ABSTRACT

Improvements in open end wrenches, and particularly the classes of wrench adapted for turning hexagonal head nuts, wherein the wrench jaw or seizing opening may be adapted with a plurality of metallic inserts of prescribed dimension which serve to adapt the wrench for operation in tightening or loosening any of a plurality of standardized nut sizes. The improvements further consist of handle and fixture accessories for enabling open end wrench operation, more particularly ratchet-type speed wrench operation utilizing ratchet-type open end wrenches with and without size adapter inserts being utilized therewith.

11 Claims, 11 Drawing Figures
1  RATCHET-TYPE SPEED WRENCH

CROSS REFERENCE TO RELATED APPLICATIONS

The present invention is related to the subject matter of U.S. Pat. application Ser. No. 157,113 filed on June 28, 1971 in the name of James P. Evans and entitled "Improvements in Speed Wrenches," and the invention is also related to the subject matter of U.S. Pat. application Ser. No. 181,173 filed on Sept. 16, 1971 in the name of James P. Evans and William R. Avev, Jr. and entitled "Ratchet-Type Speed Wrench."

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to open end wrenches for hex nut operation and, more particularly, but not by way of limitation, it relates to improvements in open end wrenches as well as socket type wrenches capable of retaining within the jaw opening a plurality of inserts which serve to adapt the wrench size for one of a plurality of nut sizes.

2. Description of the Prior Art

As is well known, the prior art includes a great many types and sizes of wrench design which serve to turn nuts of various configuration and sizes. In addition, the many wrench types have been adapted to include several different forms of adjustable features wherein a single wrench instrument can be adapted to fit a plurality of nut sizes. A well-known example of adjustable wrenches is the adjustable open end wrench which utilizes a screw driven lower jaw structure to adapt the wrench jaw opening to whatever the turning operation at hand.

SUMMARY OF THE INVENTION

The present invention provides improvements in wrenches relating to nut size adaptation and accessory features for enabling optimum usage of a wrench. In a more limited aspect, the invention consists of the utilization of a plurality of uniquely configured wrench size adaptor inserts such that one or more nested adaptor inserts may be inserted within the wrench jaw opening to perform wrench turning of a selected size nut; and further, the invention relates to wrench moving fixtures for imparting wrenching force to the tool, particularly the form of open end wrench known as the ratchet-type speed wrench of unitary formation having the capability of clockwise as well as counterclockwise movement without necessity for removal of the wrench from its operative position.

Therefore, it is an object of the present invention to provide a ratchet-type wrench having no moving parts, except for one or more jaw opening inserts, which is effective to grip and turn any of a plurality of hexagonal head nut sizes.

It is also an object of the invention to provide an open end wrench having selectively enabled jaw opening for selected nut sizes which jaw opening will not vary with use or vibration.

It is yet another object of the present invention to provide apparatus for loosening or tightening one of a selected plurality of nut sizes while utilizing but a single wrench/handle element and a plurality of jaw opening adaptor inserts.

Finally, it is an object of the invention to provide wrench and fixture elements which enable either tightening or loosening movement in hidden and hardly accessible locations, and which may be used with any of a plurality of standardized nut sizes.

Other objects and advantages will be evident from the following detailed description when read in conjunction with the accompanying drawing which illustrates the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side view of a wrench constructed in accordance with the present invention;

FIG. 2 is a fragmentary side view with exploded component of a wrench constructed in accordance with the present invention;

FIG. 3 is a fragmentary side view of an alternative form of the invention;

FIG. 4 is a fragmentary side view of still another form of the invention;

FIG. 5 is a fragmentary side view of yet another form of the invention;

FIG. 6 illustrates an accessory fixture as utilized with the present invention;

FIG. 7 is a side view of a portion of the fixture illustrated in FIG. 6;

FIG. 8 is a plan view of the accessory fixture as used with an alternative form of ratchet-type open end wrench;

FIG. 9 is a plan view of the accessory fixture as utilized with yet another form of ratchet-type open end wrench;

FIG. 10 is a plan view of the accessory fixture as utilized with a ratcheting type wrench as shown in FIG. 1; and

FIG. 11 illustrates alternative forms as may be employed in interconnecting a wrench and accessory fixture.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, a wrench 10 of the ratcheting open end type consists of a handle portion or elongated shaft 12 which is formed to carry at the end a generally circularly shaped flat portion or wrench end 14. In accordance with conventional wrench forming practice, suitable wrench heads may be disposed on each end of the elongated shaft 12. The wrench head 14 may include polished, flat side surfaces 16 (as disposed on each side of wrench head 14), and it is further formed with a seizing jaw 18.

The seizing jaw 18 is formed by an upper jaw portion 20 and a lower jaw portion 22, each of which have their contacting surfaces generally aligned along the parallel inner sides of upper jaw portion 20 and lower jaw portion 22. An inner jaw portion 24 contiguous between the interior portions of upper and lower jaw portions 20 and 22 is then formed by particular further critical shaping, as will be further discussed below.

The wrench head 10 is a variation of what is known as the ratchet-type open end wrench as described in the previously disclosed related patent applications. However, in the present instance the seizing jaw 18 is adapted to receive an insertable jaw spacer or adaptor insert 26 which serves to adapt seizing jaw 18 for the particular hexagonal head nut 28, rotational about the axial point indicated by vertical center line 30 and horizontal center line 32.
While the inner surfaces of seizing jaw 18 of wrench head 14 would be adapted for similar seizure of a hex head nut of the next larger size, the structural description is set forth hereafter with respect to adaptor insert 26 to simplify matters. It should be understood that the relationships of seizing jaw 18 to the next larger size nut are the same as they are depicted in FIG. 1 for adaptor insert 26 and any number of additional adaptors such as are depicted in FIG. 2, to be further described below.

Seizing jaw 18, including adaptor insert 26, is formed to include a first arcuate recess 34 as formed in upper jaw portion 20 and terminating at a first contacting point 36 in abutment with the upper side of hex head nut 28. Adjacent contacting point 36 there extends an angular recess 38 which extends down to a contacting surface 40 in contact with the upper diagonal side of hex head nut 28. Contacting surface 40 then extends into a second arcuate recess 42, of small radius relative to the first arcuate recess 34, which is aligned generally with horizontal center line 32. Arcuate recess 42 then extends downward to form second contacting surface 44 in contact with a portion of the lower diagonal side of hex head nut 28 which, in turn, extends into arcuate recess 46, also of small radius and similar to that of arcuate recess 42. The arcuate recess 46 then continues and extends into lower contacting surface 48 which is parallel to and in contact with the lower side of hexagonal head nut 28.

As can be noted from FIG. 1, the adaptor insert 26 is formed of generally similar shape to that of the inner surfaces of jaw opening 18 of wrench head 14 to present the same effective gripping or contacting surfaces and points relative to the respective sides of the hex head nut. The adaptor insert 26 may be formed from hard metal or alloy having good spring characteristics so that it may be easily inserted in jaw opening 18 and securely maintained therein through a nut tightening or loosening operation. Also, the upper jaw portion 20 may include a longitudinal center groove 50 serving to receive a mating ridge formed on the upper surface of adaptor insert 26. Similarly, the lower extension of adaptor element 26, that portion forming contacting surface 48, may include a ridge formed longitudinally thereunder while lower jaw portion 22 includes a mating longitudinal groove, as shown by dash line 52.

The operation of wrench 10 is similar to that of the ratchet-type wrenches as disclosed in the previously cited patent application. Thus, in the position as shown in FIG. 1, a tightening operation requiring clockwise movement of handle 12 results in contacting point 36, contacting surface 40, contacting surface 44 and contacting surface 48 bearing upon the respective adjacent sides of hexagonal head nut 28 to exert turning force through a portion or all of a rotational movement, depending upon operational space available. When space is limited, handle 12 can be moved in the counterclockwise position to gain a new power stroke grip. During counterclockwise movement, the wrench head 14 is capable of moving about hexagonal head nut 28 with little or hardly appreciable radial movement relative to the turning axis of hexagonal head nut 28 due to the fact that the arcuate recesses 34, 42 and 46 will allow reverse slippage of wrench head 14 until the desired new gripping or power stroke position is gained.

FIG. 2 illustrates the wrench head 10 as it is adapted to include a plurality or set of adaptor inserts 26a, 26b, 26c, 26d and 26e, each of which is of a size to provide ratchet-type contacting of respectively different sizes of hexagonal head nuts. The adaptor insert 26a is shown in exploded form to illustrate the positioning of locking grooves 50a and 52a on the upper and lower extensions 54 and 56. Although not specifically shown with respect to each of adaptor inserts 26b through 26e, the similar mating configurations would be supplied. Further, it may be desirable to include a pivot fastener 58 through the outer ends of all adaptor inserts 26a through 26e to enable operation wherein selected adaptor inserts could be swung upward, out of operational contact with the hex head nut under operation, but securely retained to avoid loss or misplacement.

FIG. 3 illustrates the usage of an adaptor insert 60 as utilized with a ratchet-type open end wrench 62 which is known as a radial type ratchet speed wrench and is the subject of separate invention in a U.S. patent application filed on even date herewith in the name of the same inventors and entitled “Ratchet-Type Speed Wrench.” The wrench 62 is another form of four point contacting open end wrench having ratcheting capability without the necessity of moving parts, i.e., gears, pawls, and the like.

FIG. 4 illustrates yet another type of ratchet opening end wrench 64 which includes one or more adaptor inserts 66 which present the appropriate nut size contacting points and/or surfaces. Wrench 64 is also the subject matter of one of the previously recited related patent applications. As shown by upper and lower dash line 68 and 70, wrench head 64 and adaptors 66 may include longitudinal groove and ridge securing affixures as are generally shown and described in FIGS. 1 and 2.

FIG. 5 illustrates the employ of a standard form of box end wrench 72 with a handle 74 and box end casing 76 having unitarily formed therein a plurality of gripping teeth 78. One or more adaptor rings 80, formed similarly and concentric with gripping teeth 78, may be inserted into the box end wrench for the purpose of reducing the diameter of the gripping surface of the wrench. Thus, as shown in FIG. 5, two insert rings 80a and 80b have been placed in box end wrench 72 to enable gripping of a selected size of nut which will fit within the gripping surface 82.

FIG. 6 illustrates an accessory fixture which is particularly applicable to ratchet-type open end wrenches due to the fact that a push-pull operation is possible. A handle accessory 90 is illustrated in pivotal connection to shaft 12 of a form of ratcheting wrench 92. The fixture 90 includes a hand grip 94 which may be pivotally affixed by suitable fastening means to a shaft 96 which, in turn, is secured to a bifurcated yoke member 98. The yoke member is shown to better advantage in FIG. 7 wherein it consists of parallel barl portions 100 and 102 rotatably receiving wrench handle 12 therewithin as secured by a pivot pin 104 or the like. The fixture 90 is particularly valuable in operations on a nut 106 as it may be hardly accessible as when located behind an obstacle 108, the advantage being due to the fact that the ratchet wrench 92 is capable of power stroke rotation in one direction and return stroke rotation in the opposite linear direction. It is merely necessary that the operator hold the fixture 90 and reciprocate the fixture endwise to effect a tightening or loosening operation on the nut 106. As shown in FIG. 6, pulling on fixture 90 will effect tightening and,
for a loosening operation, it is merely necessary to turn the wrench head 92 over to enable the opposite sequence. Wrench head 92 is also shown as including a retaining tab 110 as pivotally affixed by suitable fastener to the head of wrench 92.

FIG. 8 illustrates the extension fixture 90 as it may be utilized with a different form of ratcheting open end wrench 112, a radial type ratcheting wrench as previously discussed in connection with FIG. 3. The wrench 112 is a variation on the radial wrench in that it includes parallel surface contact points 114, 116 and 118 of minimal contacting surface operating in conjunction with a lower contact surface 120.

FIG. 9 illustrates the fixture 90 operating in conjunction with a radial-angular ratchet-type open end wrench 122. Wrench 122 is another alternative form of ratcheting open end wrench which is the subject matter of the previously disclosed related U.S. Pat. applications. In like manner, FIG. 10 illustrates use of the handle fixture 90 as it is pivotally connected for operation with ratcheting open end wrench 10 (FIG. 1) including an adaptor insert 26. Either one or a plurality of mating adaptor inserts 26 may be employed to provide the right contacting size relative to nut 106.

Still further ease of operation may be enabled with respect to certain obstacles by the configurations as illustrated in FIG. 11. Thus, a selected wrench head 130 and its handle 12 may be pivotally connected to a bifurcated element 132 which is also formed to include offset right angle bends vertical prior to affixure to shaft 96. Alternatively, the previously described bifurcated element 98 may be employed as pivotally affixed to a specially formed wrench shaft 134 which includes the offset bends. The angle and distance of offset bends may be varied in any manner to meet the exigencies of given requirements.

The foregoing discloses novel improvements in the form of accessories as particularly adaptable for ratchet-type speed wrenches of the open end variety; however, it should be understood that the various teachings are also applicable to other more standard forms of wrenches which are presently known and used. A plurality of mating adaptor inserts of standard nut sizing may be utilized with a single handle and wrench head element to enable a wide variety of operational capabilities as regards varying sizes of nuts to be encountered on the job. Further, retention of the adaptor inserts is made possible due to the unique configurations of the ratchet-type open end speed wrenches such that once an adaptor insert is placed under tension and inserted into the enclosing wrench jaw opening, it may be held in quite secure manner throughout a work operation.

It should be understood that the adaptor inserts will not necessarily be formed of precisely uniform thickness around their extent, especially as regards formation of a varying size set of such inserts. It will be necessary to vary the thicknesses at radius or bending points in order to maintain the proper operational jaw tolerances for each respective size.

Changes may be made in the combination and arrangement of elements heretofore set forth in the specification and shown in the drawings; it being understood that changes may be made in the embodiment disclosed without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. Improvements for ratchet-type speed wrenches of the open end type for use with hexagonal head nuts, which speed wrenches have an elongated shaft and a seizing jaw opening defined by upper and lower jaw portions and an inner jaw portion extending therebetween, said seizing jaw opening being formed as a non-symmetrical opening including at least two recesses departing from contact with said hexagonal head nut and extending at least four contacting surfaces into contact with portions of four adjacent sides of said hexagonal head nut when in the operative position, said improvements comprising:

   insert means of generally rectangular cross-section and generally uniform thickness while being shaped in the same non-symmetrical configuration as said seizing jaw opening such that its outer surface can be tightly received and held within said seizing jaw opening while said inner surface defines said at least two recesses and four contact surfaces for contact with a nut of selected smaller size; and

   means for enhancing the capability of said insert means to remain securely in position in said seizing jaw opening.

2. Improvements as set forth in claim 1 wherein said means for enhancing comprises:

   ridge means formed on the outside of each outer end of said insert means in generally longitudinal direction relative to said elongated shaft, said ridge means being formed for making engagement with grooves formed in the inner sides of the outer portions thereby to maintain the insert means in a locked position.

3. Improvements for ratchet-type speed wrenches as set forth in claim 1 wherein:

   said insert means is formed from selected spring metal alloy and said upper and lower end portions tend to stress upward and downward, respectively, against said upper and lower jaw portions in said seizing jaw opening.

4. Improvements in ratchet-type speed wrenches as set forth in claim 1 which are further characterized to include:

   a bifurcated member extending first and second bail projections into pivotal attachment with said elongated shaft; and

   extended shaft means secured to said bifurcated member.

5. Improvements for ratchet-type speed wrenches as set forth in claim 4 which are further characterized to include:

   handle means rotatably secured at right-angle to the end of said extended shaft means.

6. Improvements for ratchet-type speed wrenches of the open end type for use with hexagonal head nuts, which speed wrenches have an elongated shaft and a seizing jaw opening defined by upper and lower jaw portions and an inner jaw portion extending therebetween, said seizing jaw opening being formed as a non-symmetrical opening including at least three recesses departing from contact with said hexagonal head nut and extending at least four contacting surfaces into contact with portions of four adjacent sides of said hexagonal head nut when in the operative position, said improvements comprising:

   insert means of generally rectangular cross-section and generally uniform thickness while being
shaped in the same non-symmetrical configuration as said seizing jaw opening such that its outer surface can be rigidly received and held within said seizing jaw opening while said inner surface defines said at least three recesses and four contact surfaces for contact with a nut of selected smaller size; and
means for enhancing the capability of said insert means to remain securely in position in said seizing jaw opening.

7. Improvements for ratchet-type speed wrenches as set forth in claim 6 wherein said means for enhancing comprises:
ridge means formed on the outside of each outer end of said insert means in generally longitudinal direction relative to said elongated shaft, said ridge means being formed for making engagement with grooves formed in the inner side of the outer portions of said upper and lower jaw portions thereby to maintain the insert means in a locked position.

8. Improvements for ratchet-type speed wrenches as set forth in claim 6 wherein:
said insert means is formed from selected spring metal alloy and said upper and lower end portions tend to stress upward and downward, respectively, against said upper and lower jaw portions in said seizing jaw opening.

9. Improvements in ratchet-type speed wrenches as set forth in claim 6 which are further characterized to include:
a bifurcated member extending first and second bail projections into pivotal attachment with said elongated shaft; and
extended shaft means secured to said bifurcated member.

10. Improvements for ratchet-type speed wrenches as set forth in claim 1 which are further characterized to include:
a plurality of said insert means each being of progressively smaller size such that each is capable of insertion within the plurality of larger sizes to enable effective gripping seizure of a selected size hexagonal head nut.

11. Improvements for ratchet-type speed wrenches as set forth in claim 6 which is further characterized to include:
a plurality of said insert means each being of progressively smaller size such that each is capable of insertion within the plurality of larger sizes to enable effective gripping seizure of a selected size hexagonal head nut.

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