June 4, 1968 J. W. BLOOM 3,386,319

POWER ONE-WAY DRIVE ENGAGING WRENCH

Filed Aug. 29, 1966

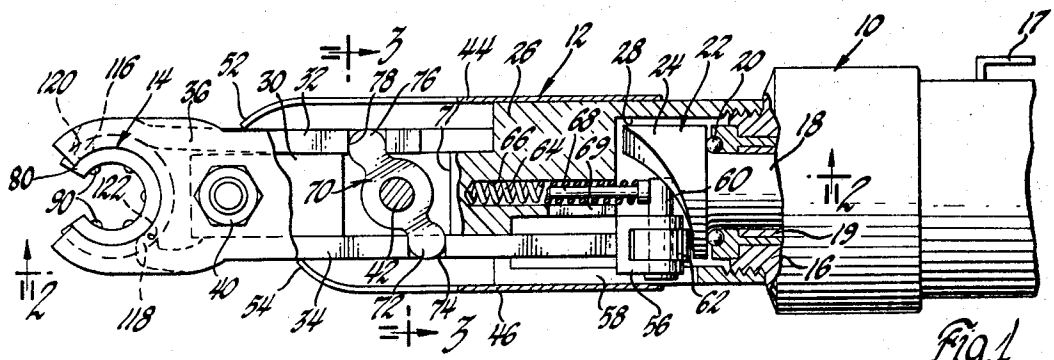


Fig. 1

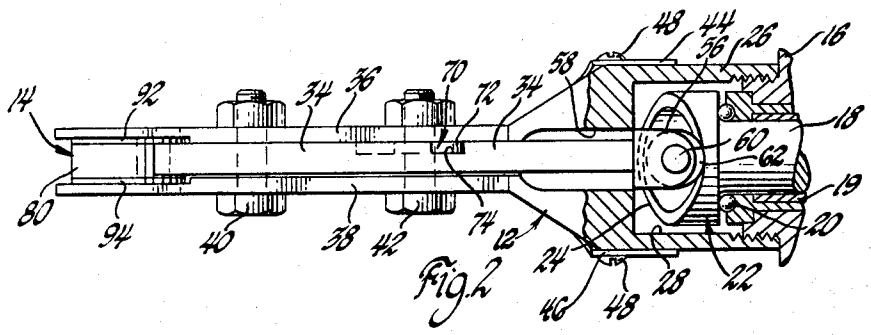


Fig. 2

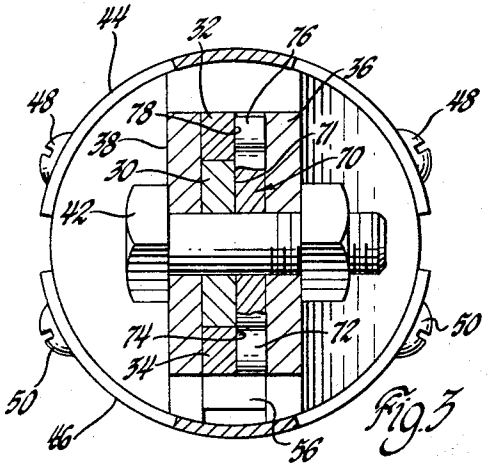


Fig. 3

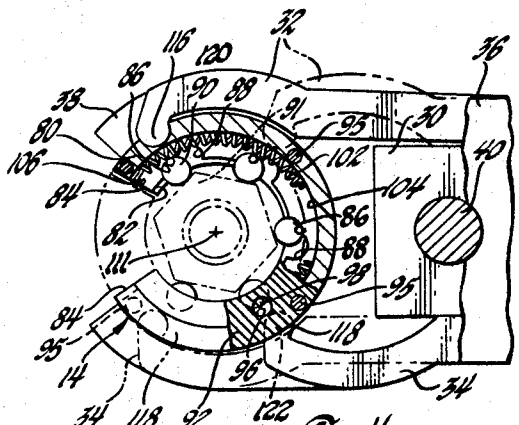


Fig. 4

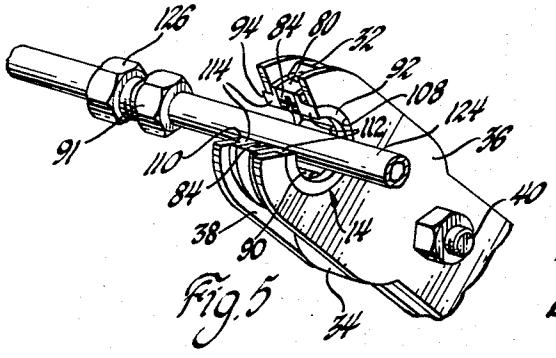


Fig. 5

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POWER ONE-WAY DRIVE ENGAGING WRENCH

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ABSTRACT OF THE DISCLOSURE

A wrench having an open end head oscillated between an open and obstructed position to turn an object. The wrench head is driven through linkage including a pair of reciprocating rods having lug engagement with the head. One of the rods receives the input by a spring biased cam follower engaging an input cam member. The spring force and cam profile provide for swinging the head from the obstructed position to the open position upon discontinuance of input to the wrench.

This invention relates to a power wrench and more particularly to a power one-way drive engaging wrench of the open end type employing an oscillator drive for oscillating the wrench head and positioning the head in an open position for wrench removal.

In prior power wrenches, the wrench head is generally continuously rotated in one direction or the other to turn an object, such as a nut, to effect loosening or tightening of a threaded fitting. While wrenches of this type have proven generally satisfactory with closed end heads, these wrenches present problems in applications, such as tube fittings, where an open end head is required. Because of the rotary head motion, the open side of the head may stop in a closed or obstructed position upon tightening the fitting thereby requiring operator time to index the head to the open position to enable wrench removal from the tubing.

The power wrench of the present invention employs an oscillatory head providing one-way drive operation for engaging and turning an object to be turned and an oscillator drive operable with both a unidirectional and a bidirectional power input to oscillate the wrench head. The power wrench is illustrated as comprising an open end one-way drive engaging head having guided, spring biased engaging rollers for engaging the object to be turned, which may be a nut and an open end which is unobstructed in an open position. The head is operable when oscillated to have the rollers drivingly engage and rotate the nut in one direction when the head is swung in the one direction and release the nut when the head is swung in the opposite direction. The oscillator drive for oscillating the head includes a rotary input member powered by a power unit and having a cam. Reciprocating linkage is connected at one end to the head and has a cam follower at the other end biased by a spring against the cam. The spring biased cam follower cooperates with the cam to position and hold the input member in a normal position when there is no power input so that the linkage positions the head in its open position for insertion over a tube to enable engagement with the tube's nut fitting. When the input member receives power input, the cam operates on the linkage to oscillate the head and

turn the nut. Upon interruption of power input, the spring biased cam follower cooperates with the cam to rotate the input member to position the head in its unobstructed open position. Since the head operates in only a relatively small arc as compared with a 360° rotating pattern, there is considerably less possibility for the open end head to stop tightening in a closed or obstructed position. If the head does stop in a closed or obstructed position, it is returned automatically to its normal open position when the power input is discontinued. Thus, operator time is saved because of the considerable less possibility of the open end wrench stopping in a closed or obstructed position, and in the event that it does stop in an obstructed position, the self-indexing feature will return the head to its open position. Another feature of the present invention is that the ratcheting action occurs in the head and not in the oscillator drive so that the object being turned is part of the wear surface whereby the oscillator drive maintenance requirements are reduced.

An object of this invention is to provide a power wrench having a head operable when oscillated to drivingly engage and rotate a member in only one direction and an oscillator drive operable with both a unidirectional and a bidirectional input to oscillate the head.

Another object of this invention is to provide a power open end wrench having a head whose open end is unobstructed in an open position and an oscillator drive for driving the head and for biasing the head to the open position when power input is discontinued.

Another object of this invention is to provide an oscillatory open end head having a one-way engaging drive operable to drivingly engage an object when the head is swung in one direction and release the object when swung in the opposite direction and also having an open end which is unobstructed in an open position and an oscillatory drive having a rotary input and a spring biased cam drive for connecting the rotary input to the head and maintaining the head in the open position when there is no power input and converting rotary input movement into oscillatory movement of the head upon power input and biasing the head to the open position when power input is discontinued.

These and other objects of the invention will be more apparent from the following description and drawing in which:

FIGURE 1 is a longitudinal view with parts in section of the power wrench of the present invention.

FIGURE 2 is a view taken on the line 2—2 in FIGURE 1.

FIGURE 3 is a view taken on the line 3—3 in FIGURE 1.

FIGURE 4 is an enlarged view of the wrench head shown in FIGURE 1 with additional parts being shown in section.

FIGURE 5 is a partial perspective view of the wrench head showing a typical application of the tool.

In the illustrated embodiment of the present invention and referring to FIGURE 1, the power wrench generally comprises a power unit 10 drive connected by an oscillator drive assembly 12 to a head assembly 14. The complete wrench assembly which is compactly arranged about a common central longitudinal axis, is of the open end type.

The power unit 10 includes a casing 16 housing suitable power means such as a hydraulic, electric or pneumatic motor which is operable by a manual control 17 to selectively rotate a wrench input member or spindle 18 and also permits the spindle to be rotated by the oscillator drive when the power is turned off as described in detail later. The spindle is rotatably mounted in the casing on a sleeve bearing 19 and a thrust ball bearing 20 and is provided at its outer end with a barrrel cam 22 having a single lobe 24.

The oscillatory drive assembly 12 and head assembly 14 are detachably secured to the power unit by having their common frame 26 internally threaded and screwed upon a threaded flange integral with the power unit casing 16. The frame 26 has a circular chamber 28 adjacent the power unit accommodating the cam 22 and also has an elongated, flat portion or arm 30 for supporting the head assembly 14 and also the reciprocating linkage drive connecting the cam to the head. The linkage, as best shown in FIGURES 1, 2 and 3, comprises a rod 32 and a rod 34 which are received and guided by channels provided by the opposite edges of arm 30 and a pair of side plates 36 and 38 which are secured to the opposite sides of arm 30 by a pair of bolts 40 and 42. A pair of cantilevered spring members 44 and 46 are secured at their bases to the frame 26 by pairs of screws 48 and 50, respectively, and have their respective finger tips 52 and 54 slidably engaged by the rods 32 and 34.

One end of rod 34 is provided with a yoke 56 which is received and guided in an elongated slot 58 provided in frame 26. Coaxial apertures in the yoke arms receive a pin 60 which rotatably supports a cam follower or roller 62 mounted between the yoke arms and having a rolling surface engageable with the cam surface of cam 22. One end of pin 60 extends past the outer side of the inner yoke arm, and a coil spring 64, which is received in a blind bore 66 at the center of the frame, acts through a plunger 68 which bears against the pin 60 so that the roller 62 is maintained in contact with cam 22. An elongated slot 69 in the frame receives the pin extension upon sufficient leftward pin movement.

The rods 32 and 34 are linked by a pivotal lever 70 which is received in a side recess 71 in arm 30 and centrally pivoted on the shank of bolt 42. Lever 70 has one rounded end 72 received in a side recess 74 in rod 34 and the other rounded end 76 received in a side recess 78 in the rod 32 as shown in FIGURES 1, 2 and 3.

Upon rotation of the spindle 18, the roller 62 is caused to follow the contour of cam 22 thereby causing reciprocal movement of both rod 32 and rod 34. The reciprocal motion of the rods is 180° out-of-phase with rod 34 being pushed to the left and the swinging link 70 pulling rod 32 to the right as roller 62 rides up the cam surface towards the apex of lobe 24 whereafter the spring 64 maintains contact of the roller 62 with the cam surface so that it rides down the other side of the lobe under the biasing action of the spring to pull rod 34 to the right and push rod 32 to the left. Thus, the rotary input has thus far been converted by the oscillator drive into reciprocating movement of the rods 32 and 34 which movement will occur regardless of the power input drive direction of power unit 10.

The head assembly 14, as best shown in FIGURES 1, 2, 4 and 5, comprises a cylindrical head plate 80 provided with a circular aperture 82 having an arcuate opening 84 at the forward portion of the head plate. A series of contiguous and intersecting grooves 86 and 88 of equal diameter but having offset and parallel axes are equally spaced about the inner peripheral surface of head plate 80. The grooves 86 and the deeper and intersecting grooves 88 provide a series of cam surfaces for receiving pawls provided by rollers 90. Rollers 90 have a diameter equal to that of the grooves 86 and 88 so that the roller surfaces are capable of full groove contact with the groove surface of either the grooves 86 or 88. The grooves 86 and 88 are arranged so that when the rollers are disposed in the deep grooves 88 they do not protrude substantially into the aperture 82 enabling the head to turn freely about objects such as a hex nut tube fitting 91. When the rollers are disposed in the shallow grooves 86, a substantial portion of each roller extends into the aperture to provide a gripping action to turn the nut.

The rollers 90 are supported by arcuate side plates 92 and 94 which do not obstruct the head plate openings 82 and 84 and are secured to the opposite sides of the head plate by rivets 95. Each side plate has a series of apertures 96 receiving pins 98 extending from the opposite ends of the rollers. Each roller 90 is normally urged to a maximum extended position by an elongated coil spring 102 disposed radially outward of each roller in a slot 104 in head plate 80, the spring's hook ends being connected by pins 106 to the head plate at opposite sides of head opening 84.

The apertures 96 in the side plates are larger in diameter than the roller pins 98 and overlie the intersections of the grooves 86 and 88 so that swinging movement of the rollers occurs with the rollers rolling over the intersection of the adjacent groove walls. The rollers are thereby always in contact with a wall of one or the other of the grooves, the engagement of the roller pins 98 with the side walls of the apertures 96 merely serving to guide the rollers in their swinging movements, to limit their radially inward displacement by the spring 102 and to keep the rollers always in contact with the side walls of one of the grooves 86 or 88. The pins 98 do not bear the work loads of the rollers, the work load being directly transmitted to the walls of the grooves 86.

The side plates 92 and 94 have a reduced diameter at their outer sides as best shown in FIGURE 5 to provide collars or shoulders which are received in coaxial apertures 108 and 110 provided in the frame side plates 36 and 38 respectively whereby the head assembly is capable of oscillatory movement about its axis 111. Apertures 108 and 110 are contiguous with arcuate openings 112 and 114, respectively, through the forward ends of the frame side plates 36 and 38, respectively, which openings permit entry to the head opening 84.

Lugs 116 and 118 provided on the arcuate ends of rods 32 and 34, respectively, are respectively received in accommodating recesses 120 and 122 provided in the head plate 80, the recesses and thus the lug locations being diametrically opposed, i.e., 180° apart. The spring members 44 and 46 respectively hold the lugs 116 and 118 continuously engaged with the head. Thus, reciprocating movement of the rods 32 and 34 is effective to oscillate the head assembly. During oscillating head movement, the rods 32 and 34 swing through a small arc because of their lug connection with the head which swinging movement is permitted by the flexible spring members 44 and 46 respectively.

The spring force of spring 64 and the slope of the cam surface of cam 22 is determined so that when there is no power input from power unit 10, the spring biased cam follower cooperates with the cam to normally hold the cam in the zero cam lift position shown in FIGURE 1 so that the rods 32 and 34 assume the full line positions shown in FIGURES 1 and 4. In the full line position, the head assembly is positioned in what is hereinafter described as the normal open position with the head opening 84 aligned with the frame side plate openings 112 and 114 to permit entry to and exit from the head aperture 82.

As illustrated in FIGURE 5, the open end of the power wrench permits the wrench to be slipped over a tube 124 whereafter the wrench is moved axially along the tube to position the head assembly on the hex nut tube fitting 91 which is desired to be threaded into the fitting 126. The operator then operates the power unit 10 by the control 17 to rotate the spindle 18, which rotational direction

may be in either direction. The reciprocating rods and cam drive convert the rotary input of the power unit into oscillating movement of the head assembly.

Upon clockwise swinging movement of the head assembly as viewed in FIGURE 4, the nut engages the adjacent extending rollers **90** to initially displace the contacted rollers to their seated position in the shallow grooves **86**. Further roller displacement is thereafter prevented so that the continuing clockwise swinging movement of the head assembly causes the immovable rollers to drivingly engage and effect rotational movement of the nut in the same direction. The head assembly's clockwise movement terminates at the dash line position shown in FIGURE 4 which occurs when the cam apex contacts the follower whereafter the head assembly is swung in the opposite or counterclockwise direction by the spring action. Swinging movement of the head assembly in the counterclockwise direction on the remaining half of the cycle initially causes the rollers, when contacted by the nut edges, to be displaced in the direction towards the deep grooves **88** so that the rollers are sufficiently withdrawn from the head aperture to enable the nut to remain stationary within the head aperture while the head assembly continues to swing counterclockwise.

Thus, the complete cycle is composed of an unyielding force transmitting drive to the head assembly in one direction for turning the nut and a biasing force to turn the head assembly in the opposite direction while the nut remains stationary, the head assembly cycling until the nut is tightened. The power unit **10** is preferably of the type which stalls after the threaded element has been set with a predetermined torque.

Since the head operates in a relatively small arc dependent on the pawl spacing which increases with increasing nut head size and may be in the 30° to 60° range, for example, as compare with a full 360° rotating pattern, there is a considerably greater chance that the head opening **84** will stop in an unobstructed or the normal open position when the nut has been tightened to permit wrench removal from the tubing. If the head does stop tightening in a closed or obstructed position, it is returned automatically to its normally open position by the return action provided by the predetermined spring biased cooperation of the cam follower and cam, i.e., the spring **64** biasing the roller **62** against the cam **22** urges the spindle **18** to rotate and seek the zero cam lift position shown in FIGURE 1. Thus, the wrench has a much reduced possibility of completing the tightening cycle in a closed position because of both of the aforementioned factors and does not require an operator indexing operation to enable removal of the wrench from the tubing. Furthermore, the oscillator drive is a simple construction having low maintenance requirements since the ratcheting action occurs in the head assembly.

Similar wrench operation to loosen the nut is provided by turning the wrench 180° in either direction about its longitudinal axis. The deep grooves **88** are then disposed counterclockwise of their adjacent shallow grooves **86** so that the nut is turned in the counterclockwise direction in response to oscillating head movement.

The above described preferred embodiment is illustrative of the invention which may be modified within the scope of the appended claims.

I claim:

1. In a wrench assembly the combination of support means having a side opening only substantially as wide as an object to be turned and rotary bearing means only interrupted by said side opening; an opened end wrench head mounted in said bearing means on said support means for oscillatory movement; said wrench head having a side opening only substantially as wide as the object to be turned to receive the object, a bearing surface only interrupted by said side opening in said wrench head and one-way engaging means for engaging the object to be turned when said wrench head is turned in one direction and releasing the object when said wrench head is turned in the opposite direction; said side opening of said wrench head being substantially aligned with said side opening of said support means for unobstructed reception of the object to be turned into the side opening of said wrench head when said wrench head is in an open position at one end of said oscillatory movement and being aligned with said side opening of said support means when said wrench head is in a relatively large range of obstructed positions and a final obstructed position at the other end of said oscillatory movement; and drive means including a rod mounted on said support means for reciprocal movement, pivot means connecting one end portion of said rod to a substantially fixed point on said wrench head for providing a drive connection to oscillate said wrench head between said open and final obstructed position when said rod is reciprocated, a rotary input having cam means, said rod having a cam follower engaging said cam means, spring means operatively biased between said support means and said cam follower for holding said cam follower in engagement with said cam means, said cam means reciprocating said rod to oscillate said wrench head between the open and final obstructed position when said input member is rotating in response to a rotary input, said spring means providing a spring force and said cam means having a profile cooperatively providing for rotating said input member to operate said rod to turn said wrench head with sufficient force to disengage said one-way engaging means and to move said wrench head from any of said obstructed positions to said open position upon freeing said input member on discontinuance of rotary input to said input member.

2. In a wrench assembly the combination of support means having a side opening substantially as wide as an object to be turned and rotary bearing means only interrupted by said side opening; an open end wrench head mounted in said bearing means on said support means for oscillatory movement; said wrench head having a side opening only substantially as wide as the object to be turned to receive the object, a bearing surface only interrupted by said side opening in said wrench head and one-way engaging means for engaging the object to be turned when said wrench head is turned in one direction and releasing the object when said wrench head is turned in the opposite direction; said side opening of said wrench head being substantially aligned with said side opening of said support means for unobstructed reception of the object to be turned into the side opening of said wrench head when said wrench head is in an open position at one end of said oscillatory movement and being unaligned with said side opening of said support means when said wrench head is in a range of obstructed positions and a final obstructed position at the other end of said oscillatory movement; and drive means including a pair of rods mounted on said support means for reciprocal movement, recesses on opposite sides of said wrench head, one end of each said rod having a lug pivotally received in a recess in said wrench head for providing a drive connection, springs for holding said rods to position said lugs in said recesses during rod reciprocation to oscillate said wrench head, a lever mounted on said support means for pivotal movement and engaging said rods on opposite sides of said lever's fulcrum whereby both said rods are reciprocated in opposite phase relation and oscillate said wrench head between said open and final obstructed position when one of said rods is reciprocated, a rotary input member having cam means, said one rod having a cam follower engaging said cam means, spring means operatively biased between said support means and said cam follower for holding said cam follower in engagement with said cam means, said cam means reciprocating said one rod to oscillate said wrench head between the open and final obstructed position when said input member is

rotating in response to a rotary input, said spring means providing a force and said cam means having a profile cooperatively providing for rotating said input member to operate said one rod to turn said wrench head with sufficient force to disengage said one-way engaging means and to move said wrench head from any of said obstructed positions to said open position upon freeing said input member on discontinuance of rotary input to said input member.

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