May 23, 1950 W. V. ELLISON 2,508,568

HYDRAULIC RATCHET WRENCH

Filed June 6, 1947 2 Sheets-Sheet 1

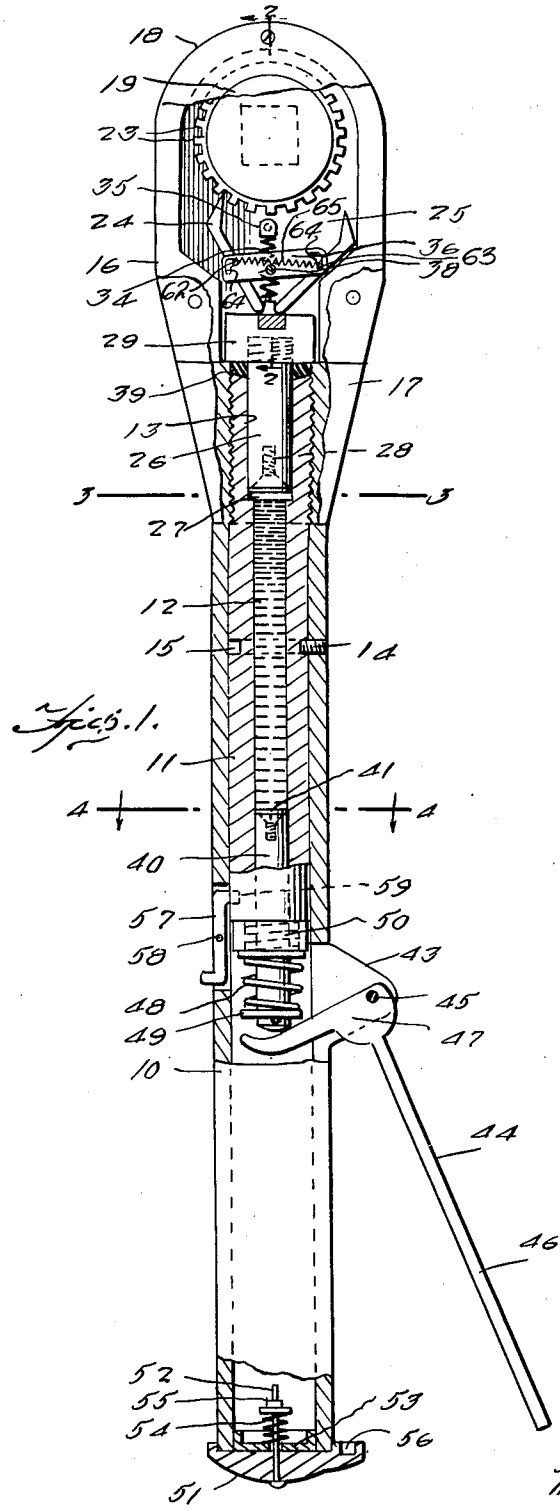


Fig. 1.

Fig. 7.

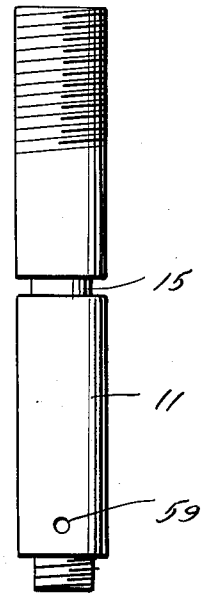
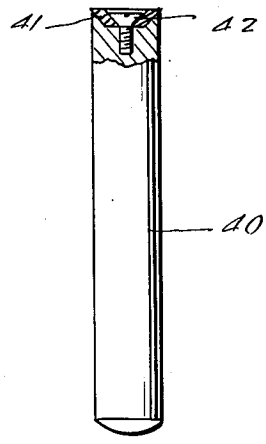


Fig. 8.



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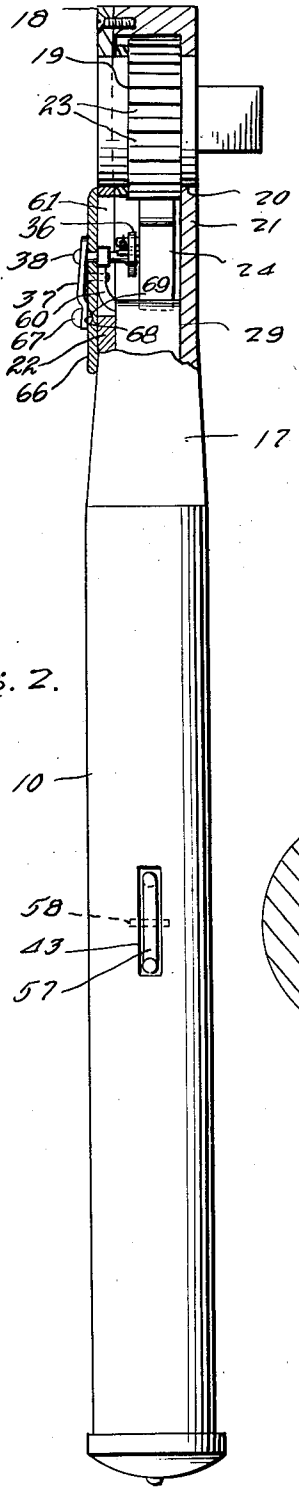


Fig. 2.

Fig. 5.

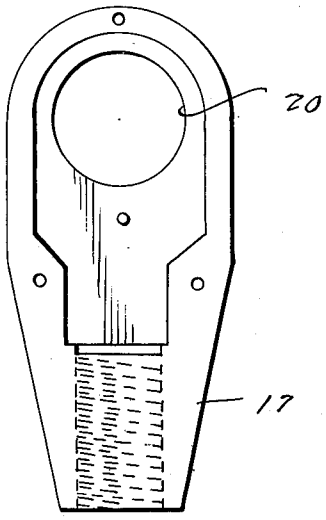


Fig. 3.

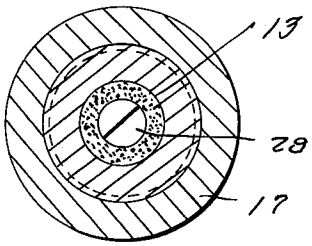


Fig. 4.

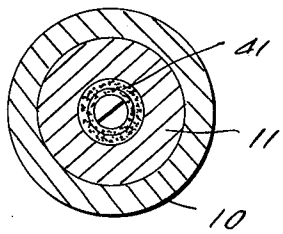
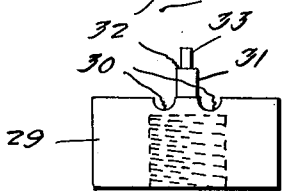


Fig. 6.



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Patented May 23, 1950 2,508,568

UNITED STATES PATENT OFFICE

2,508,568

HYDRAULIC RATCHET WRENCH

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Application June 6, 1947, Serial No. 753,068

4 Claims. (Cl. 74—157)

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This invention relates to improvements in wrenches, and more particular to an improved ratchet-type wrench having hydraulic operating means incorporated therein.

It is among the objects of the present invention to provide an improved ratchet-type wrench which can be used to turn a bolt or nut in spite of obstructions that preclude the operation of an ordinary ratchet wrench by limiting movements of the wrench handle to an amount insufficient to operate the wrench, which is capable of applying a bolt or nut turning torque substantially as great as can be applied by an ordinary ratchet wrench of equivalent size, which can be used as a hydraulically operated wrench or an ordinary ratchet wrench as may be most convenient under the particular circumstances of use, which is positively reversible, simple, durable and economical in construction, and no more difficult to use than an ordinary ratchet wrench.

Other objects and advantages will become apparent from a consideration of the following description in conjunction with the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a wrench illustrative of the invention.

Figure 2 is a side elevational view of the wrench, a portion being broken away and being shown in section to better illustrate the construction thereof.

Figure 3 is a transverse section on the line 3—3 of Figure 1.

Figure 4 is a transverse section on the line 4—4 of Figure 1.

Figure 5 is a plan view of the wrench head with the detachable cover plate removed.

Figure 6 is a side elevation of a piston head illustrated in Figure 1 and constituting an operative component of the wrench.

Figure 7 is an elevation of a hydraulic cylinder or core member; and

Figure 8 is an elevation of a plunger operative in the core shown in Figure 7, a portion being broken away and shown in section to better illustrate the construction thereof.

With continued reference to the drawings, the wrench has a tubular handle 10 of cylindrical shape which receives in one end portion a tubular core 11 having a bore 12 extending therethrough and a counterbore 13 in one end portion thereof. The core 11 is slidable into the handle 10 and has a close turning fit therein. A set screw 14 threaded into an aperture in the handle extends into a annular groove 15 in the core to maintain the core in operative association with

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the handle against relative longitudinal movement.

The counterbored end of the core 11 extends beyond the handle and is externally screw threaded to receive a hollow wrench head 16 which may be of conventional shape having a tapered end portion 17 flaring out from the associated end of the handle 10 and a rounded outer end portion 18, this head being rotatable together with the core 11 relative to the handle 10.

A sprocket 19 is journaled in the wrench head by the integral bosses 20 received in the apertures in the base 21 of the head and in the removable cover plate 22. The sprocket 19 is provided with peripheral ratchet teeth 23 selectively engageable by a pair of dogs 24 and 25 mounted in the head 16 for operative engagement with the sprocket in a manner presently to be described.

A piston 26 is slidably received in the counterbore 13 and provided at its inner end with a leather cup seal 27 secured to the piston end by a conventional screw 28. The opposite end of the piston 26 is externally screw threaded and inserted into a cylindrical head 29 which overlies the end of the core 11 surrounding the counterbore. The outer face of this head is provided with a pair of rounded indentations 30 particularly shown in Figure 6, separated by an extension 31 providing a shoulder 32 and a guide 33 for a piston-retracting-compression spring 34 one end of which bears against the shoulder 32 and the opposite end of which bears against an abutment 35 secured to the base 21 of the wrench head. The ends of the dogs 24 and 25 opposite the ratchet tooth engaging ends thereof are seated respectively in rounded depressions 30 in the piston head 29 and are controlled by suitable reversing means to reverse the direction of rotation of sprocket 19 by selectively bringing the dogs 24 and 25 into engagement with the teeth 23. The reversing means comprises an arm 60 joined at one end to the piston head 29 and extending toward the sprocket 19. An apertured boss is provided at the end of this arm opposite the head, and a mounting pin 38 is journaled in this boss and projects through an elongated slot 61 in the side plate 22 of the wrench head, so that the pin can move with the piston head 29. Each of the dogs 24 and 25 carries a laterally-extending pin, 62 and 63 respectively, positioned at substantially equal distances from the ends of the dogs resting on piston head 29. A yoke 36 is secured at its mid-length location to the end of mounting pin 38 adjacent the dogs, and has near

its opposite ends inverted, substantially L-shaped openings 64 through which the pins 62 and 63 respectively extend.

The openings 64 have their inner corners rounded or cam shaped and a light tension spring 65 is connected at its opposite ends to the pins 62 and 63 and resiliently urges both dogs 24 and 25 inwardly toward the sprocket teeth 23.

Yoke 36 is tiltable about the axis of mounting pin 38 between two operative positions in one of which the pin 62 is in that portion of the corresponding L-shaped opening 64 extending longitudinally of the yoke, while pin 63 is in that portion of the other L-shaped opening extending transversely of the yoke. Under these conditions, dog 24 will be pulled into engagement with the ratchet teeth 23 by spring 65 and will have ample freedom to move outwardly as the sprocket is turned and to ratchet past the teeth 23 on the return stroke, because of the freedom of movement of the pin 62 in the longitudinally-extending portion of the corresponding L-shaped opening 64 in yoke 36. At the same time pin 63 will be held substantially against movement in the transversely-extending portion of the other L-shaped opening 64 holding dog 25 entirely out of engagement with the ratchet teeth.

When the yoke is tilted to its alternative operative position, pin 63 will be freed to enable spring 65 to pull dog 25 into engagement with the ratchet teeth, while dog 24 will be held out of engagement with the ratchet teeth by freeing of pin 62 in the transversely-extending portion of corresponding yoke opening 64.

A slidable cover plate 66 is secured to arm 60 and overlies slot 61 at the outer side of side plate 22. Mounting pin 38 extends through a suitable aperture in cover plate 66 and a spring lever 37 is secured at one end to the end of the mounting pin projecting at the outer side of the cover plate. This spring lever is angularly movable over the cover plate about the axis of pin 38, and is provided on its outer surface near its free end with an outwardly-projecting lug 67 for manual movement of the spring lever to tilt yoke 36 from one to the other of its two operative positions.

Cover plate 66 is provided in its outer surface with two depressions or recesses 68, located to correspond to the two operative positions of the yoke, and a detent 69 on the inner side of spring arm 37 near the free or outer end of the latter, seats in the recesses 68 alternatively to releasably lock the yoke in one or the other of its two operative positions.

A packing gland 39 is provided at the outer end of the counterbore 13 to provide a seal between the piston 26 and the end of the core member 11.

A plunger 40 having an end area less than the end area of piston 26 is reciprocally mounted in the end of the bore 12 opposite the counterbore and is provided at its inner end with a cup-washer seal 41 held in place by a screw 42. The handle at the opposite end of the plunger 40 is provided with a longitudinal slot and with a pair of outwardly-extending-apertured lugs 43 disposed one at each side of the slot. A manually-moveable lever 44 in the form of a bell crank is pivotally mounted at its knee to the lugs 43 by a pivot pin 45 so that its longer arm 46 extends downwardly from the lugs along the handle 10 and its shorter arm 47 extends into the handle and bears against the outer end of the plunger 40.

With this arrangement, when the arm 46 of the lever 44 is moved toward the handle, the plunger 40 will be forced inwardly relative to the bore 12 forcing hydraulic fluid in the bore into the counterbore behind the piston 26 to project the piston and move the dogs 24 and 25 toward the sprocket 19. The dog having its end opposite the head 29 in engagement with the ratchet teeth of the sprocket will impart a rotational movement to the sprocket in the corresponding direction. When manual pressure on the lever 44 is released, spring 34 will retract the piston into the counterbore moving the operative dogs along the ratchet teeth to a new engagement therewith from which it will impart further rotation to the sprocket when the lever 44 is again moved. Movement of the arm 46 of the lever 44 away from the handle is assisted by a compression spring 48 surrounding the projecting end of the plunger 40 between a plunger-carried abutment 49 and a packing 50 provided between the plunger and the corresponding end of the core 11.

When it is desired to use the wrench as an ordinary ratchet wrench the arm 46 of the lever 44 is brought to position alongside the adjacent portion of the handle 10 and is locked in this position by a locking cap 51 secured to the end of the handle by a pin 52 extending through a central aperture in the end closure 53 and surrounded by a compression spring 54 which bears against the inner surface of the end closure and an abutment 55 secured on the pin to resiliently maintain the cap against the end of the handle. The cap may be moved away from the handle so that the outer end of the lever arm 46 may be inserted in a socket 56 provided on one side of the cap.

A position lock is provided between the handle 10 and the core 11 to releasably hold the core at any one of various predetermined rotational positions so that the face of the sprocket 19 may be brought to any one of several angular positions relative to the outer or grip end of the handle and the associated lever arm 46. This locking device may conveniently comprise a Z-shaped lever member 57 positioned in a longitudinal slot provided in the wall of the handle and pivoted intermediate its length to the slot wall by a pivot pin 58. One angularly-turned end of the lever projects inwardly of the handle to engage in any one of several angularly-spaced recesses 59 provided in the core 11 and the opposite end projects outwardly of the handle to provide a button for lifting the opposite end out of a recess 59 in which it may be engaged.

The ratio of the area of the plunger 40 to the piston 26 may be varied to multiply the manual force applied to the lever arm 46 and the distance of the pivot pin 45 from the adjacent end of the plunger 40 may be also varied to provide the desired stroke of the plunger and the force applied thereto, the principal requirement being that full movement of the plunger 40 shall move the piston 26 sufficiently to rotate the sprocket 19 an angular distance corresponding to the width of at least one ratchet tooth so that the dogs will be able to re-engage the sprocket when the piston is retracted into the counterbore.

When the hydraulic mechanism is used to rotate a bolt or nut, the handle 10 may be rested against a convenient projection or abutment while the lever arm 46 is operated to apply hydraulic force to the sprocket 19. Under these conditions a force can be exerted on the sprocket at least as great as the torque ordinarily applied to the sprocket by a conventional ratchet wrench

through movement of the handle. If it is desired to use the improved wrench as an ordinary ratchet wrench, the handle **44** may be locked in inoperative position by the lock cap **51** and the dogs **24** and **25** may then operate to engage the sprocket and rotate it with the wrench handle and wrench head in the conventional manner.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed is:

1. A wrench comprising a tubular handle, a core in said handle having an externally-screw-threaded portion extending outwardly from one end of the handle and having a bore therethrough and a cylindrical counterbore in one end thereof, means operatively connecting said handle and said core for relative co-axial turning movement while precluding relative lengthwise movement, releasable locking means carried by said handle and engageable with said core to restrain said core and handle against relative turning movement, a hollow, open-sided wrench head received on the projecting end portion of said core and abutting the corresponding end of said handle, a sprocket journaled in said head and having peripheral ratchet teeth, a piston slidable in said counterbore having a head overlying the corresponding end of said core and a pair of rounded depressions in the outer face of said head, a pair of oppositely-acting dogs having their adjacent ends supported in said depressions and their opposite ends engageable with said ratchet teeth, a detachable side plate closing the open side of said wrench head, means extending through said side plate operative to selectively bring either one of said dogs into engagement with and move the other dog away from said ratchet teeth, a compression spring in said head operative to force said piston to its innermost position in said counterbore, a plunger in the end of said bore opposite said counterbore, a body of hydraulic fluid in said bore between said piston and said plunger, and a plunger-operating lever pivotally mounted on said handle and operative upon said plunger to force hydraulic fluid from said bore into said counterbore to project said piston and thereby actuate the dogs in engagement with said ratchet teeth to turn said sprocket.

2. A wrench comprising a tubular handle, a core in said handle having a bore extending therethrough and a counterbore in one end portion, a hollow wrench head secured to said core at the end thereof having said counterbore, a

sprocket journaled in said head and having peripheral ratchet teeth, a pair of dogs supported in said head and selectively engageable with said ratchet teeth to turn said sprocket in corresponding direction, a piston in said counterbore having a head operatively supporting said dogs, a plunger in the end portion of said bore opposite said counterbore having an end area less than the end area of the said piston, a body of hydraulic fluid in said core between said piston and said plunger, and a manually-movable lever mounted on said handle and operatively associated with said plunger to move said plunger in said bore and thereby impart sprocket-turning movement to said piston.

3. A wrench comprising a tubular handle, a core in said handle having a bore extending therethrough and a counterbore in one end portion, a hollow wrench head secured to said core at the end thereof having said counterbore, a sprocket journaled in said head and having peripheral ratchet teeth, a pair of dogs supported in said head and selectively engageable with said ratchet teeth to turn said sprocket in corresponding directions, a piston in said counterbore having a head operatively supporting said dogs, a plunger in the end portion of said bore opposite said counterbore having an end area less than the end area of the said piston, a body of hydraulic fluid in said core between said piston and said plunger, a manually-movable lever mounted on said handle and operatively associated with said plunger to move said plunger in said bore and thereby impart a sprocket-turning movement to said piston, and lock means carried by said handle and engageable with said lever to lock said lever in inoperative position adjacent said handle.

4. A ratchet wrench comprising a tubular handle, a wrench head secured to said handle, a sprocket in said head, oppositely-acting dogs in said head operative to selectively lock said sprocket to said head for turning movement therewith in either direction, hydraulic means in said handle operatively associated with said dogs to rotate said sprocket in either selected direction when said handle is maintained against movement, and manually-movable means carried by said handle and operatively connected with said hydraulic means for manual actuation of said hydraulic means.

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