Nov. 25, 1941. R. B. WASSON 2,264,012

POWER WRENCH

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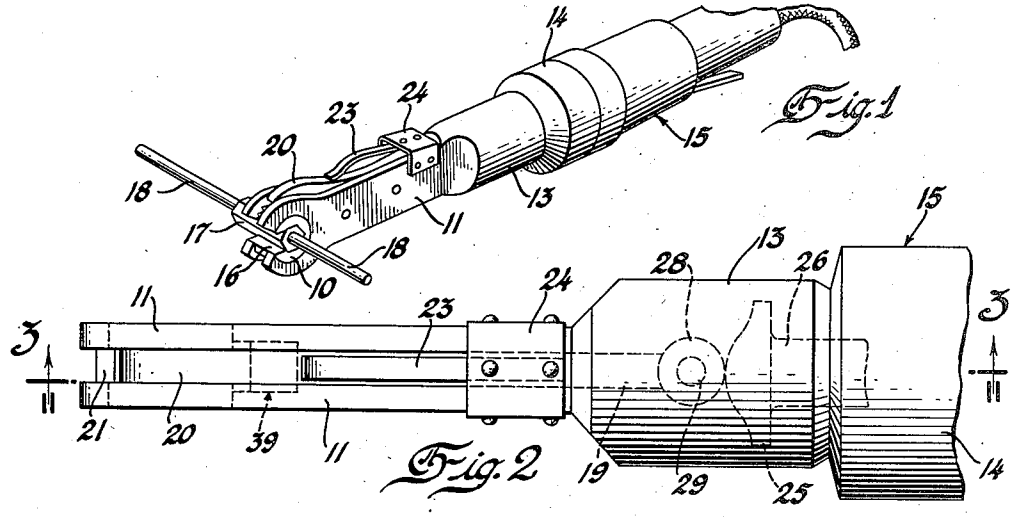

Fig. 1



Fig. 2

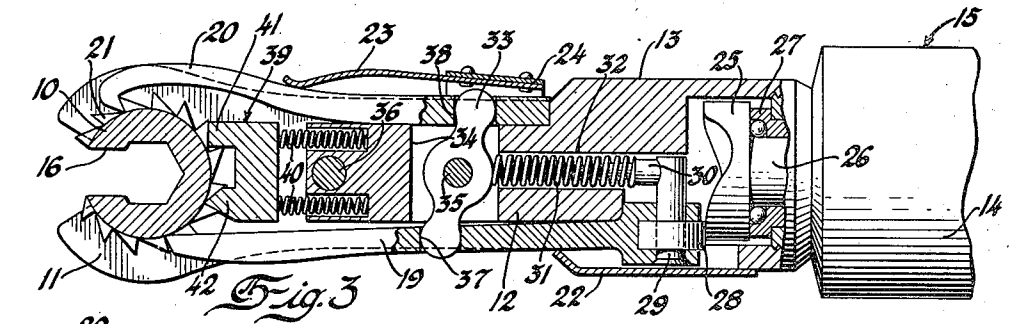

Fig. 3

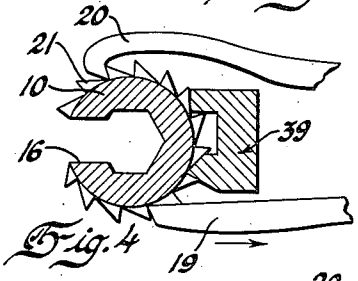

Fig. 4

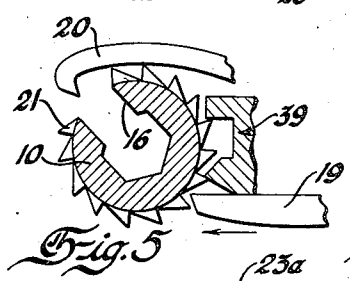

Fig. 5

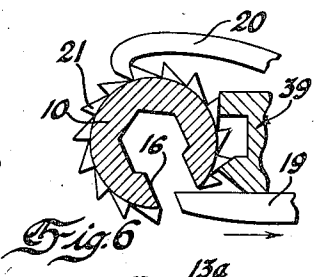

Fig. 6

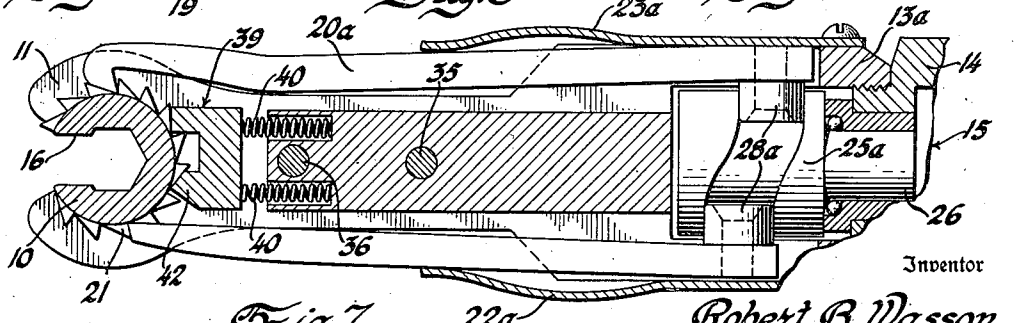

Fig. 7

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# UNITED STATES PATENT OFFICE

2,264,012

## POWER WRENCH

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Application March 20, 1940, Serial No. 324,898

3 Claims. (Cl. 81—54)

The invention relates to improvements in power operated wrenches, and may in general be considered as an improvement on that disclosed in Ernest H. Shaff Patent No. 2,119,968 issued June 7, 1938. This Shaff patent discloses a wrench embodying a socket at one end which is rotated by a power actuated pawl, engageable with a circular series of ratchet teeth on the socket periphery. Though this wrench has met with marked success, it has one definite limitation, namely, that it can be applied only endwise of a nut, bolt or the like, which is to be turned. In other words, it cannot be moved laterally into engagement with the member to be turned, in the manner of a so-called open end wrench. Furthermore, merely cutting an entrance opening or throat in the side of the socket, to make it an open end type, will not solve the problem, for then the series of ratchet teeth would be interrupted by the entrance opening and the device rendered inoperative as soon as the driving pawl came into registry with the opening. Accordingly, one aim of the present invention is to provide a power driven wrench having the attributes of ruggedness and simplicity characteristic of the wrench of the Shaff patent, but embodying a novel power driving arrangement for rotating a socket having an entrance opening in one side so that it can be applied to a part, which is to be turned, in the manner of an open end wrench.

Another object is to provide a power wrench having a rotatable socket, with an entrance opening in its side and a peripheral series of ratchet teeth interrupted at the opening, together with a plurality of pawls, power driven in timed relation, and arranged to insure a positive drive for the socket in all rotary positions of the latter.

Another object is to provide means to split the power impulse driving the rotatable socket into vectors of opposite direction so that the power thrust will be converted to a torque couple. This is desirable because manufacturers of power wrenches have in the past, devised wrenches in which the power vector was in one direction. They proved impractical in use because the supporting members with their necessarily limited bearing surface rapidly wore under this one direction load.

The invention also resides in various structural improvements and combinations of parts by means of which simplicity and low cost of production are combined with effectiveness and versatility of operation and use.

Further objects and advantages of the invention will become apparent as the following description proceeds, taken in connection with the accompanying drawing in which:

Figure 1 is a general perspective view illustrating the use of a power wrench embodying the invention; Figure 2 is an enlarged partial plan view of the wrench shown in Figure 1; Figure 3 is a longitudinal sectional view substantially along the line 3—3 in Figure 2; Figures 4, 5 and 6 are a series of fragmentary stop motion views showing successive positions of the pawls and ratchet teeth during rotation of the socket; and Figure 7 is a partial longitudinal sectional view similar to Figure 3, of a modified form of power wrench embodying the invention.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the first embodiment of the invention selected for illustration (Figure 1) the wrench shown includes a cylindrical socket 10 rotatably journaled in the yoke shaped jaw ends of a pair of thin side plates 11. The shank portions of these side plates receive between them a spacer web or septum 12 projecting from the nose of a cylindrical housing 13, to the outer end of which is screwed the casing 14 of a power unit 15 (Figure 3). The unit 15 embodies a suitable power means such as a pneumatic motor, power being supplied from this motor, through the medium of a novel drive mechanism described more particularly below, for rotating the socket 10.

It will be observed that the socket 10 has a longitudinal entrance opening 16 (Figure 3) in its side. A so-called open end is thus formed for the wrench through which a device to be turned, such as the coupling 17 in Figure 1, may be inserted. This is, of course, particularly advantageous where the device to be turned is such that the socket cannot be engaged with it by movement longitudinally of the member. For example, the coupling 17 in Figure 1 is threaded at its opposite ends on rods 18 so that only an open end type of wrench can be applied to it. The present wrench thus has the versatility peculiar to a hand operated wrench of the open end type and yet has all of the advantages of a full power operated device. The interior of the socket 10 has been shown as being of hexagonal

configuration and the usual adaptors (not shown) may be inserted in it to accommodate nuts or the like of different diameters or shapes.

To drive the socket 10, a pair of motor driven pawls 19 and 20 are arranged to engage a series of ratchet teeth 21 (Figure 3) rigid with the periphery of the socket. The series of ratchet teeth is C-shaped, rather than annular, because of the interruption in them necessitated by the entrance opening 16 in the socket. In general, the pawls 19 and 20 are reciprocated in opposite vectors to each other and in timed relation by the power unit 15 and are engageable with the ratchet teeth at points spaced apart circumferentially of the socket a greater distance than the width of the entrance opening 16 so that the teeth are engaged by at least one pawl in all rotational positions of the socket (see Figures 4, 5 and 6).

The lower pawl 19 is of the pusher type while the upper pawl 20 is of the puller type, being provided with a hook shaped end for engaging the ratchet teeth 21. These pawls are longitudinally reciprocable in corresponding grooves defined between the side plates 11 at the lower and upper edges, respectively, of the central web 12. The pusher pawl 19 is yieldably urged upward into engagement with the ratchet teeth by a leaf spring 22 screwed to the housing 13. Similarly, the puller pawl 20 is yieldably urged into engagement with the ratchet teeth by a second leaf spring 23 bearing against it and mounted on a U-shaped bracket 24 which is fixed to and embraces the inner ends of the side plates 11 (see Figure 1).

To connect the pusher pawl 19 in driven relation with the motor in the power unit 15, an open face barrel cam 25 is provided, which is rigid with the end of the motor shaft 26, the latter being journaled in suitable anti-friction bearings 27 in the inner end of the casing 14 (Figure 3). Coacting with this cam 25 is a cam follower roller 28 journaled on a pin 29 in the bifurcated inner end of the pusher pawl 19. It will be observed that the inner end of the pin 29 extends laterally from the pawl and has fixed on it a projection 30 receiving the end of a helical compression spring 31. The latter is located in a longitudinal bored recess 32 in the housing 13 and yieldably urges the pin 29 to the right (as viewed in Figure 3) to retain the cam follower roller in engagement with the cam. As the motor shaft 26 rotates the pawl 19 is pushed longitudinally outward as the roller 28 rides up on the lobes or high points of the cam 25, and the pawl is then reciprocated inward in the opposite direction by the compression spring 31 as the roller rides into the low points on the cam. Since the inner portion of the pawl 19 is held loosely in position by the leaf spring 22 its necessary downward tilting or pivotal motion is permitted so that the pawl nose can pass over the ratchet teeth 21 during the return motions of the pawl.

The other, or puller pawl 20 is driven from, and in timed relation with, the pusher pawl 19. For this purpose a rocker 33 is pivoted in a transverse opening 34 in the housing web 12 on a transverse pin 35. Incidentally, this latter pin, as well as a second transverse pin 36 serve to secure the side plates 11 in place. The rounded ends of the rocker 33 are received respectively in slots 37 and 38 in the pawls 19 and 20.

As the pusher pawl 19 is thrust outward by the cam 25 the puller pawl is simultaneously drawn inward by the rocker 33, so that the two pawls act simultaneously to advance the ratchet 21 a distance of slightly more than one tooth for each reciprocation of the pawls.

By using pusher and puller pawls, as distinguished from, say, two pusher pawls, it is possible to assure positive actuation of both pawls during their power strokes even though they are driven from an open faced cam and are spring returned. Thus the pusher pawl 19 is positively thrust outward by the cam, during its power stroke, and simultaneously the puller pawl 20 is positively drawn inward. It is only during their return strokes, when no torque is applied to the ratchet, that the spring 31 moves the pawls.

To prevent inadvertent reverse rotation of the series of ratchet teeth 21, a back-up pawl 39 is utilized. This pawl is block shaped in form and is longitudinally slidable between the side plates 11. A pair of compression springs 40, located in parallel bores in the outer end of the housing web 12, yieldably urge the back-up pawl into engagement with the ratchet teeth 21. Two abutments or teeth 41 and 42 are provided on the back-up pawl. The upper tooth 41 is of rectangular configuration and the lower tooth 42 triangular so that they will conform to the angular positions of the ratchet teeth faces presented to them in the manner shown. The pawl teeth 41 and 42 are spaced apart a distance slightly greater than the width of the entrance opening 16 in the socket 10 so that even when the socket is rotated to present this opening toward the back-up pawl 39, at least one of the latter's teeth will always be in engagement with the ratchet teeth. By locking the socket against reverse rotation with such a back-up pawl, the device can be used effectually as a hand wrench when the motor is idle.

In the operation of the power wrench described the socket 10 is initially located with its entrance opening 16 in registry with the corresponding openings in the ends of the side plates 11 (as shown in Figure 3) so that the socket can readily be slipped over a device to be turned, such as the coupling 17 (Figure 1). Having engaged the wrench socket with the coupling, the operator starts the motor of the power unit 15 thus starting rotation of the motor outlet shaft 26. The resultant rotation of the cam 25 reciprocates the pusher pawl 19, as heretofore described, and at the same time the puller pawl 20 is reciprocated in the opposite direction, through the medium of the connecting rocker 33. In this way a strong torque is applied to the socket 10 at generally diametrically opposite points about its periphery. Even when the socket entrance opening 16 is in registry with one or the other of the pawls 19 and 20 (Figures 5 and 6) the other pawl is always in engagement with the ratchet teeth so that the drive is not interrupted nor seriously impaired and a continuous rotation of the socket is insured.

In Figure 7 a modified form of power wrench has been shown which is in general very similar to that of Figures 1 to 6, inclusive, except that a somewhat different arrangement has been provided for reciprocating the pawls. In the present instance both of them are driven directly from the cam instead of using an intermediate connection from one pawl to the second, and in addition, the pawls are positively returned by the cam rather than by a spring means. The same reference numerals have been used for identical parts and, accordingly, their description need not again be detailed.

In this modified construction, the pawls 19ª and 20ª correspond to the pawls 19 and 20 in Figure 3 and are similar in construction to them except that there is no cross linkage but, instead, each pawl is provided with a cam follower 28ª, rotatable on a pin fixed to the inner end of its pawl. These cam follower rollers are received in the peripheral groove of a barrel cam 25ª. Consequently, as this cam is rotated by the power unit 15, the pawls 19ª and 20ª are positively advanced and retracted in timed relation.

The supporting structure is much the same as that previously described, with changes as are necessary to accommodate the differently shaped cam, cam followers, etc. A cylindrical housing 13ª is threaded on the end of the motor casing 14, as before, and the barrel cam 25ª is received in the interior of this housing. A thin shank or projection 12ª on the housing has fixed to its opposite sides the side plates 11, by pins 35 and 36, and the socket 10 is rotatably journaled in the yoke shaped ends of these side plates. The pusher and puller pawls 19ª and 20ª are yieldably retained in position in the grooves defined on the opposite sides of the supporting structure shank by leaf springs 22ª and 23ª. In this instance, both of these leaf springs are screwed directly to the housing 13ª and overlie the respective pawls.

From the foregoing, it will be seen that wrenches embodying the present invention afford the extreme flexibility of use and application heretofore peculiar to hand operated open end wrenches, and yet, have all of the advantages of positive power actuation.

I claim:

1. A power wrench of the open end type comprising, in combination, an elongated body structure having a transversely extending socket rotatably supported on one end thereof, said socket having a longitudinal opening in one side, an annular series of ratchet teeth on the socket periphery interrupted at the side opening in the socket to leave the same unobstructed, elongated pusher and puller pawls longitudinally reciprocable on said body structure and engageable at their outer ends with said ratchet teeth at generally diametrically opposite points, a cam follower on the inner end of said pusher pawl, a rotatable cam engageable with said follower, a power unit on said body structure for rotating said cam, a spring yieldably urging said pusher pawl longitudinally away from said teeth and into engagement with the cam, and means including a transverse rocker link pivoted intermediate its ends on said body structure and engaged at its opposite ends with said pawls for actuating said puller pawl in timed relation with the reciprocation of said pusher pawl.

2. A power operated wrench including a power actuated motor, a forwardly projecting shank fixed at one end to the motor, a rotatable socket mounted in the opposite end of the shank and provided with an annular series of ratchet teeth, a pusher rod slidable in a guide slot in one face of the shank and engageable at one end with said ratchet teeth and drive connected at its other end with said motor, a puller rod slidable in a guide slot in the opposite face of the shank and engageable at one end with said ratchet teeth, and a rock lever pivoted within a transverse slot in the shank and engageable at opposite ends with intermediate portions of the two rods.

3. In a power hand wrench, a power motor having a forwardly projecting shank and an open end socket rotatable in the nose of the shank and provided with peripheral ratchet teeth, a pair of ratchet tooth engaging rods slidably guided on opposite faces of the shank, and arranged to engage ratchet teeth spaced apart a distance greater than the width of the socket opening, drive means between the motor and one of said rods and a rock lever pivotally mounted in the shank and engaged at opposite ends with said rods for transmitting motion from the motor driven rod to the other rod.

ROBERT B. WASSON.