Aug. 3, 1954 A. P. STONE 2,685,355

REVERSIBLE RATCHET WRENCH MECHANISM

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FIG. 1

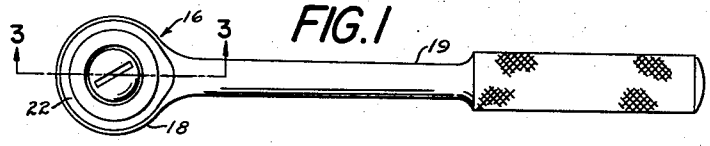



FIG. 2

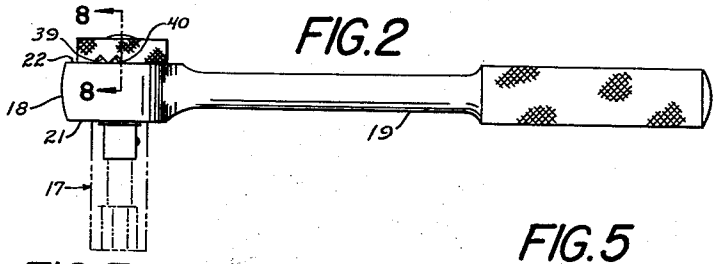



FIG. 3

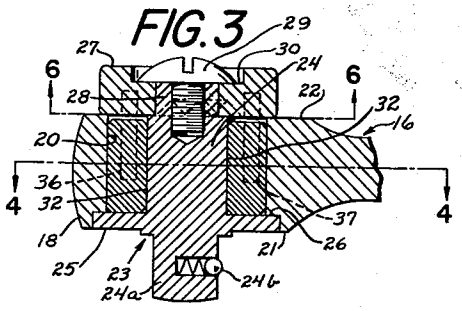



FIG. 5

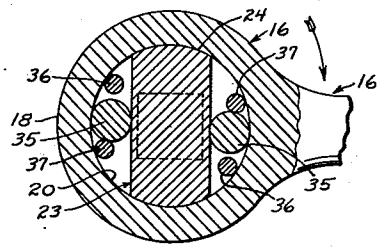



FIG. 4

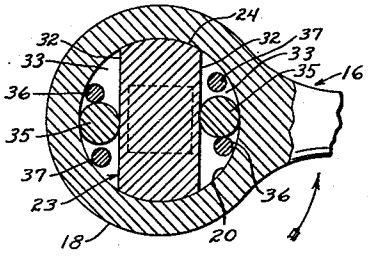



FIG. 6

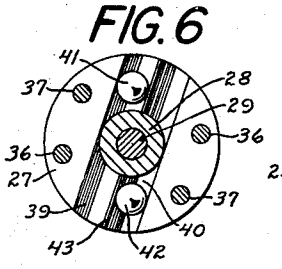



FIG. 7

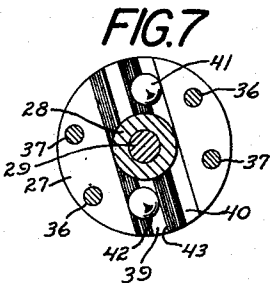
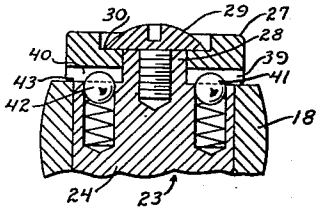



FIG. 8

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REVERSIBLE RATCHET WRENCH MECHANISM

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FIG. 9

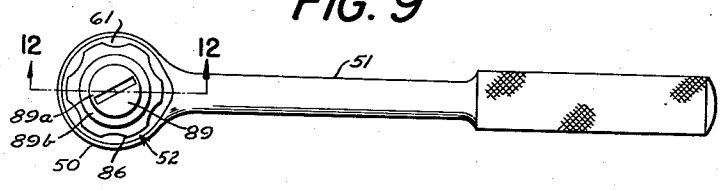



FIG. 10

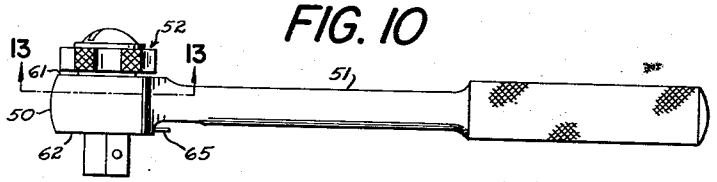



FIG. 11

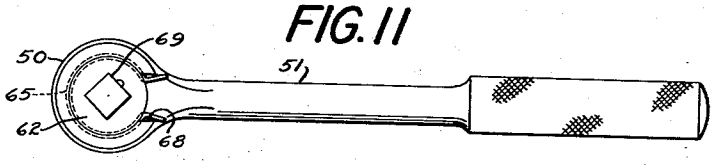



FIG. 11a

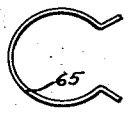



FIG. 12

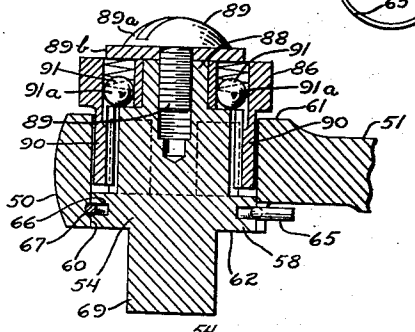
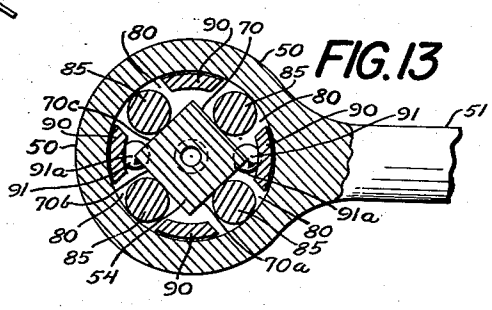



FIG. 13



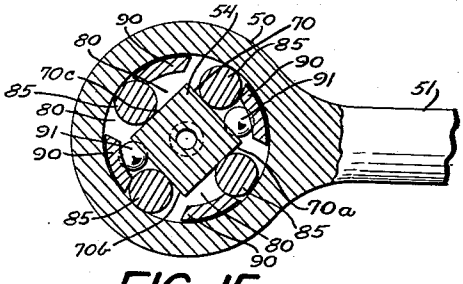




FIG. 15

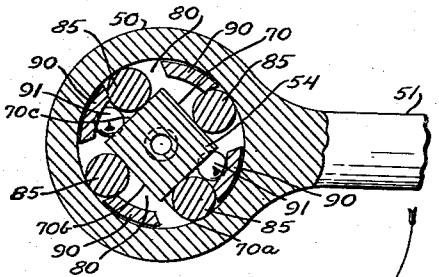



FIG. 14

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## REVERSIBLE RATCHET WRENCH MECHANISM

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Application November 18, 1949, Serial No. 128,140

4 Claims. (Cl. 192—44)

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This invention relates to a reversible ratchet mechanism, and, in particular, relates to an improved ratchet wrench.

In the past, ratchet wrenches of generally satisfactory construction have been provided. Very small ratchet wrenches, however, as for quarter-inch drive sockets, could be produced, but only at a cost comparable with that of larger sizes, while the purchasing public expected to buy the smaller wrenches at a relatively lower cost. If the demand for a small wrench at a relatively low cost were met they would necessarily have been of inferior quality.

One object of the present invention is to provide a strong, efficient ratchet wrench particularly for use with drive sockets of extremely small size, and yet which by having a minimum of parts, and being of simple construction, is adapted to be sold at lower cost than larger wrenches of comparable quality.

Another object of the invention is to provide an improved wrench mechanism of the character described which is easy to adjust for reversing the operation thereof.

Other objects of the invention will be manifest from the following brief description and the accompanying drawings.

Of the accompanying drawings:

Fig. 1 is a top plan view of a ratchet wrench embodying the features of the invention.

Figure 2 is a side elevation thereof.

Figure 3 is an enlarged fragmentary cross-section, taken substantially on the line 3—3 of Figure 1.

Figure 4 is a horizontal cross-section, on the same scale, taken substantially on the line 4—4 of Figure 3, in relative position of the reversing mechanism for driving work in counterclockwise direction.

Figure 5 is a cross-section corresponding to Figure 4, except that the reversing mechanism is in relative position for driving work in clockwise direction.

Figure 6 is a horizontal cross-section, taken substantially on the line 6—6 of Figure 3, and on the same scale, illustrating the relative position of said adjusting means, corresponding to Figure 5.

Figure 7 is a view similar to Figure 6, illustrating the relative position of reversing mechanism adjusting means corresponding to Figure 4.

Figure 8 is a fragmentary enlarged vertical cross-section taken through said adjusting means, substantially on the line 8—8 of Figure 2.

Figures 9 and 10 are views corresponding to

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Figures 1 and 2, illustrating a modified form of the invention.

Figure 11 is a bottom plan view of the wrench shown in Figure 10.

Figure 11*a* shows a detail of a retainer spring utilized in said modified form of wrench.

Figure 12 is an enlarged fragmentary cross-section, taken substantially on the line 12—12 of Figure 9, showing the operating parts in neutral position.

Figure 13 is an enlarged fragmentary cross-section, taken substantially on the line 13—13 of Figure 10, in said neutral position.

Figures 14 and 15 are views similar to Figure 13, but with the operating parts in reversed operating positions.

Referring particularly to Figures 1 to 8 of the drawings, there is illustrated one embodiment of the invention in the form of a ratchet wrench 16 for turning a wrench socket 17 of known type (shown in chain-dotted lines in Figure 2). The wrench essentially includes a head 18, a handle extension 19 integrally connected to said head and extending therefrom at right angles to an axis of a cylindrical bore or opening 20 through the head, between opposite parallel faces 21 and 22 thereof, and a reversible ratchet mechanism 23 mounted in said opening 20 and adjustable to rotate with the head in reverse directions of operation of the same in a manner to be described.

The ratchet mechanism 23 may include a generally cylindrical shank 24, rotatably received in the cylindrical opening 20, and having an integral flange 25 providing an annular shoulder rotatably seating in a counterbore 26 in one side face 21 of the head. The shank may be retained against axial movement in said opening by means of a disc-like cap 27 centrally apertured to receive a reduced extension 28 on the end of the shank adjacent the other face 22 of the head. Cap 27 is relatively rotatably retained on extension 28, against said face 22, by a screw 29 threaded on the extension and having a head engaging an outwardly presented annular seat portion 30 in the cap. The shank 24 has an integral squared extension 24*a* from the flanged end thereof, for reception in a correspondingly shaped orifice in a wrench socket 17 or similar device, the socket being yieldingly releasably retained on the shank by a spring-pressed detent 24*b*.

As shown in Figures 3 and 4, the portion of the shank 24 within said opening 20 may be reduced at diametrically opposite sides to provide flat,

diametrically spaced cam faces 32, 32, which, with the adjacent arcuate wall portions of the opening 20, define axially extending recesses 33 of shape corresponding to segments of a cylinder, that is, with the opposite arcuate and flat surfaces converging in circumferentially opposite directions. Extending in axial direction in each recess 33, between the flange 25 and cap 27, is an elongated roller bearing 35 of diameter equal to or slightly less than the maximum width of the segmental recess 33. Spaced pins 36 and 37 extend from the inner face of the cap 27 into each recess 33 and straddle the bearing 35 therein, with a slight clearance between the pins and the bearing (see Figure 4). Thus, by rotation of the cap 27 in clockwise direction as far as it will go, relatively of head 18, the pairs of pins 36 and 37 will urge the bearings 35 toward frictional wedging engagement with the corresponding converging wall portions of recesses 33, as illustrated in Figure 5, so that by turning handle 19 in clockwise direction the shank 24 may be turned in the same direction against retarding action applied to shank 24 as by a nut (not shown) being tightened by socket 17 on said shank extension 24*a*. Conversely, by turning the cap 27 in counterclockwise direction relatively of head 18, the pairs of pins 36 and 37 will urge the bearings 33 toward frictional wedging engagement with the opposite converging wall portions for the reverse operation of the wrench to loosen a nut.

Indexing means is required for releasably holding the cap 27 in either of the two operative positions described. Accordingly, two closely adjacent V-shaped grooves 39 and 40 extend diametrically across the inner face of the cap, as shown in Figures 6, 7 and 8, and two spring-pressed balls or detents 41 and 42 are mounted in cooperation therewith on an adjacent annular shoulder 43, defined in the end of shank 24, by the reduced extension 28 thereof. The arrangement is such that upon rotation of the cap relatively of the shank 24 in either direction, as far as said wedging of rollers 35 will permit, the balls 41 and 42 will be yieldingly urged past the dividing ridge, either into the grooves 39 and 40, respectively, as shown in Figure 6, or into the grooves 40 and 39, respectively, as shown in Figure 7. Engagement of the balls in the cap grooves as shown in Figures 6 and 7 is effective to hold the bearings 35 in the previously described wedging positions of Figures 4 and 5, respectively, the head 18, in any event, being freely rotatable with respect to the shank in directions opposite to said wedging rotations of the same. Force is necessary to change the setting of the indexing means just described and such setting will not be disturbed in normal use of the tool.

In use of the improved wrench of Figures 1 to 8, as for turning a nut (not shown) a standard wrench socket 17 of requisite size, is fitted onto the squared extension 24*a* of shank 24. For tightening the nut the cap 27 is first urged in clockwise direction, as viewed in Figure 1, to set the spring-pressed balls 41 and 42 in the grooves 40 and 39 in the manner shown in Figure 7, thereby to lock the cap with respect to the shank with the bearings 35 toward wedging position in recesses 33, as shown in Figure 5. The nut is then tightened by alternately urging handle 19 in the described clockwise wedging and counter-clockwise bearing-releasing directions, as viewed in Figure 5. A nut may be loosened by first urging the cap 27 in counter-clockwise direction (Figure 1) to set said balls in the relative positions shown in Figure 6 and thereby lock the cap in position to retain bearings 35 in the opposite wedging positions shown in Figure 4, and then reciprocating the handle 19 as before, in which case the effective rotation of head 18 and associated parts is in counter-clockwise direction.



Referring now to Figures 9 to 15, there is shown a modified form of ratchet wrench wherein a head part 50 has an extension 51, as before, the main difference in construction being in the reversing mechanism 52 by which is reduced to a minimum the friction affecting the efficiency of the indexing means 53.

To this end, as best shown in Figures 12 to 14, a shank 54 has a relatively short cylindrical portion 58, rotatable adjacent one end of a bore 60 which extends all the way through head 50, between opposite flat faces 61 and 62 thereof, the shank being releasably retained against axial shifting in the bore as by means of a retractible loop type spring 65, received in registering annular grooves 66 and 67 in the head 50 within bore 60 and in the outer periphery of cylindrical part 58, respectively. The groove 66 is of sufficient depth whereby the spring 65 is retractible inwardly within the same to release engagement thereof from within the groove 67, for example, when the shank is being positioned in the head during assembly or being removed therefrom for repairing or cleaning the mechanism. Retraction of the spring for these purposes is facilitated by the same having two free ends which extend into a wide slot 68 in the face 62 of head 50, these ends being engageable between the tips of two fingers or by means of a suitable tool (not shown). A square extension 69 is provided on shank 54 for releasably retaining a wrench socket, as previously described.

The major proportion of the shank 58 within bore 59 is reduced to polygonal cross-section, such as square, as shown, providing a plurality of flat cam faces 70, 70*a*, 70*b*, and 70*c*, which with the opposed arcuate wall portions of the bore form axially-extending recesses 80 converging in circumferentially opposite directions. An elongated roller bearing 85 in each recess is frictionally engageable at either end thereof, as before, upon rotating the shank slightly in either direction relatively of the head 50.

For so moving the bearings for said frictional engagement, a cap 86, rotatably retained on a reduced extension 88 of the shank outwardly of said face 61 of the head, has prongs 90 which extend into the spaces adjacent said bearings (Figures 12 to 14), the arrangement being such that when the cap is first rotated relatively of the shank to change the frictional grip of the bearings there will be a certain degree of lost-motion before the prongs will have been moved sufficiently to apply requisite binding action. The cap 86 may be rotatably held on shank extension 88, as by means of a screw 89 threaded into the outer end thereof, with the head 89*a* of the screw engaging a washer 89*b* interposed between the same and the outer face of the cap.

Simple means is provided for indexing or releasably locking the cap 86 with respect to the shank in either of the two extreme limits of said reversing action. This indexing means may comprise spring-pressed balls or detents 91*a* arranged in recesses to project to a slight extent from the inner face of said cap, as shown in dotted lines in Figure 12, there being one such ball at each of two diametrically opposite corner shoulder portions of shank 54 defined by said reduced exten-

sion 88 thereof. The balls in the neutral position of the parts of the reversing mechanism, as best shown in Figure 13, rest on said corner edge portions, and when the cap is relatively rotated with respect to the shank toward full wedging engagement of the bearings 85 in the respective recesses 80, in one direction or the other (see Figures 14 and 15), the balls 91 will overhang one side edge or the other of its said corner shoulder portions, sufficiently to retain the cap in the corresponding positions of limited relative rotation of the cap and shank (see the positions of the balls in Figures 14 and 15).

The use of the wrench of Figures 7 to 15 is otherwise substantially the same as previously described in connection with Figures 1 to 8. It will be noted, however, that there is no direct frictional engagement between any part of the cap 86 and the head 50, and hence during normal use of the improved tool any tendency of the indexing means 52 to get out of adjustment is reduced to a minimum.

Other modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. A reversible ratchet wrench comprising a head having an opening therethrough between opposite sides thereof and including a cylindrical track portion, a turning handle affixed on said head, a shank having a work-turning portion at one end thereof, means for rotatably mounting said shank in said opening to have said work-turning portion at one side of the head and the opposite end of the shank presented at the other side of the head, releasable locking means for retaining said rotatable shank against axial movement in said opening, a cap, means for mounting said cap on said opposite end of said shank to be manually rotatable relatively of the same, said shank having an axially extending portion of polygonal cross-section within said cylindrical track portion presenting a plurality of substantially flat cam faces in spaced relation to the same and thereby defining with corresponding arcuate wall portions of said cylindrical track portions a plurality of spaces which converge in circumferentially opposite directions, a cylindrical bearing in each said recess for wedging engagement between opposite converging wall portions of the same, guide fingers on said cap extending freely inwardly thereof to have opposite edge portions of the same engageable with either of adjacent said bearings upon rotation of the cap relatively of said shank in either of opposite directions to move the bearings in unison into frictional wedging engagement in correspondingly opposite said converging wall portions, at least one shoulder being provided on said polygonal portion of said shank inwardly opposite said cap and exposing opposite corner edges on the shank defined by two adjacent converging said cam faces, at least one spring-pressed ball mounted on the inner side of said cap and ball-retaining guide means provided in said cap to be in cooperation with either of said converging corner edges of said shoulder and the nearest adjacent said bearing, in a given locked position of the cap and shank, and thereby defining confining space between the same which retains the ball in given locked position, said cap being rotatable relatively of said shank to ride the spring-pressed ball over said shoulder between opposite said corner edges thereof in which the spring-pressed ball is yieldingly retained by the same and said guide means, thereby to lock the cap relatively of said shank in positions corresponding to said opposite wedging portions of said bearing.



2. A reversible ratchet wrench comprising a head having an opening therethrough between opposite sides thereof and including a cylindrical track portion, a turning handle affixed on said head, a shank having a work-turning portion at one end thereof, means for rotatably mounting said shank in said opening to have said work-turning portion at one side of the head and the opposite end of the shank presented at the other side of the head, releasable locking means for retaining said rotatable shank against axial movement in said opening, a cap, means for mounting said cap on said opposite end of said shank to be manually rotatable relatively of the same, said shank having an axially extending portion of polygonal cross-section within said cylindrical track portion presenting a plurality of substantially flat cam faces in spaced relation to the same and thereby defining with corresponding arcuate wall portions of said cylindrical track portions a plurality of spaces which converge in circumferentially opposite directions, a cylindrical bearing in each said recess for wedging engagement between opposite converging wall portions of the same, guide fingers on said cap extending freely inwardly thereof to have opposite edge portions of the same engageable with either of adjacent said bearings upon rotation of the cap relatively of said shank in either of opposite directions to move the bearings in unison into frictional wedging engagement in correspondingly opposite said converging wall portions, and at least one spring-pressed ball mounted to be movable by rotation of said cap relatively of said shank to opposite stop positions against opposite said converging cam faces in which said cap is locked with respect to said shank in positions corresponding to said opposite wedging portions of said bearings.

3. A reversible ratchet wrench comprising a head having an opening therethrough between opposite sides thereof and including a cylindrical track portion, a turning handle affixed on said head, a shank having a work-turning portion at one end thereof, means for rotatably mounting said shank in said opening to have said work-turning portion at one side of the head and the opposite end of the shank presented at the other side of the head, releasable locking means for retaining said rotatable shank against axial movement in said opening, a cap, means for mounting said cap on said opposite end of said shank to be manually rotatable relatively of the same, said shank having an axially extending portion of polygonal cross-section within said cylindrical track portion presenting a plurality of substantially flat cam faces in spaced relation to the same and thereby defining with corresponding arcuate wall portions of said cylindrical track portions a plurality of spaces which converge in circumferentially opposite directions, a cylindrical bearing in each said recess for wedging engagement between opposite converging wall portions of the same, guide fingers on said cap extending freely inwardly thereof to have opposite edge portions of the same engageable with either of adjacent said bearings upon rotation of the cap relatively of said shank in either of opposite directions to move the bearings in unison into frictional wedging engagement in correspondingly opposite said converging wall

portions, and at least one spring-pressed ball mounted to be movable by rotation of said cap relatively of said shank to opposite stop positions against opposite said converging cam faces in which said cap is locked with respect to said shank in positions corresponding to said opposite wedging portions of said bearings, said means for mounting the cap including a reduced portion on said shank rotatably received through a central aperture in the cap and releasable retaining means on the outer end of the reduced portion engageable with axially outward portions of the cap, said cap being mounted on the shank without substantial frictional engagement of any part thereof including said fingers with said head, whereby operation of the wrench will not change the rotational adjustment of the cap on said shank.

4. A reversible ratchet wrench comprising a head having an opening therethrough between opposite sides thereof and including a cylindrical track portion, a turning handle affixed on said head, a shank having a work-turning portion at one end thereof, means for rotatably mounting said shank in said opening to have said work-turning portion at one side of the head and the opposite end of the shank presented at the other side of the head, releasable locking means for retaining said rotatable shank against axial movement in said opening, a cap, means for mounting said cap on said opposite end of said shank to be manually rotatable relatively of the same, said shank having an axially extending portion of polygonal cross-section within said cylindrical track portion presenting a plurality of substantially flat cam faces in spaced relation to the same and thereby defining with corresponding arcuate wall portions of said cylindrical track portions a plurality of spaces which converge in circumferentially opposite directions, a cylindrical bearing in each said recess for wedging engagement between opposite converging wall portions of the same, guide fingers on said cap extending freely inwardly thereof to have opposite edge portions of the same engageable with either of adjacent said bearings upon rotation of the cap relatively of said shank in either of opposite directions to move the bearings in unison into frictional wedging engagement in correspondingly opposite said converging wall portions, at least one shoulder being provided on said polygonal portion of said shank inwardly opposite said cap and exposing opposite corner edges on the shank defined by two adjacent converging said cam faces, at least one spring-pressed ball mounted on the inner side of said cap and ball-retaining guide means provided in said cap to be in cooperation with either of said converging corner edges of said shoulder and the nearest adjacent said bearing, in a given locked position of the cap and shank, and thereby defining confining space between the same which retains the ball in given locked position, said cap being rotatable relatively of said shank to ride the spring-pressed ball over said shoulder between opposite said corner edges thereof in which the spring-pressed ball is yieldingly retained by the same and said guide means, thereby to lock the cap relatively of said shank in positions corresponding to said opposite wedging positions of said bearings, said means for mounting the cap including a reduced portion on said shank rotatably received through a central aperture in the cap and releasable retaining means on the outer end of the reduced portion engageable with axially outward portions of the cap, said cap being mounted on the shank without substantial frictional engagement of any part thereof including said fingers with said head, whereby operation of the wrench will not change the rotational adjustment of the cap on said shank, said shank mounting means including cylindrical seating portions on the shank and said opening at said one side of the head, mating annular grooves in said seating portions, and a retractable loop spring having portions normally interlockingly received in both said mating grooves, said spring having outwardly exposed end portions compressible to retract the loop of the spring more deeply within the groove in the shank for removing the shank from the head.



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