

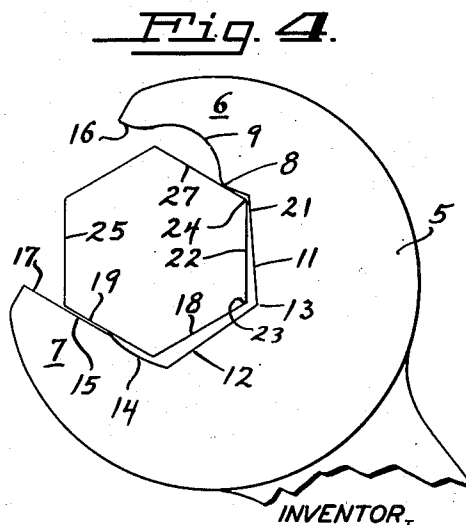
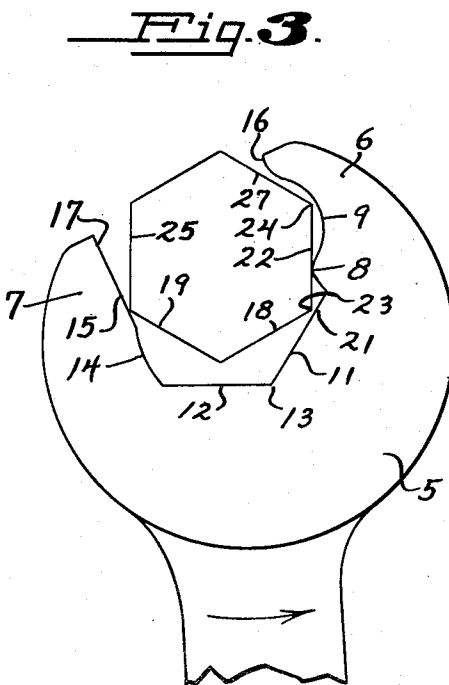
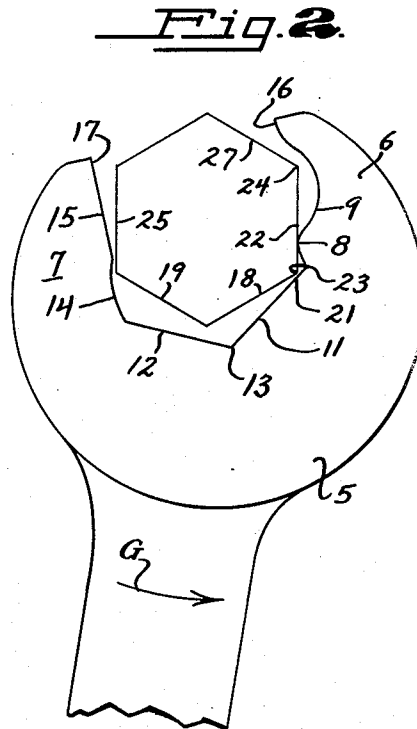
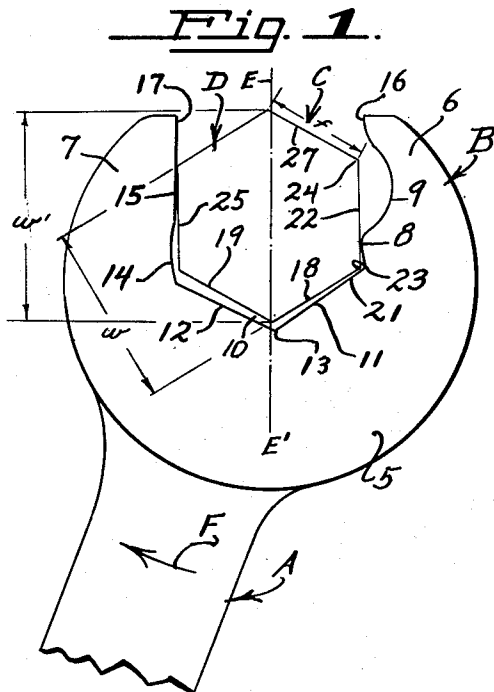
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G. W. WILDER

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OPEN-END WRENCH

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INVENTOR,
GLENN W. WILDER.
BY

Stephen P. ...
ATTORNEY.

UNITED STATES PATENT OFFICE

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OPEN-END WRENCH

Glenn W. Wilder, Sutherlin, Oreg.

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3 Claims. (Cl. 81-119)

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This invention relates to an improved open-end type wrench. This application is a continuation in part of my copending application, Ser. No. 8,561 filed February 16, 1948, now abandoned.

The particular embodiment of my invention which is illustrated in the drawings and which will be more fully described hereinafter in greater detail comprises, generally, a wrench having a handle to which is attached a head portion provided with a nut-receiving recess therein of sufficient size to accommodate a hexagonal nut or screw head of known diameter. The parts of the head which define the nut-receiving recess are arranged and constructed so as to permit the wrench to be turned about said nut in a ratchet-like manner, in order that the wrench need not be removed from work association with the nut each time that a new work stroke is instituted.

The principal object of the present invention is to provide an open-end type wrench designed and constructed so as to permit the wrench to be turned about the nut in a ratchet-like manner to thereby eliminate the necessity of removing the wrench from a nut and re-applying it in a different position with respect thereto each time a turn or partial turn of the wrench is effected. A distinct advantage of such an arrangement of parts is that when the work must be accomplished in rather confined or inaccessible quarters where complete revolutions of the wrench cannot be effected, it is not necessary to have to continuously remove and re-apply the wrench to the nut after completion of each working stroke of the wrench. It is to be understood, however, that no moving parts or true ratchet mechanism is employed or incorporated within the present invention—the above described ratchet-like movement of the wrench being made attainable solely through the novel construction and design of the portions of the head which define the nut-receiving recess therein.

Another object of the present invention is to provide an open-end type wrench of the character above mentioned which incorporates certain novel features of construction to insure positive gripping engagement between the wrench and nut, whereby there is eliminated any practical possibility or likelihood that a user will suffer injury or harm caused by virtue of the wrench slipping off the nut during nut tightening or loosening operations.

Another object of the present invention is to provide an open-end type wrench of the character above indicated which is relatively simple

and inexpensive to manufacture and which is of exceedingly rugged construction.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

Fig. 1 is a plan view of the head portion of the wrench showing it in operative work association with a hexagonal nut during a working stroke of the wrench and showing portions of the handle part of the wrench partly broken away.

Fig. 2 is the same as Fig. 1 but shows the relation of the wrench and nut with respect to one another at the beginning of a ratcheting or return stroke of the wrench.

Fig. 3 illustrates the relative positions between the nut and the wrench at approximately the midway point during a ratcheting or return stroke of the wrench.

Fig. 4 illustrates the relative positions between the nut and the wrench after completion of a ratcheting or return stroke of the wrench.

Referring now more particularly to the drawings, the present wrench comprises, generally, a handle portion A, a head portion B preferably formed integral with handle portion A, and provided with a nut-receiving recess, indicated generally at C to accommodate a hexagonal nut or screw D. In view of the fact that a wrench constructed according to the present invention is not provided with any adjustably movable parts to accommodate nuts or screws of varying diameters, it is readily understood that the nut-receiving recess C of each wrench must necessarily be specifically designed and constructed to accommodate a nut of predetermined nominal diameter. In actual practice I prefer to construct each wrench so that it can satisfactorily accommodate a nut which may be slightly oversize to the extent of (+).002 of an inch over nominal diameter, or undersize to the extent of (—).014 of an inch under nominal diameter.

For purpose of reference, the hexagonal head of the nut or bolt with which the wrench may be used, has a width between parallel sides designated by the symbol w , a length across corners designated by the symbol w' , and the width of a side designated by the symbol f .

Head portion B of the wrench comprises more specifically a body portion 5 and a pair of opposed jaws 6 and 7. Occasionally hereinafter

jaw 6 will be referred to as the short jaw or following jaw, and jaw 7 will be referred to as the long jaw or leading jaw.

Defining a portion of nut-receiving recess C and projecting inwardly from short jaw 6 as an integral part thereof and at a distance greater than f is a pressure pad or lug 8, and formed forwardly of pressure pad 8 in jaw 6 is an arcuate notch 9 which also defines a part of said recess C.

The rearward portion of the recess is illustrated as being defined by a pair of V-shaped walls or side surfaces 11 and 12 which converge at a point or apex, indicated at 13. Formed in jaw 7 and located forwardly of side surface 12 and defining a part of recess C is a second arcuate notch 14 having a radius of curvature substantially greater than the radius of curvature of notch 9. The forward portion of jaw 7 comprises a substantially flat elongated surface 15 having a length substantially less than f , and which, as will hereinafter appear, serves as a bearing pad or surface to engage a facet of nut D opposite the facet engaged by bearing pad 8. The bearing pad 8 forms part of a reverse curve, and is located at a distance less than $\frac{1}{2} f$ from the outer end of side wall 11, the latter wall and an inner end of the reverse curve forming an angle substantially less than 120° .

Points 16 and 17 in the drawings indicate roughly the forwardmost portions of jaws 6 and 7, respectively. The distance between these two points on the wrench should be slightly greater than the nominal diameter w of a circle tangent to all sides of the hexagonal head of the nut D, and preferably the distance separating the points should be sufficient to permit passage therebetween of a nut which is $+.002$ of an inch over said nominal diameter.

Line E—E' appearing in Fig. 1 in the drawings represents a convenient reference line which is disposed medially of points 16 and 17 and extends parallel to the bearing axis of surface 15. It is noted that apex 13, representing the point of juncture between side surfaces 11 and 12, is laterally offset in the direction of jaw 6 with respect to said reference line. The reason for this peculiar arrangement of parts will be more fully explained hereinafter.

In operation, the wrench may be applied to a hexagonal nut or screw substantially in the manner as indicated in Fig. 1 wherein it is seen that the nut assumes a position well disposed within the nut-receiving recess C. An important feature of the present wrench construction is that the rearward portion of recess C comprising V-shaped side surfaces 11 and 12 is constructed in such manner that a space or clearance, such as indicated at 19, is established between the parts of the wrench defining the rearward portion of recess C and the nut. In actual practice only a relatively small portion of the entire area comprising side surface 11 contacts or touches facet 18 of the nut D, and this point of contact between side surface 11 and facet 18 is indicated as being located approximately at point 21. Although Fig. 1 is exaggerated in that there is illustrated a very slight clearance between said point and facet 18, such exaggeration is believed to better emphasize the fact that even though the facet and point are normally brought into touching engagement with one another when the wrench is applied to the nut that, nevertheless, said contact point 21 is not intended to be nor in

actual practice does it in any way serve or function as a pressure point on the wrench through which working leverage is imparted to the nut. In short, point 21 serves only as a guide means to facilitate positioning of the wrench with respect to the nut, whereby pressure pad 8 will bear against facet 22 of the nut at a point removed from the nut corners 23 and 24 which define said facet 22.

As has been heretofore indicated, the present wrench is designed to permit both a working stroke (which occurs when handle A is moved or turned in the direction of arrow F) and a return stroke (which occurs when handle A is moved in the direction of arrow G) whereby the wrench may be turned about the nut in ratchet-like manner without imparting movement to the nut. During a working stroke of the wrench turning leverage is imparted to the nut through pressure pads 8 and 15 which securely grip oppositely disposed nut facets 22 and 25, respectively. In view of the fact that pressure pad 8 is designed so as to engage facet 22 at a point thereon removed from either of the nut corners 23 or 24, it is readily understood that very considerable turning pressure may be exerted on the wrench without the danger or possibility of the pressure pad 8 shearing off or slipping off of corner 23.

After a working or turning stroke has been completed in the direction of arrow F and it is desired to establish another grip on the nut without having to remove the wrench and re-apply it to the nut the handle of the wrench may be moved in the direction of its return stroke G. As has already been indicated, I have chosen to describe the movement of the wrench during its return stroke as a ratchet-like movement, although it is understood that no moving parts or true ratchet mechanism is incorporated within the present invention. The return stroke of the wrench around the nut actually involves both a rotational movement of the head around the nut and a sliding movement of pressure pad 8 around a facet of the nut.

Fig. 2 shows the relative position of the wrench with respect to nut D at the beginning of the return stroke of the wrench around the nut and shows how normally pressure pad 8 serves as the principal point about which the wrench rotates during the initial stages of said stroke. Fig. 3 indicates the relationship of wrench to nut after further rotation of the wrench around the nut has been effected and shows how pressure pad 8 has started to move slidably upwardly along facet 22 from its original point of gripping or working engagement with said facet. Figs. 2 and 3 also illustrate how notches 9 and 14 establish sufficient clearance to permit the wrench to be turned about the corners of the nut during the return stroke. Because arcuate notch 14 is located further away than arcuate notch 9 from pressure pad 8 which represents the principal point about which the wrench rotates, the radius of curvature of arcuate notch 14 may be considerably larger than the radius of curvature of arcuate notch 9.

Fig. 4 illustrates the relative positions between wrench and nut after completion of a return stroke, and a second working stroke may then be initiated by urging the wrench in a direction towards the nut whereby point 21 of side surface 11 is brought into contact with facet 22 to guide automatically pressure pads 8 and 15 into proper gripping positions with respect to facets 27 and 19, respectively.

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One further point should be made clear with respect to the operation of the wrench during a return stroke, to wit: portions 16 and 17 of the jaws, in cooperation with arcuate notch 9, function as retaining fingers to prevent removal of the wrench from the nut in a direction axially of the wrench handle during a return stroke. For example, it is readily seen that it would be extremely difficult if not impossible to remove the wrench from the nut merely by withdrawing it in the direction of its handle when the wrench has been turned about the nut to either of its positions such as indicated in Fig. 2 or Fig. 3. It is believed obvious that the portion of jaw 6 adjacent point 16 would adequately prevent such withdrawal until the wrench has been turned almost completely around to a position substantially like that illustrated in Fig. 4.

As has been pointed out above, side surfaces 11 and 12 do not touch or engage the nut during a working stroke except at the point of contact 21, which serves only as a guide means to aid in operatively positioning the wrench with respect to the nut. By establishing clearance between the greater part of side surfaces 11 and 12 of the wrench and adjacent facets 18 and 19 of the nut, there is no practical possibility that a point of contact between wrench and nut will be established whereat the wrench could pivot about such point with resultant ill-effect that pressure pad 8 would be pulled or pried around corner 23.

It should be further noted that by forming side surfaces 11 and 12 in such manner that apex 13 is offset laterally with respect to reference line E-E', that even when the wrench is used in work association with slightly undersized nuts, that clearance 10 between the nut and side surfaces may be maintained. Furthermore, the theoretically structurally weakest points on the wrench, and, therefore, the points most subject to breakage are located approximately adjacent apex 13 and at the base of jaw 7 where arcuate notch 14 and side surface 12 join. Because of this fact it is highly desirable to keep the clearances between nut and wrench in the vicinity of these weak points as small as possible in order to avoid the possible weakening effect occasioned by the removal or cutting away of too much structural material adjacent said points. It is readily seen that the preferred construction shown in the drawings, (comprising V-shaped side surfaces 11 and 12 and arcuate notch 14 having a relatively large radius of curvature), permits accomplishment of the above objects—i. e., very little structural material is cut away or removed adjacent the theoretically weak points on the wrench.

It has already been explained in some detail that contact point 21 located along side surface 11 serves only as a guide means to guide the wrench into operative position with respect to the nut. Although I have found that this particular and preferred arrangement of parts is extremely satisfactory and desirable in that only relatively small clearances between the side surfaces and the nut can be established to thereby insure maximum structural reinforcement around the parts of the wrench most subject to breakage, it is nevertheless believed self-evident that the rearward part of the recess may be formed in a variety of different ways without basically affecting the practical utility and operativeness of the wrench. So long as some sort of a guide or stop means functionally similar or comparable to contact point 21 is provided

in the rearward part of recess C to abut against the nut and thereby guide the wrench to operative position with respect to the nut, the method and manner of operation of the present wrench would be substantially the same as hereinabove described.

Although I have illustrated and described the working stroke of the wrench as constituting a clockwise movement (which is the normal direction of movement to tighten a conventional right-handed screw or nut), it will be readily understood that the wrench need only be turned over so that the relative positions of the leading and following jaws are reversed in order to establish the working stroke as a counter-clockwise movement and to thereby permit use of the wrench to forcefully loosen as well as tighten a conventionally threaded nut, and to make the wrench equally adaptable for use either on right or left handed screws or nuts.

Although I have described my invention in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be practiced within the spirit of the invention which is limited only by the scope of the appended claims. It is understood that the use of the term "nut" in the description and claims applies, and is intended to cover, nuts or bolt heads or other objects having a hexagonal wrench engaging portion.

I claim:

1. An open-end wrench for use with hexagonal-headed threaded members, the width of the hexagonal heads of said members between parallel sides being designated by the symbol w , the width across corners by the symbol w' , and the length of each side by the symbol f , said wrench being bifurcated to form a recessed portion at one end having a long jaw and a short jaw, the depth of bifurcation being substantially equal to w' , the distance between the outer extremities of said long jaw and said short jaw being slightly greater than w , said wrench having a configuration in plan such that commencing at the point of innermost depth of bifurcation, said recessed portion extends in a first surface toward the long jaw side of said point for a distance slightly greater than f , thence outwardly along a second surface at an angle of approximately 120° with respect to said first surface to said outer extremity of said long jaw, said second surface being arcuately inwardly cut away adjacent the corner juncture thereof with said first surface, said recessed portion also having a third surface extending from said innermost point of bifurcation toward the short jaw side of said wrench at an angle of approximately 120° with respect to said first surface for a distance substantially equal to f , said recessed portion further having a reverse curve fourth surface extending from said third surface outwardly to said extremity of said short jaw, said fourth surface extending at an angle of substantially less than 120° with respect to said third surface for a distance less than $\frac{1}{2} f$ to a fulcrum and thence arcuately outwardly to said outer extremity of said short jaw to provide clearance for a corner of said hexagonal head without removal of said head from between said jaws when said wrench is manually indexed in order to shift said fulcrum into contact with the next side of said head.

2. A wrench according to claim 1 wherein said second surface terminates in a flat gripping area adjacent the outer extremity of said long jaw

and wherein said point of innermost depth of bifurcation is disposed toward the short jaw side of a reference line drawn parallel to said flat area of said long jaw and disposed midway between the closest points of said extremities of said short and long jaws.

3. An open-end wrench for use with hexagonal-headed threaded members, the width of the hexagonal heads of said members between parallel sides being designated by the symbol w , the width across corners by the symbol w' , and the length of each side by the symbol f , said wrench being bifurcated to form a recessed portion at one end having a long jaw and a short jaw, the depth of bifurcation being substantially equal to w' , the distance between the outer extremities of said long jaw and said short jaw being slightly greater than w , said wrench having an abutment limiting effective inward movement of said head within said bifurcation to a distance substantially equal to w' , said long jaw adjacent its outer extremity having a side-engaging flat pad, substantially parallel to a first side of said head when said head is in contact with said abutment, extending inward from said extremity a distance substantially less than f , said short jaw having an arcuate fulcrum adjacent its inner end engaging a second side of said head opposite said first side, said fulcrum being positioned so that when said head abuts said abutment said fulcrum contacts said second side outwardly from the inner corner thereof a distance less than $\frac{1}{2}f$, the distance between said flat pad and a ref-

erence line drawn tangent to said fulcrum and parallel to said flat pad being slightly greater than w , said short jaw, extending outwardly beyond said fulcrum a distance greater than f , being arcuately inwardly recessed beyond said fulcrum to provide clearance for a corner of said hexagonal head without removal of said head from between said jaws when said wrench is manually indexed in order to shift said fulcrum into contact with the next side of said head, said long jaw being arcuately recessed inwardly of said pad to provide clearance for an adjacent corner of said head when said wrench is manually indexed.

GLENN W. WILDER.

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