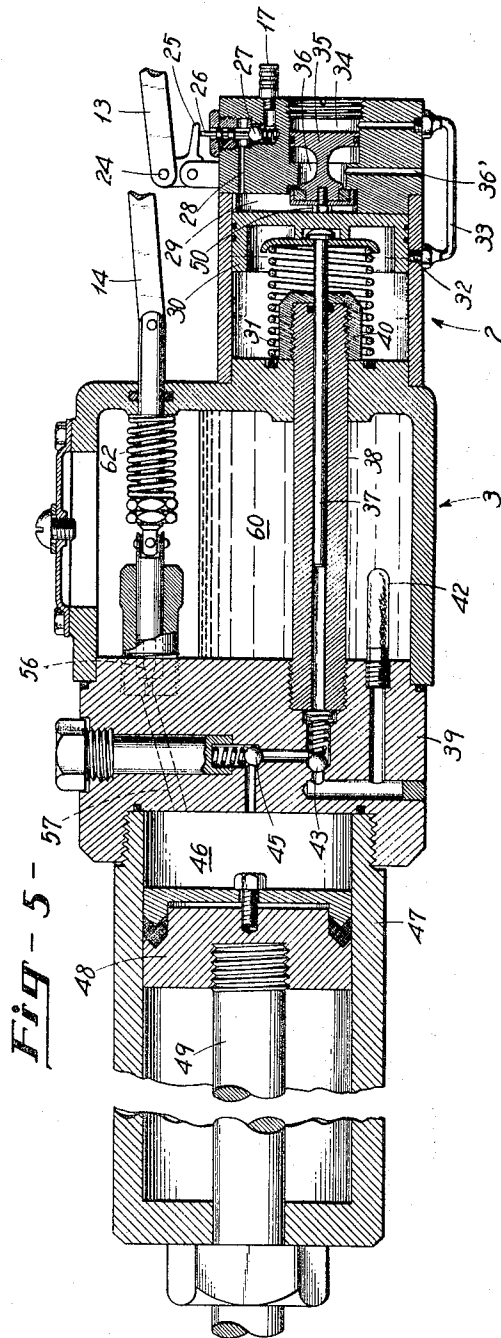


Fig. 5 -

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PNEUMATIC AND HYDRAULIC JACK FOR GARAGE USE

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7 Claims

ABSTRACT OF THE DISCLOSURE

The pneumatic and hydraulic jack of the present invention comprises generally a horizontally disposed cylinder body, an air piston, an oil pressure means including an oil pump connected to one end of the air piston rod, an elongated rod for controlling an air valve to the air piston, an elongated rod for controlling a needle valve for releasing oil pressure, an operating arm for mounting a load plate, and an operating lever for controlling the air valve and the needle valve, disposed on an elongated tubular member which serves as a remote control means for the jack.

The present invention relates to jack mechanisms for garage use, particularly, provided with oil hydraulic cylinder and piston arrangements which are driven or operated by compressed air and hydraulic oil.

Heretofore, a jack of manual oil pump type has been used for lifting heavy weights, particularly, in the automotive field, but it is inconvenient for operation, because a lot of human labor is consumed, and its lifting power for a load is considerably slow in action. While a jack of electric motor pump type is of a complicated and relatively large construction, it has a disadvantage that it is expensive. On the other hand, a jack of compressed air operation type is easy and simple to handle, but its size of construction is pretty big if a relatively large area lifted by the action of compressed air is to be desired. Hence it is also inconvenient for handling, and besides, it is impossible to have a stronger lifting power.

A pneumatic and hydraulic jack of this invention has been invented for the purpose of overcoming the above defects and disadvantages. In the jack of this invention, compressed air drives or operates an air piston having a small area, which, in turn, drives an oil plunger secured to an end of the air piston, and then, an oil piston having a relatively large area is driven by an oil pressure generated by the oil plunger so that a large lifting power will be imparted to the load. Recently a source of compressed air is readily available in shops where automobile repair works are done. In addition, in operation, the jack of this invention can be operated easily and simply in an effective manner by an operating lever accessible to an operator, which is one of the essential features of the invention.

Briefly stated, in accordance with a preferred embodiment of the invention, the pneumatic and hydraulic jack comprises a horizontally disposed jack cylinder body, an air piston, an oil pressure means including an oil plunger connected to one end of the air piston rod, an elongated rod for controlling an air valve, an elongated rod for controlling a needle valve for releasing oil pressure, an operating arm for mounting a load plate, and an operating lever for controlling the air valve and the needle valve, disposed on an elongated tubular member which serves as a steering shaft.

It is therefore an object of the invention to provide an oil hydraulic jack operated by compressed air in which an air piston is driven by compressed air fed into the cylinder body with a simple operation of the operating lever, and an oil plunger connected to one end of the

air piston rod is driven thereby in order to increase oil pressure in the oil pressure means and impart a lifting power to a load plate.

Another object of the invention is to provide a pneumatic and hydraulic jack for garage use in which a lifting power is increased by driving an oil piston of a relatively large area with an increased oil pressure resulting from driving an air piston of a relatively small area.

Still another object of the invention is to provide an improved jack which can work based on both actions of air and oil pressure and which has a high lifting power with a compact construction compared to the conventional one.

Still another object of the invention is to provide an improved novel jack in which its operating lever for controlling the valves is mounted on the elongated rod which can be selectively positioned on a mounting plate having a plurality of slots through which the rod can be fixed at as convenient a position as possible for an operator, whereby the operator can select the position of the operating lever at as convenient a position as desired with no hindrance in his way.

Still an additional object of the invention is to provide a less expensive garage jack than the one of electric motor type in which it is automatically driven by the compressed air readily available in automobile repair shops, no human labor is consumed, a lifting power for load can be accelerated, its operating hour therefore can be reduced, and its air motor means can be made as compact as possible.

Still an additional object of the invention is to provide an improved garage jack in which an operating lever for effecting a remote control on the lifting speed, stop and drop of load is disposed at as suitable a position as desired by the operator.

Other objects together with the foregoing are attained in the preferred embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of the jack of the invention showing its interior except its forward portion having a load plate.

FIG. 2 is a side elevation of the jack of the invention showing the forward portion with the load plate, except its steering shaft, with a side frame removed.

FIG. 3 is a top plan view showing the valve operating mechanism taken along the A-A line of FIG. 2.

FIG. 4 is a similar view to FIG. 3 showing the action of the valve mechanisms.

FIG. 5 is a longitudinal sectional view of the air piston and the coil hydraulic means of the jack of the invention.

FIG. 6 is a fragmentary elevational view taken along the B-B line of FIG. 1.

In proceeding the description of the garage jack of the invention, first of all, its compressed air motor means is described.

A source of compressed air (not shown) is connected to an air inlet 15 (FIG. 1) which is also to an air inlet 17 (FIG. 5) through an air hose 16. An air valve 27 urged upwardly by a spring 63 is opened to compressed air, and the compressed air thus supplied enters an air chamber 29 through a passage 28, and fills the chamber 29 with compressed air to increase an air pressure in the chamber 29. Accordingly, an air piston 30 is pushed leftward in FIG. 5 owing to an increased air pressure in the air chamber 29. The air piston 30 is urged rightward by the action of a coiled compression spring 31 in FIG. 5. At this event, the air piston 30 is pushed leftward by compressed air against the resistance of the spring 31.

When the air piston 30 reaches a position shown by a hypothetical line, an exhaust outlet 32 in communication with a conduit 33 allows compressed air to enter a chamber 34 to compress air therein in order to push an exhaust valve 35 leftward in FIG. 5. Hence, the air chamber 29 comes in communication with an exhaust chamber 36, and the compressed air flowing into the air chamber 29 enters the exhaust chamber 36 directly.

The exhaust chamber 36 is formed to open into the atmosphere through an opening 36', so the air pressure in the air chamber 29 is reduced to push the piston 30 rightward by the force of the spring 31 in FIG. 5. On pushing the piston 30 rightward, the exhaust outlet 32 is closed by the piston 30. The outer end of the piston 30 pushes a boss 50 provided on the left side of the exhaust valve 35 to close it and increase the air pressure in the air chamber 29 again, because compressed air is continually supplied thereto. At this event, the communication between exhaust chamber 36 and air chamber 29 is interrupted by the exhaust valve 35.

Thus, the piston 30 effects a reciprocating motion, and a plunger 37 integral with the piston 30 does a reciprocating motion within an oil pump 38 in the form of a cylinder. When the plunger 37 retracts rightward, oil 60 in the oil hydraulic means 3 is absorbed into the oil pump 38 through an oil strainer 42 and a non-return valve 43. When the plunger 37 proceeds, the oil in the oil pump 38 is forced into the oil cylinder 47 through the non-return valves 43 and 45 to push a piston 48 and a piston rod 49 forwardly (leftward in FIG. 5).

The extreme end of the piston rod 49 is pivotally connected to 49' to a slot 51 at the trailing end of a driving arm 55, the upper end of which is pivotally supported on a cross beam 52 secured to the frame 1 of the jack, therefore, when the piston rod 49 proceeds forwardly, a load plate 53 secured to the forward end of the driving arm 55 rises up.

There is provided a connecting rod 54 which connects the load plate 53 and the driving arm 55, hence the load plate 53 is constructed to maintain its horizontal position at all times.

The oil hydraulic means 3 is connected to the oil cylinder 47 by means of a connecting member 39, within which the non-return valves 43 and 45 are provided. There is provided an arm 44 on either side of the connecting member 39.

An operating lever for controlling two valves at a remote position, one of the essential features of the invention, will be described hereinbelow. The operating lever 22 is provided on a steering hollow shaft 4 of the jack as shown in FIG. 1. The operating lever 22 is adapted to control a needle valve 56 (FIG. 5) in the oil hydraulic means 3 and the air valve 27 (FIG. 5) in the air outlet 17, respectively, from a relatively remote position.

As clearly shown in FIGS. 1 and 6, the operating lever 22 is projected vertically from the upper end of a rod 7 housed in the tubular steering shaft 4 through a T-shaped slot 20 drilled thereinto. The operating lever 22 is adapted to swing left and right along a transverse groove of slot 20 at right angle to the axis of the shaft 4, and besides, be pulled upwardly along an axial groove of slot 20.

The lower portion 6 of the rod 7 integral with the operating lever 22 is slidably inserted into a hollow shank of a bifurcated metallic fixture 5. Both ends of two arms of the bifurcated fixture 5 are loosely mounted on a shaft 23 (FIGS. 1-4), both ends of which are secured to the frame 1 of the jack. As two arms of the fixture 5 are loosely mounted on the shaft 23, the fixture 5 is adapted to swing up and down relative to the shaft 23.

An extreme end 21 of the lower portion 6 of the rod 7 integral with the operating lever 22 is formed in a crescent shape in section as shown in FIGS. 3-4. This crescent end may be formed by various metal working

steps, such as, forming it integral with the lower portion 6 of the rod 7, and attaching it to the rod by welding, screwing or keying.

As shown in FIGS. 3-4, a pair of similar shape disks 58 and 59 are loosely mounted on the shaft 23 on either side of the rod 6 with the crescent end 21. A plurality of projections 11a, 11b, 11c, 12a, 12b, 12c in FIG. 1 are provided on the circumferences of two disks, respectively.

Three projections 11a, 11b and 11c are attached on the circumference of the disk 58, and three projections 12a, 12b and 12c are similarly attached on the circumference of the disk 59. In addition, three slots 18a, 18b and 18c which correspond to the projections, respectively are drilled through a mounting plate 61 (FIG. 1) fixed to the frame 1.

As described hereinbefore, the end 6 of the rod 7 is inserted into the hollow shank of the bifurcated fixture 5 so as to slide up and down therein. Therefore, the end 6 of the rod 7 is adapted to be removed from the shank and inserted into one of the slots 18a, 18b and 18c, whereby the end 6 is positioned at any desired projection of the disks 58 and 59. When the crescent end 6 of the rod 7 is engaged with the projections 11a and 12a of the disks, the steering shaft 4 is positioned at the highest level; when engaged with the projections 11b and 12b, the shaft 4 is positioned at the intermediate level; and when engaged with the projections 11c and 12c, it is at the lowest level. Depending on the height of the operator or the level of the working space where the operator works, there is an advantage from the above means that any level of position of the steering handle of the jack can be selected as desired.

The disk 59 is connected to one end of a connecting rod 14, the other end of which is connected to the needle valve 56 of the oil hydraulic means 3. When the disk 59 moves backward, the needle valve 56 moves backward against the action of a spring 62 which urges it forward to open itself. Similarly, the disk 58 is connected to one end of a connecting rod 13, the other end of which is connected to a pusher 26 pivotally connected at 24 to a lever 25, whereby the air valve 27 of the air chamber can be controlled. When the connecting rod 13 is pulled backward, the air valve 27 is pushed downward by the pusher 26 against the action of a spring 63 to open itself.

Now, the operator stands by the steering handle of the jack face to face with the operating lever 22, and swings it right along the transverse slot 20, the connecting rod 14 is pulled backward to open the needle valve 56. When he swings the lever 22 left, the connecting rod 13 is pulled backward to make the end of the lever 25 push the pusher 26 downward with the result that the air valve 27 connected to the pusher 26 is pushed downward to open for the inflow of compressed air. It is because when the lever 22 swings leftward the crescent end of the rod 6 moves the projection 11a, and when it swings rightward, the crescent end 6 moves the projection 12a in the same manner.

In this case, it should be noted that a requirement when assembled is that the center line of the shaft 6 should intersect the center line of perpendicular to the diameter of the crescent end. If this requirement is not met, the action of crescent end may be so unstable that both projections 11a and 12a may be simultaneously moved, which should be completely obviated.

It is to be noted that the crescent end of rod 7 should not be always preferred in order to move either of the disks 58 and 59 selectively. For example, a bifurcated end of rod 7 may be preferred.

The needle valve 56 is always closed by the spring 62. On opening the needle valve 56 by the actuation of the operating lever 22, the compressed oil in the oil cylinder 47 escapes through the passage 57 into the oil hydraulic

means 3 to reduce the oil pressure and drop the load plate 53.

In operation, the steering shaft 4 is positioned at a desired level, the air inlet 15 is connected to the source of compressed air, the lever 22 is swung left to open the air valve 27 so that the air piston is driven to operate the oil hydraulic motor 3 in order to lift the load plate 53. When the load plate 53 is required to stop at a desired position, the operating lever 22 for the air valve should be preferred to stand erect. If the load plate 53 is desired to drop, the operating lever 22 should be preferred to swing right.

While the invention has been described with particular reference to the construction shown in the drawing, it is to be understood that such is not to be construed as imparting limitations upon the invention, which is best defined by the claims appended hereto.

What is claimed is:

1. In an oil hydraulic jack driven by compressed air in which there is provided an oil cylinder including a piston for lifting a load, an oil pressure generating means driven by a reciprocating plunger which is driven by compressed air, and said oil pressure is delivered into said oil cylinder, the improvement which comprises:

- (a) a rod rotatably axially housed in a hollow tubular steering shaft,
- (b) a valve for supplying compressed air which drives said oil hydraulic means,
- (c) a valve for escaping hydraulic oil in said oil cylinder, and
- (d) means operatively connected to said rod for selectively controlling said two valves of (b) and (c) by rotating said rod in said steering shaft.

2. In a pneumatic and oil hydraulic jack for garage use comprising a jack body, an oil pressure cylinder for lifting a load, a hollow tubular steering shaft connected to said jack body, a rod housed in a hollow space of said steering shaft, an operating lever secured to said rod, an

engaging member formed at the lower end of said rod, an air piston for driving an oil piston for increasing oil pressure, a valve for supplying compressed air to drive said air piston, an exhaust valve for exhausting hydraulic oil in said oil cylinder, a pair of disks engageable with said engaging member, a control rod connected to said disk to control said valve for supplying compressed air, and a control rod connected to said disk to control said valve for escaping hydraulic oil.

3. A pneumatic and hydraulic jack as defined in claim 2 in which said operating lever is secured to said rod through a T-shaped slot drilled in said tubular steering shaft.

4. A pneumatic and hydraulic jack as defined in claim 2 in which said operating lever is adapted to swing left and right along a transverse groove of said slot, and control one valve when swung left and the other valve when swung right.

5. A pneumatic and hydraulic jack as defined in claim 2 in which said pair of disks are provided with a plurality of projections on the circumferences thereof, respectively, and adapted to position said steering shaft at a desired position when engaged with said engaging member of said rod.

6. A pneumatic and hydraulic jack as defined in claim 2 in which said engaging member formed at the lower end of said rod is a bifurcated member.

7. A pneumatic and hydraulic jack as defined in claim 2 in which said engaging member formed at the lower end of said rod is a crescent member.

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