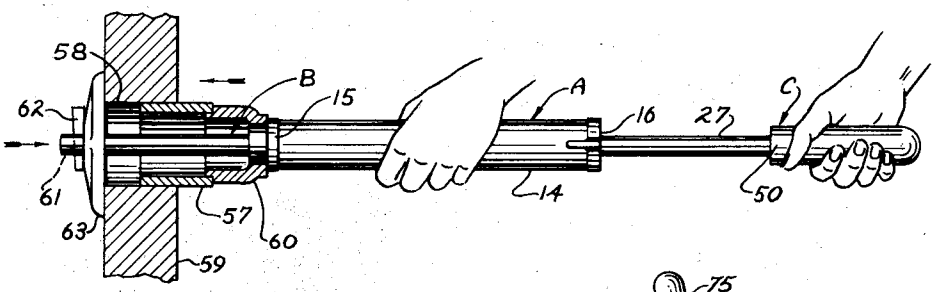
June 12, 1951 H. NILSON 2,556,481

HYDRAULIC JACK

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FIG 1



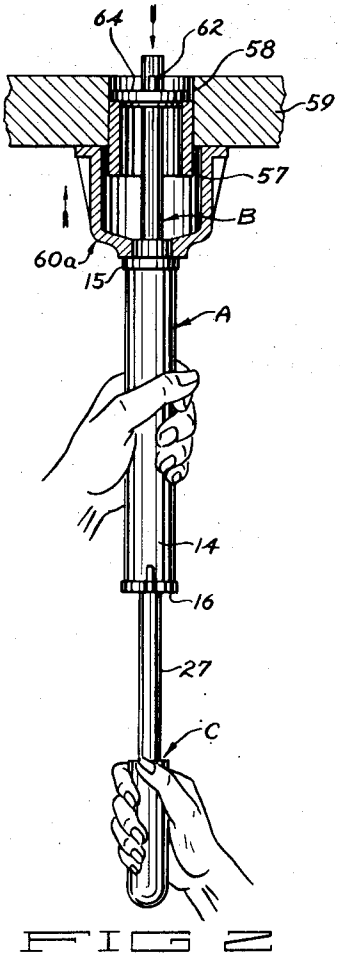


FIG 2

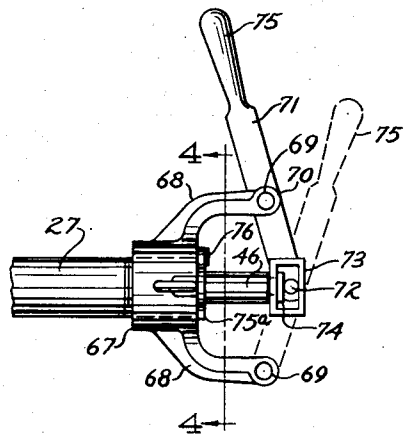


FIG 3

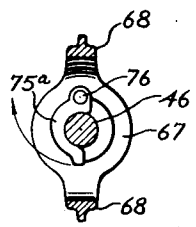


FIG 4

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HYDRAULIC JACK

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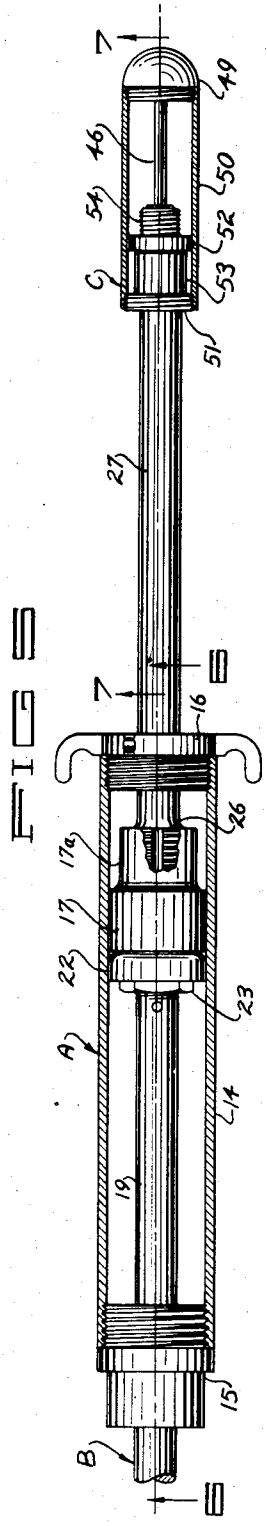


FIG 5

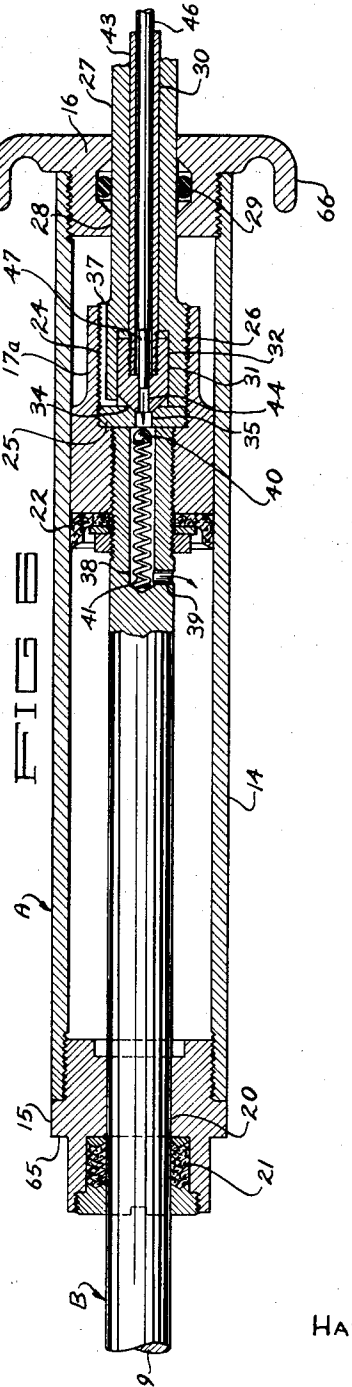


FIG 6

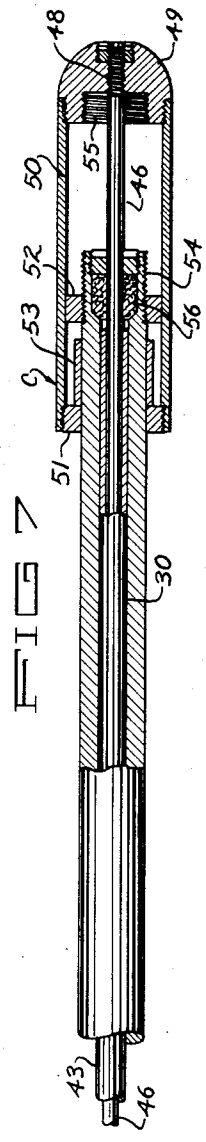


FIG 7

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FIG 8

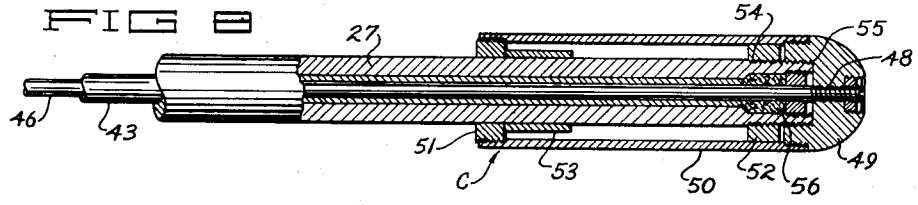


FIG 9

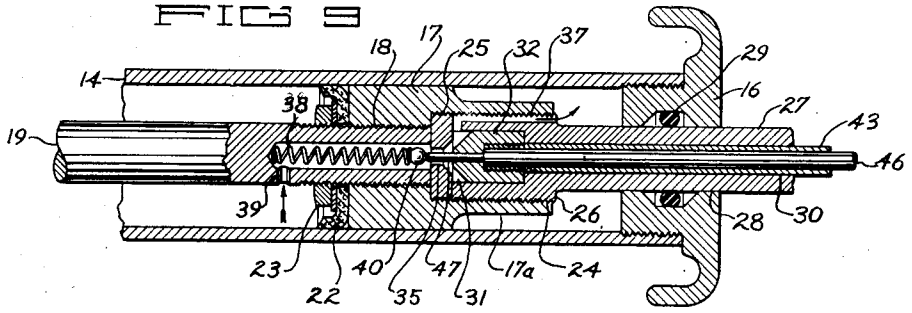
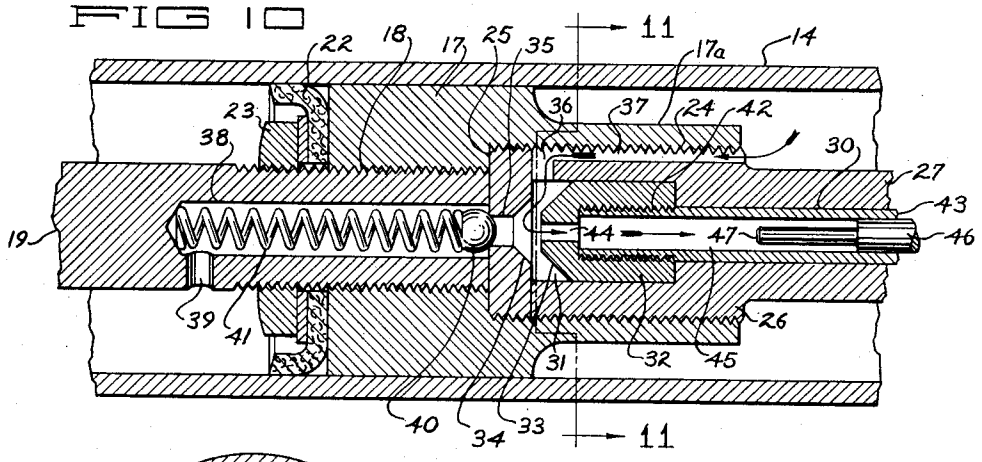


FIG 10



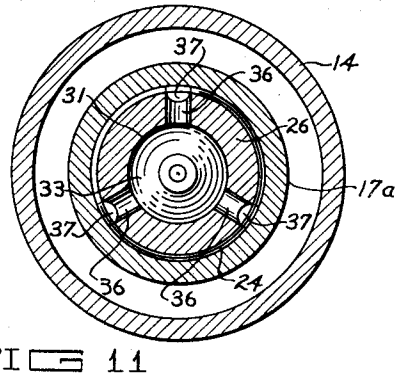


FIG 11

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HYDRAULIC JACK

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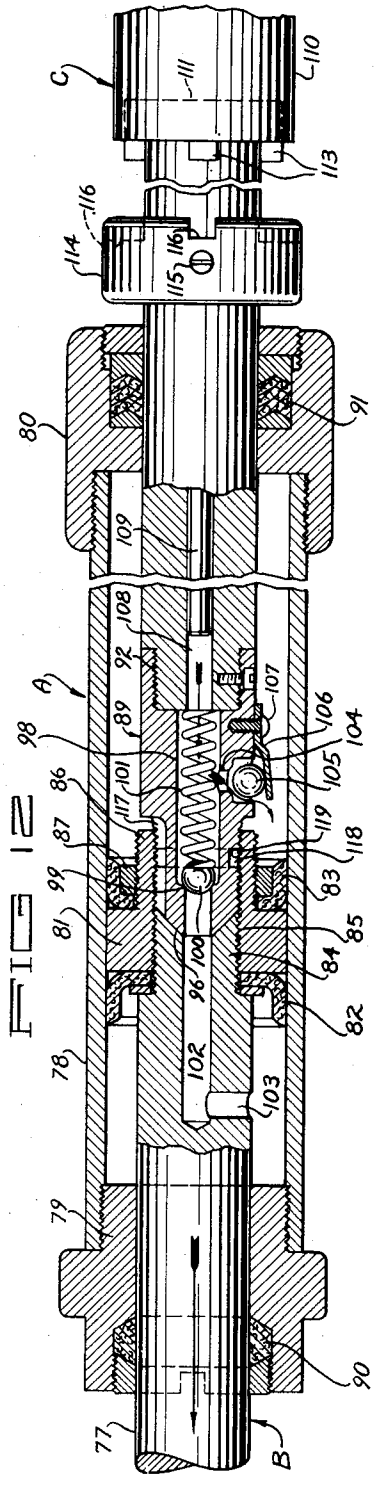


FIG 12

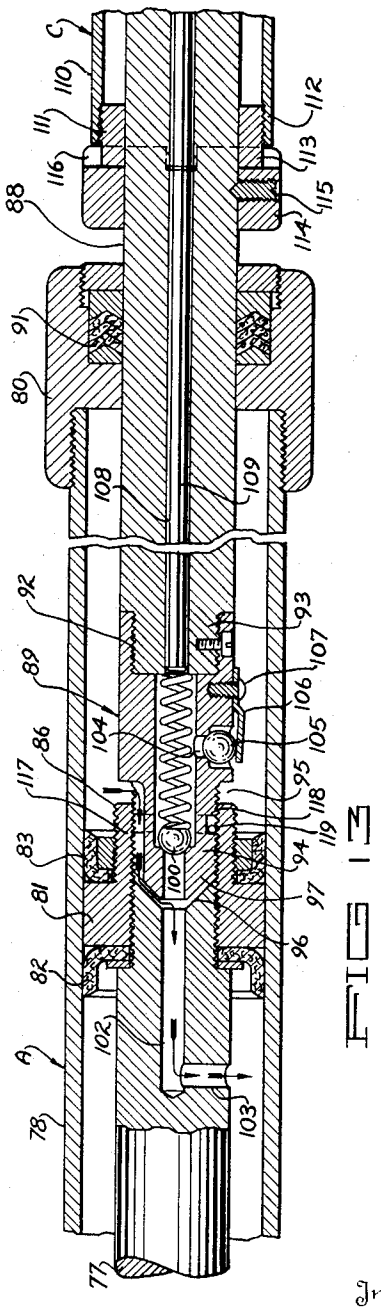


FIG 13

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UNITED STATES PATENT OFFICE

2,556,481

HYDRAULIC JACK

Harold Nilson, Wayzata, Minn., assignor of sixty per cent to Earl Lincoln, Minneapolis, Minn.

Application December 6, 1945, Serial No. 633,230

3 Claims. (Cl. 60—52)

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This invention relates generally to improvements in hydraulic tools and more particularly to tools for pushing and pulling operations, embodying a member for connection to the work and a hand operative means for developing a hydraulic force for moving said member.

The primary object of my invention is to provide a readily portable tool which will develop comparatively great power with but little effort on the part of the operator and which is adapted to a wide variety of uses, wherein movement of the work is required with power and force. Another object is to provide such a tool of a compact and light construction and one which is simple, easy and safe to use and durable and long wearing. Still another object is to provide a tool wherein sealing is effective to prevent the loss of fluid and the entire construction is such as to make the tool usable in any position called for by the work at hand.

With these and other important objects and advantages in view, as will appear in the course of the following specification, reference is now made to the accompanying drawings forming a part of that specification, and wherein:

Fig. 1 is an elevational view, partially in section, of my tool and illustrating the manner in which it is used in pushing a bushing into place.

Fig. 2 is a similar view but illustrating the tool in another position and as in use for pulling a bushing.

Fig. 3 is a slightly enlarged fragmentary side elevation showing a lever actuating means for the tool.

Fig. 4 is a cross section along the line 4—4 in Fig. 3.

Fig. 5 is an enlarged, longitudinal sectional view of the tool, with certain parts in elevation.

Fig. 6 is an enlarged, fragmentary sectional view taken substantially along the line 6—6 in Fig. 5.

Fig. 7 is a similar view along the line 7—7 in Fig. 5.

Fig. 8 is a view similar to Fig. 7 but illustrating the parts in another position.

Fig. 9 is a sectional view similar to the right hand portion of Fig. 6 but also illustrating another position of the parts.

Fig. 10 is a further enlarged sectional detail view of a portion of the tool.

Fig. 11 is a cross sectional view along the line 11—11 in Fig. 10.

Fig. 12 is a fragmentary longitudinal sectional view, partially in elevation, of a modified form of tool.

Fig. 13 is a view similar to Fig. 12 illustrating certain parts in another position.

Referring now more particularly and by reference characters to the drawing, in the first modification of my tool as disclosed in Figs. 1 through 11, A designates generally the body portion or assembly of the tool, B the endwise movable working member and C the handle assembly by

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means of which hydraulic power is developed for actuating member B.

The body assembly A comprises an elongated cylinder or barrel 14 the opposite ends of which are fitted with plugs or caps 15 and 16 of any suitable form. Reciprocable in the cylinder 14 is a piston 17 in which is secured, as by threads 18, one end of the member B. Said member B takes the form of a comparatively slender rod or shaft 19 and it extends outward through an opening 20 in the plug 15, the opening being packed as at 21 (Fig. 6) to seal around the rod while allowing it to slide in well known manner. The piston 17 is provided at one end with a cup leather 22 held in place by a nut 23 for the usual purpose.

At the end opposite to that carrying cup leather 22 the piston 17 has a reduced extension 17a forming a housing for a pump and valve assembly which will now be described. The said extension 17a is cylindrically recessed and interiorly threaded as indicated at 24, said recess opening through the end of the extension and communicating at its opposite end with the end of the rod 19 where the same is screwed into the piston. Screwed into the recess 24 down against the end of rod 19 is a washer-like valve seat member or collar 25 and in turn screwed into the recess down against this member 24 is the diametrically enlarged and exteriorly threaded end 26 of a handle or actuating rod 27. Said rod 27 extends slidably out through an opening 28 in the plug 16 and is suitably packed, as at 29, where it passes through the plug.

Actually the rod 27 is tubular, having a bore 30 extending from end to end and within the enlargement 26 the bore 30 is diametrically enlarged for a short distance forming a cylindrical chamber 31 opening toward the valve seat collar 25. Reciprocably mounted in this chamber 31 is a valve member or plunger 32 and at the end facing the valve seat collar 25 the plunger 32 is formed with a tapered or beveled nose 33 which cooperates with a complementarily beveled seat 34 formed around an opening 35 in said collar. The length of the plunger 32 is such, in comparison to the length of the chamber 31, that the plunger may move back and forth in the chamber from a position in sealing engagement with the seat 34 (Fig. 6) to a position clearing the seat (Figs. 9 and 10). In this manner the plunger 32 intermittently seals off communication between the opening 35 and the inwardly opening ends 36 of three, more or less, grooves 37 extending lengthwise along the enlarged end 26. Said grooves 37 thus, as clearly shown, communicate with the interior of the cylinder 14 at the end thereof between the piston 17 and plug 16.

The rod 19 is provided with an axially extending bore 38 which communicates at one end with the opening 35 in the valve seat collar 25. At its other end the bore 38 is closed except for a radially extending and outwardly opening port 39 which communicates with that portion of the

cylinder 14 between the piston 17 and plug 15. A ball check valve 40 is placed in the bore 39 and is urged by an expansion coil spring 41 into sealing engagement (Fig. 10) with the margin of the opening 35 opposite the seat 34.

The plunger 32 is screwed, as indicated at 42, upon the end of a plunger sleeve 43 which fits slidably in the bore 30 in rod 27 and extends from the plunger outward nearly to the extremity of the rod. The plunger 32 further has a central, axial bore 44 which communicates with the interior or bore 45 of the sleeve 43, the bore 44 being somewhat smaller in diameter than bore 45.

Slidably fitted through the sleeve 43 is a pump plunger or rod 46 and at its inner end it is diametrically reduced to form a finger 47 adapted to slide through the bore 44 in the plunger 32. At its opposite, outer end the pump rod 46 is threaded at 48 into the end cap 49 of a cylindrical pump handle 50. Said pump handle 50 is larger in diameter than the rod 27 and extends back thereover toward cylinder 14. The inner end, or end opposite cap 49 is threaded upon a guide collar 51 having an internal diameter such as to nicely, slidably, and rotatably, fit the rod 27 and so guide the handle. Additionally a collar 52 is threaded upon the end of the rod 27 and this collar has an external diameter such as to fit the interior of the handle in the same fashion. There is also positioned between the two collars 51 and 52 a stop sleeve 53 which loosely fits the rod 27 and, of course, acts to limit outward movement of the handle 50 with respect to the rod 27, as seen in Fig. 5.

The rod 27 is threaded at 54 to take collar 52 and this threaded end of the rod projects beyond the collar to enter a tapped socket 55 formed in the handle cap 49 when the handle is pushed inward and rotated to thread the parts together. (See Fig. 8.) When thus engaged obviously the handle 50 is locked with respect to rod 27.

The extremity of the bore 30, where the pump rod 46 projects is packed as indicated at 56 to prevent fluid escape about the rod.

In operation the interior of the cylinder 14, at both sides of piston 17, is substantially filled with fluid such as oil or the like. To then move the piston 17, and rod 19, to the right as viewed in Figs. 5 through 11, which is the direction of the powered or hydraulically driven movement of the parts, the handle 50, being loosened by unscrewing socket 55 from the threaded end 54 of rod 27, is reciprocated by hand. As the handle is pulled out, or away from cylinder 14, the pump rod 46 is correspondingly moved through an intake stroke the length of which is limited by sleeve 53. The earliest part of this outward movement of the pump rod 46 through the effects of vacuum and drag carries along the sleeve 43 and pulls the plunger 32 away from its seat 34 and a pump-full of fluid may then be drawn into the sleeve 43 through the grooves 37 as indicated by the arrows in Fig. 10. This fluid is taken from what may be called the reservoir low or no pressure end or chamber in the cylinder 14 between the piston 17 and the plug 16. Now as the handle 50 is pushed forward or inward, toward the cylinder 14, the sleeve 43 and plunger 32 are correspondingly moved a short distance until the plunger returns to its seat 34 whereat it closes off communication between the interior of the pump, or the sleeve 43, and the grooves 37 leading to the aforesaid low pressure chamber in the cylinder. Continuation of this movement, or discharge stroke of the handle and pump rod will cause the latter to eject the pump-full of fluid by unseating the ball check valve 40 so that this quantity of fluid will pass through bore 38 and port 39 into the cylinder between the piston 17 and plug 15, or into what may be called the high pressure end or chamber. When the discharge stroke of the pump is completed the ball check valve 40 is reseated, by the spring 41 and pressure of the fluid from said high pressure chamber, and the same cycle of intake and exhaust movements is repeated continuously as required. Each said cycle will of course take a pump-full of liquid from the low pressure chamber and transfer it at high pressure to the high pressure chamber where its pressure exerted upon the piston 17 will move it, and rod 19, in the direction required. It will be apparent that the power developed is great and that the rapidity with which the piston is moved may be readily controlled by the amplitude and frequency of the pump strokes.

To release the piston, allowing it to move back or toward the left in the drawings, the handle 50 is pushed inward toward the cylinder and the socket 55 threaded upon the rod end 54. The pump rod 46 is thus moved to the left or inward some distance beyond its normal pumping range and the finger 47 is pushed against the ball check valve 40 unseating it as seen in Fig. 9. The fluid may then flow from the high to low pressure chambers, in which the pressures are now equalized, and the piston 17 may be moved to any position by means of the rod 27 and handle 50. The rod 46 is adjustably locked by a lock nut, as clearly shown, in the cap 49 and may be adjusted so that the finger 47 will just unseat valve 40 in this operation.

As aforesaid the low pressure or reservoir end of the cylinder 14, as well as the high pressure or working end thereof, are substantially filled with the fluid upon which the pump operates. More accurately put, of course, the high pressure end will be filled with fluid whereas the low pressure end will be not quite filled so that air of a quantity sufficient for operation of the pump will exist therein.

Referring now to Figs. 1 and 2 of the drawing, I show therein two examples of the use to which my invention may be put. As seen in Fig. 1, I may employ the tool to force a bushing 57 into its opening 58 in a wall or other member 59. For this purpose the plug 15 in the working end of the tool is fitted with a collar 60 which is adapted to center on and bear against one end of the bushing 57. The corresponding end of the working member B is provided with a slot 61 to receive a key 62 and this key 62 is arranged to engage a centrally apertured bearing plate 63, the diameter of which is larger than the bushing. In the working movement of the member B in the direction of the arrow in Fig. 1, the plate 63 then acts as a purchase against which the pressure of the collar 60 may be utilized to force the bushing 57 into the opening 58. As seen in Fig. 2, a somewhat similar arrangement may be used in order to withdraw the bushing 57 from its opening 58, but in this case the collar 60^a fixed upon the plug 15 is large enough in diameter to clear the bushing and bear upon the wall 59. The key 62 then engages a washer-like member 64 which engages the end of the bushing 57. The collar 60^a now acts as a purchase against which the pull of the member B may operate

through the member 64 in order to pull the bushing 57 from its opening.

It will be noted that in both such operations the force exerted to accomplish the work acts in tension upon the member B so that a comparatively small rod may be used for this member without any tendency for it to buckle or be otherwise distorted. It will further be apparent that the tool may be used in any position and that its manipulation is very convenient by holding the body portion A in one hand and operating the handle C with the other. The tool is very light and compact and readily portable, and it is, of course, to be understood that the uses here shown are merely examples of the many uses to which the tool may be put.

I have shown the plug 15 as reduced in diameter to provide a shoulder 65 against which the respective collars 60 and 60a may be seated. I also show the plug 16 in the other end of the tool as provided with hooks 66 to which a chain or other similar member (not here shown) may be attached when using the tool for example as a fence stretcher.

Under some circumstances it may be desirable to provide a hand lever for operating the pump in lieu of the tubular handle 50 previously described, and I show a mechanism for this purpose in Figs. 3 and 4. Here the outer end of the rod 27 is threaded to receive a coupling 67 having diametrically opposed and angularly turned arms 68. These arms 68 have openings 69 at their ends to selectively receive a pin 70 by which the hand lever 71 is pivotally connected to the tool. In one set-up, the pin 70 pivotally supports the hand lever 71 between its ends and with one end extending adjacent to the pump rod 46, where it projects beyond the rod 27. The lever then carries a pin 72 which operates in a yoke 73, attached to the rod 46 by offsetting its end, as indicated at 74, and in this arrangement it will be obvious that a pull upon the end 75 of the lever will move the pump rod 46 through its working or discharge stroke. On the other hand, by pinning the extremity of the lever 71 to the opposite arm 68 and fitting the pin 72 in the lever intermediate its ends, as shown in dotted lines in Fig. 3, the operation will be reversed so that a push upon the handle 75 will operate the pump rod through its working stroke. This selective arrangement of the hand lever is advantageous where the tool is used in different positions and may be readily made merely by changing the positions of the respective pins 70 and 72. In either case the yoke 73 permits the necessary play to accommodate the swinging movements of the lever to the straight line movements of the pump rod 46. In addition, in this arrangement I provide a stop member 75a which is pivoted at 76 to the end of the coupling 67 and which is adapted to partially encircle the rod 46 where it extends beyond the rod 47. Normally, this stop member 75a lies in the path of the yoke 73 so as to limit the inward or working stroke of the pump rod 46. However, by swinging the stop member outward, as indicated by the arrow in Fig. 4, the pump rod 46 may be moved inward a short distance beyond its normal range of movement so that the ball check valve 40 may be unseated to release the piston 17, as previously described.

Referring now to Figs. 12 and 13, I have shown therein a modified form of tool wherein the rod 77 constituting the working member B is hydraulically operated or driven in a direction opposite to that of the corresponding part B previously described. This modified form of tool has a body portion A and a pump actuating or handle assembly C and the construction of these parts will now be described in detail.

The body portion A comprises a cylinder 78 of any suitable diameter and length and is provided at its opposite ends with plugs or caps 79 and 80, as clearly shown. There is also provided a piston 81 reciprocably mounted within the cylinder and having oppositely facing cup washers 82 and 83, which are held in place by the assembly of the parts, as will presently appear. The rod 77 has a reduced threaded end 84 which is screwed into corresponding tapped opening 85 in the piston 81. The annular shoulder formed on the rod 77 is employed to hold the cup leather 82 in place. The piston 81 further has a reduced tubular extension or neck 86, the internal diameter of which corresponds to the diameter of the threaded opening 85 and the bore thus formed clear through the piston 81 is tapped full length. The exterior of the extension 86 is also threaded to receive a nut 87 by which cup leather 83 is retained in place.

I here again provide a handle or actuating rod 88 acting as a pump cylinder and this rod is connected by a coupling 89 to the piston 81. The respective rods 77 and 88 thus extend in opposite directions from the piston 81 and outward through the respective plugs 79 and 81, and to prevent the escape of fluid around the rods suitable packings are provided in both plugs, as indicated at 90 and 91. The coupling 89 acts as a valve cage or housing, as will presently appear, and at the end meeting the rod 88 this coupling is internally recessed and tapped, as indicated at 92, to threadedly engage the reduced end 93 of said rod. At its opposite end the coupling 89 is diametrically reduced and threaded at 94 to screw into the bore 85. At the piston end the length of this reduced end 94 is such that when it is screwed home against the end of the rod 77 there will be space between the extension 86 of the piston and the main body of the coupling, as indicated at 95. The extremity of the rod 77 is beveled off to form an annular cup-shaped seat 96 and the meeting extremity of the coupling extension 94 is complementally tapered, as indicated at 97, so that when the parts are screwed home, as shown in Fig. 12, a tight seal will be effected.

The coupling 89 has an axially extending bore 98 which is diametrically reduced adjacent the tapered end of the coupling to form a seat 99 for a ball check valve 100. This valve is urged to its seat by an expansion coil spring 101 braced between the ball and the end of the rod 88, as clearly shown. The rod 77 also has an axially extending bore 102 communicating with the reduced portion of the bore 98 at one end and communicating at its opposite end with the interior of the cylinder 78, between the piston and the plug 79, by means of a radially extending port 103. The coupling 89 also has a radially extending port 104 communicating with the bore 98 and the outer portion of this port is diametrically enlarged forming a seat for a check valve 105 which is normally urged to its seat by a leaf spring 106 held upon the coupling by a screw 107.

The rod 88 is provided with an axially extending pump cylinder or bore 108 and at the inner end of the rod this bore communicates with the bore 98 and the coupling 89. A pump rod 109 is slidably mounted in the bore 108, and at its outer end this pump rod is arranged for operation by a handle 110 which may be identical in arrange-

ment and operation to the handle 50, hereinbefore described. Forming part of the handle 110 is a collar 111 threaded at 112 into the open end of the handle and provided with several radially spaced and inwardly extending dogs 113. A collar 114 is secured by a set screw 115 to the rod 88 in a position such that the dogs 113 may be caused to engage notches 116 in the collar when the handle 110 is moved forward or inward to a certain position.

In operation, the interior of the cylinder 78, at opposite sides of the piston 81 is substantially filled with fluid and in the operation of the tool this fluid is transferred, one pump full at a time, from that part of the cylinder to the left of the piston to the opposite end so as to push the rod 77 to the left, as viewed in the drawing. To accomplish this, the handle 110 is pulled outward or to the right so that the pump rod 109 is correspondingly moved from its position of Fig. 13. The suction or vacuum thus set up in the bores 108 and 96 is then sufficient to unseat the ball check valve 100 so that fluid may flow from the port 103 to the bore 102 and pass the check valve into the pump cylinder. Upon the return or working stroke of the handle 110 the pump rod 109 will then eject this pump full of fluid by unseating the ball check valve 105 so that the fluid is directed out into the cylinder into the high pressure end or chamber thereof, as indicated by the arrows in Fig. 12. It will, of course, be understood that as soon as the pumping action begins the ball check valve 100 will be reseated by action of the spring 101 and of the pressure of the fluid, and as soon as the working stroke of the pump has been completed the ball check valve 105 will also reseat itself. The foregoing operation may be repeated as many times and with such frequency as may be desired, and the result will be a movement with considerable force of the working member B to the left in order to accomplish any work to which the tool may be put.

Here again there will of course be a minor differential in the volume of fluid at opposite sides of the piston 81 in order that the pump may create a vacuum sufficient for its filling.

To release the tool or to permit the piston 81 to be moved back to the right, as viewed in the drawing, the handle 110 is moved far enough inward to engage the dogs 113 with the notches 116, and then by turning the handle 110 the rod 88 itself may be turned and the reduced end 94 of the coupling 89 may be slightly unscrewed from the piston, as seen in Fig. 13. A very slight movement of this kind is sufficient to separate the tapered end 97 from the seat 96 so that fluid may flow from the port 102 into and through one or more grooves 117, which extend lengthwise along the tapered end of the coupling. The fluid is thus allowed to work back from the high pressure end of the cylinder to the reservoir or low pressure end thereof, as indicated by the arrows in Fig. 13, and the pressure may equalize itself so that the piston may be moved to any desired starting position for the next operation. To prevent the coupling 89 from being unscrewed too far in this operation it is provided with a circumferential groove 118 through which passes a pin 119 secured through the extension 86 of the piston 81 tangentially to said groove. With this pin in place it is obviously impossible to unscrew the coupling beyond the point sufficient for the rapid release of the pressure.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. A hydraulic tool, comprising in combination, a cylinder, a piston movable by hydraulic power in the cylinder, a rod extending from the piston in one direction for application to the work, a pump operative to develop hydraulic power on the piston in such direction as to push said rod from the cylinder, said pump including a tubular member and a pump rod extending from the piston in the direction opposite to said rod, means for reciprocating said pump rod, and a valve operative by rotating the tubular member to release the power exerted on the piston.

2. In a hydraulic tool of the character described having a cylinder and a piston movable therein, a work member extending from the piston out through one end of the cylinder, a pump cylinder member extending out from the piston through the other end of the cylinder, a pump rod for transferring a fluid from one end of the cylinder to the other for moving the piston on a power stroke in one direction, a release valve having a tapered seat, and the end of the pump cylinder member being tapered to normally close the seat and threaded into the piston whereby the tapered end may be moved away from the seat upon rotation of the pump cylinder member in one direction.

3. In a hydraulic tool of the character described having a cylinder and a piston movable therein, a work member extending from the piston out through one end of the cylinder, a pump cylinder member extending out from the piston through the other end of the cylinder, a pump rod for transferring a fluid from one end of the cylinder to the other for moving the piston on a power stroke in one direction, means in said piston forming a tapered release valve seat communicating with one end of the cylinder, the inner end of the pump cylinder member being threaded into the piston and being tapered to meet and close said release valve seat on rotation of the pump cylinder member in one direction, and said threaded end of the pump cylinder member having means communicating with the other end of the cylinder operative when the tapered end is unseated from the valve seat to allow the fluid to flow freely between the respective ends of the cylinder.

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