June 9, 1959 J. T. SIMMONS 2,889,616

HYDRAULIC VALVE-LIFTER TOOL

Filed March 11, 1955 2 Sheets-Sheet 1

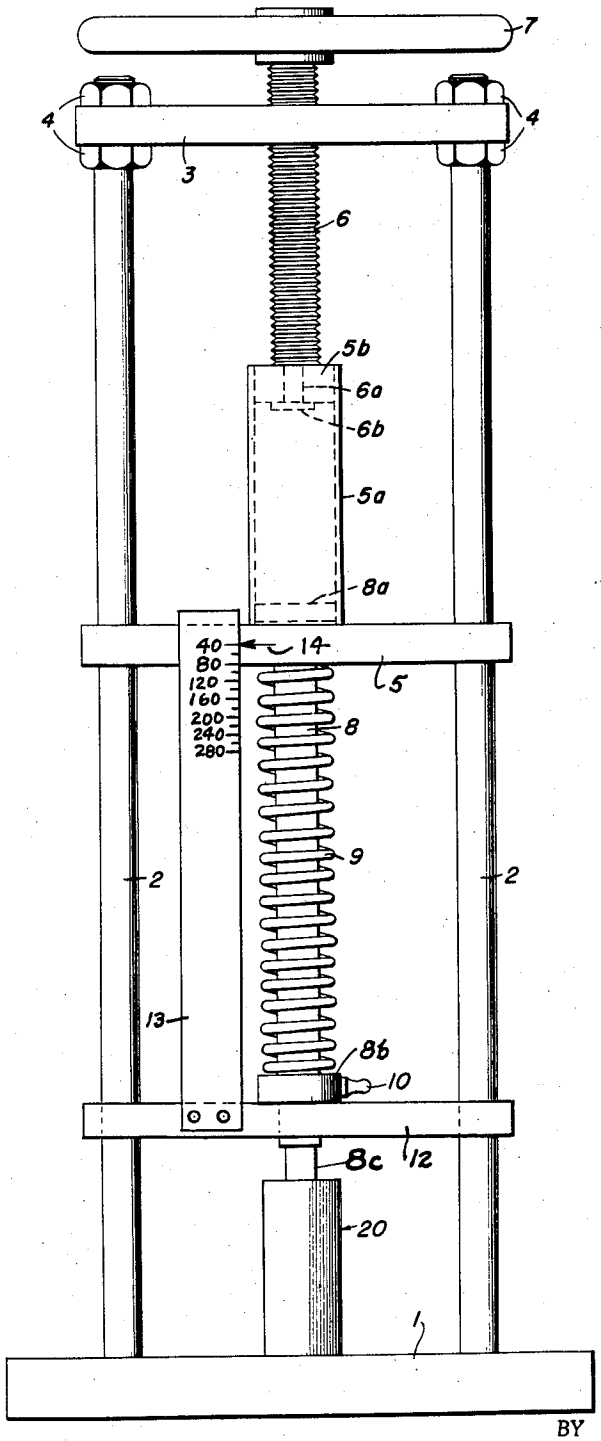


Fig. 1.

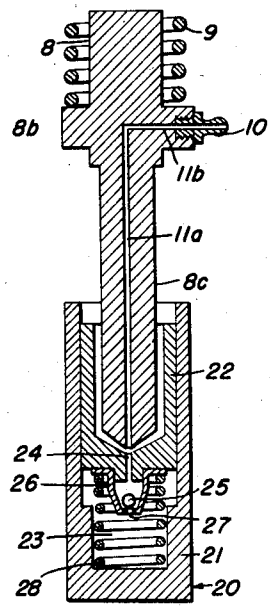


Fig. 2.

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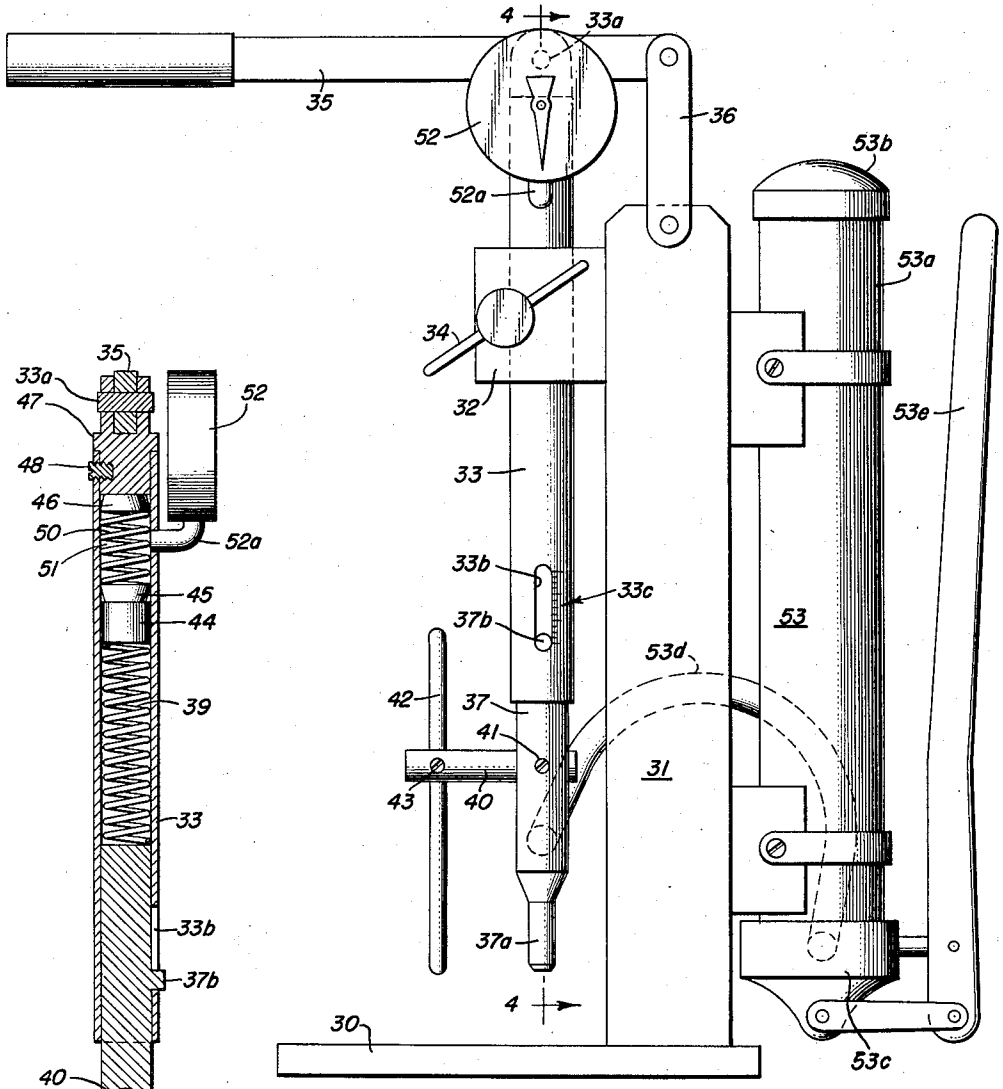


Fig. 3.

Fig. 4.

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HYDRAULIC VALVE-LIFTER TOOL

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6 Claims. (Cl. 29—213)

This invention relates to a tool for use in disassembling and assembling hydraulic valve lifters, and in particular to removing the piston of the lifter where it has become stuck in use.

This application is in part a continuation of my application, Serial No. 423,563, now abandoned, filed April 16, 1954.

A primary object of the invention is to provide a tool with which hydraulic valve lifters may be easily and quickly disassembled regardless of the amount of varnish that has been formed on the parts during use.

Another object of the invention is to provide a tool which will separate a hydraulic valve-lifter piston which has stuck, and without damage to any of the parts.

Yet another object is to provide a tool which may be used to disassemble hydraulic valve lifters and later to reassemble and test the overhauled lifters.

A further object of the invention is to provide a tool which is capable of use with any size of hydraulic valve lifter.

Many modern internal combustion engines in use in the automotive, aviation, marine and stationary power fields today make use of hydraulically operated valve lifters. These lifters consist essentially of a housing with a chamber formed therein and a piston which closes this chamber. In operation this chamber is filled with oil and the successful operation of the lifter depends upon a controlled leakage occurring between the piston and the housing and a periodic replenishment, during the period of the operating cycle when the valve is closed, of the oil that has leaked out of the chamber. Due to the small clearance between the lifter piston and the lifter housing and the high temperature at which modern internal combustion engines operate, some difficulty is experienced from time to time with the decomposition of the oil in the lifter and the subsequent formation of decomposition products known as "varnish." This varnish accumulates on the lifter parts and causes the piston to seize in the housing and renders the operation of the lifter unsatisfactory. Lifters which have become stuck in this fashion may be returned to service if they are disassembled and all varnish formation is removed. However, the construction of these lifters has made this disassembly extremely difficult and in many instances it has been found necessary to replace the entire lifter.

My invention employs a nozzle for injecting fluid under pressure into the chamber of the valve lifter through the valved passage formed in the bottom wall of the bore of the piston. The nozzle is mounted upon a vertically adjustable support above a suitable base for supporting the valve lifter, and the mounting for the nozzle includes resilient means, such as a compression spring, for permitting upward movement of the nozzle as the piston is forced out of its casing by the pressure fluid injected into the chamber by the nozzle.

Two embodiments of the invention are illustrated in the accompanying drawing, in which:

Figure 1 is a front elevational view of one form of the tool showing a hydraulic valve lifter in place;

Figure 2 is a vertical sectional view on an enlarged scale of the hydraulic lifter and a portion of the tool showing the operating relation of the tool and lifter;

Figure 3 is a front elevational view of a second form of the tool; and

Figure 4 is a sectional view taken along the longitudinal axis of a portion of the tool shown in Figure 3.

Referring to Figure 1 of the drawing, the tool comprises a base 1 having mounted thereon two standards 2 which are connected at their upper ends by a top cross-member 3 secured in position by nuts 4. Slidably mounted on the standards 2 between the base 1 and the top cross-member 3 is a sliding cross-member 5. This cross-member has a vertical sleeve 5*a* affixed thereto at its center, and this sleeve is closed at its upper end by an annular plug 5*b*. A jack screw 6 is threaded through the upper cross-member 3 and rotatably engages annular plug 5*b* by means of a reduced portion 6*a* on its lower end passing through the bore in plug 5*b* and a collar 6*b* engaging the lower face of plug 5*b*. The upper end of jack screw 6 has attached thereto a hand wheel 7 by which the screw may be turned to raise or lower cross-member 5.

A rod-like stem 8 is mounted vertically below the cross-member 5. The upper end of stem 8 passes freely through a bore in member 5 into the sleeve 5*a* and has a collar or enlarged head 8*a* which has free sliding engagement with the inner wall of sleeve 5*a*. Near the lower end of stem 8 is a second collar 8*b* which serves as a stop for compression spring 9 which surrounds stem 8 and bears against cross-member 5. The lower end of stem 8 is formed in a nozzle section 8*c* having a longitudinal passage 11*a* formed therein and terminating in a conical end. A fitting 10 is mounted on the collar 8*a* and a radial passage 11*b* connects this fitting with the longitudinal passage 11*a*. The lower end of stem 8 is guided by a cross-member 12 mounted on the stem below the collar 8*b* and having sliding engagement with the standards 2.

In order to use the tool, hand wheel 7 is turned in a counterclockwise direction until cross-member 5 has been raised to the point where a hydraulic lifter 20 may be inserted beneath the stem 8. The hand wheel is then turned in a clockwise direction until cross-member 5 has been lowered to the point where the conical tip of nozzle section 8*c* of stem 8 is resting on the bottom surface of the bore in piston 22 of the valve lifter, the longitudinal passage 11*a* in the stem 8 being aligned with the passage 24 in the bottom of the piston 22. Sufficient pressure is applied to the stem 8 through spring 9 to provide an oil-tight seal between the end of stem 8 and the bottom wall of piston 22. Oil or grease is now injected under pressure through fitting 10, passage 11*b* and passage 11*a* by means of any suitable pressure apparatus or gun. The oil or grease is forced through the passage 24 in piston 22, around ball check 25, and through two or more holes 27 in the bottom of cage 26, thus filling the chamber 23 in the hydraulic lifter housing 21 below the piston 22. It will be seen that with chamber 23 full, a considerable pressure will be developed tending to force piston 22 out of housing 21. In practice pressures ranging from 5000 lbs. per square inch to 20,000 lbs. per square inch have been found necessary in order to break free piston 22 from the housing 21. Since stem 8 is slidably mounted in cross-member 5 and is yieldably urged in a downward direction by spring 9, the stem is free to move upwardly against the action of spring 9 as the oil in the chamber 23 forces the piston 22 out of the cylinder or casing 21. Sleeve 5*a* is sufficiently long, and spring 9 is sufficiently

compressible, to allow piston 22 to be forced entirely out of casing 21.

The device may be employed to check the leakage in valve-lifters before they are put back into service. This is accomplished by filling the valve-lifter with fluid and then applying a pre-determined mechanical pressure to the piston through the stem 8, and the rate of leakage is measured by observing the time required for a given pressure drop, or by noting the amount of pressure drop in a given time. The amount of pressure applied to the piston of the valve-lifter may be indicated by a suitable pressure scale, such as the strip 13 secured at its lower end of the cross-member 12 and extending upwardly into overlapping relation with the cross-member 5 and being provided with pressure graduations on one edge thereof. The amount of pressure applied to the valve-lifter unit is indicated on the scale opposite the index mark 14 carried by the cross-member 5. By suitable design of the spring 9 and other parts, the test pressure may range from 40 lbs. to 280 lbs.

Referring now to Figures 3 and 4 of the drawing, a base 30 has a post 31 mounted thereon. The post 31 has a laterally extending arm 32 formed at the upper end thereof, and a tubular slide 33 is free to slide in a vertical bore formed in the arm. A suitable lock or clamp operated by handle 34 is provided to hold the tubular slide 33 in any adjusted position. When the slide lock is loose, the tubular slide 33 may be moved vertically by lever 35 which is pivotally connected at its end to post 31 by links 36 and is pivotally connected to the upper end of slide 33 at 33*a*.

The lower end of tubular slide 33 has a plunger 37 slidably mounted therein. The lower end of this plunger is formed in a nozzle section 37*a* similar to nozzle section 8*c* of Figure 1 with a longitudinal passageway connecting with fitting 38. In order to limit the extent of movement of plunger 37 in tubular slide 33, a slot 33*b* is provided in the wall of the tubular slide 33 and a pin 37*b* is mounted on the plunger and extends into the slot 33*a*. A compression spring 39 is provided within the tubular slide 33 and urges plunger 37 in a downward direction, toward base 30. For purposes explained later, a horizontal bar 40 is mounted in a transverse hole formed in plunger 37 and is held in place by a set screw 41. A vertical bar 42 is mounted in a vertical bore formed in the outer end portion of horizontal bar 40 and is held in adjusted position by set screw 43.

Mounted within the tubular slide 33 above the spring 39 is a piston 44 which is free to slide within the tubular slide. A flexible sealing cup 45 is mounted on the upper side of piston 44 and another sealing cup 46 is mounted on the lower side of slide head 47. The slide head 47 is removable for access to the sealing cups and is held in place by set screw 48. Mounted between the two sealing cups is a compression spring 50 which urges piston 44 away from slide head 47. The chamber 51 formed between the two sealing cups is filled with a suitable fluid, such as hydraulic brake fluid, and a pressure gauge 52 is mounted on the upper part of the tubular slide 33 and is connected by fitting 52*a* to the chamber 51 to indicate the pressure to which the fluid in the chamber is being subjected at any given time.

Fluid under pressure is supplied to the fitting 38 on plunger 37 from any suitable source, but in order to make the machine complete, I prefer to supply the fluid from a pump assembly attached to one side of the post 31 and indicated generally at 53. The pump includes a cylindrical reservoir 53*a* strapped to the post 31 and having a removable cap 53*b* for permitting the filling of the reservoir with fluid. A piston chamber 53*c* is mounted at the lower end of the reservoir 53*a* and has an outlet connected through a suitable flexible hose 53*d* to the fitting 38 on the plunger 37. The piston within the chamber 53*c* is operated by means of a vertically extending handle 53*e*.

The operation of the tool shown in Figures 3 and 4 will now be described. The valve-lifter 20 (see Figures 1 and 2) is placed on base 30 and tubular slide 33 is lowered by pulling down lever 35 until nozzle section 37*a* is in engagement with the bottom surface of the bore in piston 22 of the valve-lifter, as described in connection with Figures 1 and 2. When the nozzle section 37*a* is pressing against piston 22 with a force of approximately 50 lbs., as indicated on gauge 52, the tubular slide 33 is locked in place by tightening lock handle 34. The piston 22 of the valve-lifter is then forced out of the housing 21 by operating pump 53 to supply oil or grease under pressure to fitting 38. As the piston 22 is forced out of the housing 21, plunger 37 will be forced into tubular slide 33 against the pressure of spring 39. The spring 39 transmits the force to piston 44, which in turn transmits the pressure to the fluid in chamber 51. After the piston 22 has been forced out of the housing 21, the lifter may then be removed from the tool by loosening the slide lock and raising the slide 33.

A rough indication of the amount of the pressure applied by the nozzle 37*a* to the piston of the valve-lifter is provided by the position of the pin 37*b* within the slot 33*b*, and suitable graduations shown at 33*c* to indicate pressure may be marked on the slide 33 along one edge of the slot 33*b*.

The spring 39 may be omitted, in which case the upper end of plunger 37 would form the piston 44. In this case, the slide 33 would remain free to move vertically at all times and the necessary pressure would be applied manually through the handle 35. The amount of pressure applied to the valve-lifter at any time would be indicated by the pressure gauge 52. As the piston of the valve-lifter moves upwardly, the slide 33 and the attached handle 35 would also move upwardly under the yielding pressure applied by hand to the handle 35.

After the disassembled parts have been cleaned and reassembled, it is desirable to test the lifter before replacing it in the engine. In the past, it has been necessary to employ a separate testing device to do this, but with my tool the assembled lifter may be tested without additional equipment. The assembled lifter is placed in a cup which is filled with oil and placed on base 30 beneath rod 42. The piston of the valve-lifter is then pumped up and down by the use of vertical bar 42 until the chamber 23 has been filled with oil. The lifter is then removed from the cup and placed on base 30 beneath nozzle 37*a*. Lever 35 is pulled down until gauge 52 indicates the desired test pressure has been attained. Slide lock handle 34 is then tightened to hold the slide in set position, and the rate of leakage is measured by observing the time required for a given pressure drop as indicated by gauge 52 or by noting the amount of pressure drop in a given time.

In addition to being used to pump the lifter with oil, vertical bar 42 may be used to hold the piston 22 in place in housing 21 while inserting or removing the lock ring that is usually used to hold the piston in place.

While my tool is designed especially for removing the piston of a valve-lifter, it is apparent that it may be used for disassembling other units formed of interlocked parts embodying a closed chamber into which fluid under pressure may be introduced by the nozzle.

I claim:

1. A tool for use in removing pistons from hydraulic valve-lifters of the type wherein the piston is contained within a cylindrical casing closed at one end and open at the other end, the piston being provided with an aperture passing through it along the axis of the casing and the aperture being accessible through the open end of the casing, said tool comprising a base for supporting said casing with the open end thereof directed away from the base, a frame secured to the base and extending parallel with the axis of the casing, a tubular member having a nozzle portion at one end of a size larger than

said aperture but small enough to enter the open end of said casing and engage said piston around said aperture to provide a substantially fluid-tight joint between the nozzle bore and the piston aperture, mounting means supporting said tubular member upon said supporting frame with said nozzle in axial alignment with the aperture of said piston and providing for axial movement of said nozzle while in contact with said piston during movement thereof from the innermost position of the piston until the piston leaves the casing, a fitting on said tubular nozzle member for supplying to the bore of said nozzle fluid under pressure to effect movement of the piston out of the casing, force applying means connected to said tubular nozzle member for moving said nozzle into engagement with said piston, and a spring embodied in said force applying means for pressing said nozzle in fluid-tight contact with said piston throughout the range of movement of said piston.

2. A tool according to claim 1 wherein said mounting means includes a supporting member having said tubular nozzle member mounted thereon for sliding movement axially of the nozzle, said spring acting between said supporting member and said nozzle member and tending to move said nozzle towards said base, means mounting said supporting member upon said frame for movement towards and away from said base, means for moving said supporting member to engage said nozzle with said piston and to effect an initial compression of said spring, and means for holding said supporting member in fixed position with respect to said base to maintain pressure on said piston from said spring.

3. A tool according to claim 2 and including a fluid chamber in the connection between said nozzle and said supporting member and through which the force of said spring is transmitted to said supporting member, and a fluid-pressure indicator connected to respond to the pressure to said fluid chamber for indicating the force exerted by said nozzle upon said piston.

4. A tool according to claim 1 wherein said frame comprises a vertical post mounted on said base and having an offset arm portion formed at the upper end

thereof, and said mounting means comprises a vertically disposed tubular slide having a closed upper end portion slidably mounted in a vertical bore in said arm portion, a plunger slidably mounted within the lower end of said tubular slide and carrying a piston element at the upper end thereof, said nozzle being carried at the lower end of said plunger, said spring being located within said tubular slide and surrounding said plunger, hydraulic fluid filling the space between said piston element and said closed upper end portion, and a fluid-pressure indicator connected to respond to the pressure of the fluid in said slide to indicate the force applied to said nozzle through said hydraulic fluid.

5. A tool as in claim 1, in which said frame comprises a pair of vertical standards mounted on the base, an upper cross-arm connecting the upper ends of the standards, and said mounting means comprises a second cross-arm slidably mounted on the standards intermediate the base and upper cross-arm, and adjustable means supporting said second cross-arm for vertical movement with respect to the base.

6. A tool as in claim 5, in which the adjustable means comprises a jack screw having threaded engagement with one cross-arm and connected to the other cross-arm by a rotating joint.

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