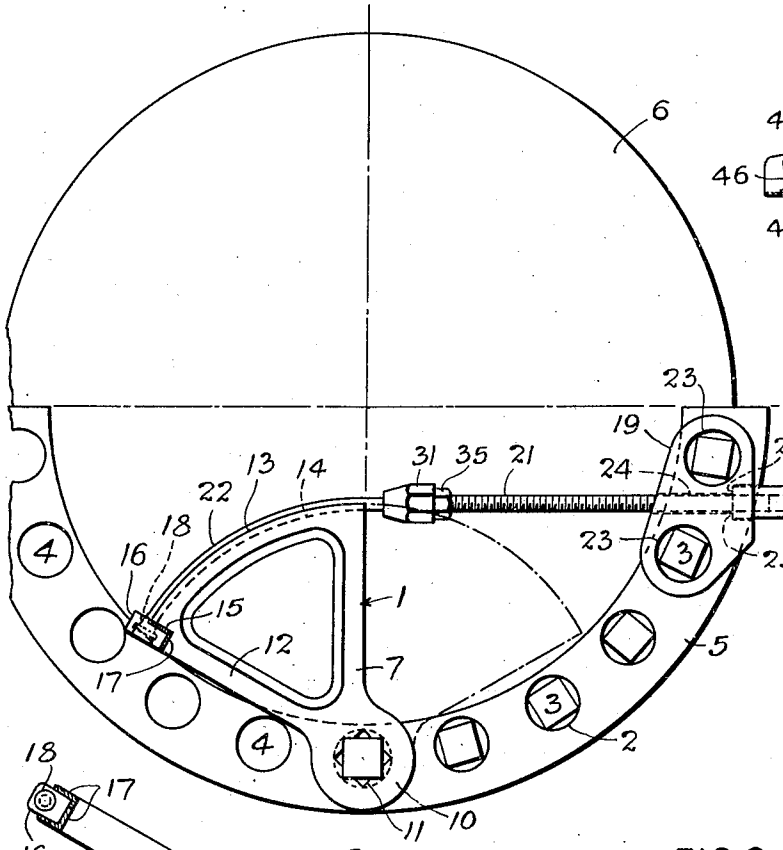
Dec. 27, 1949 G. B. FARKAS 2,492,470

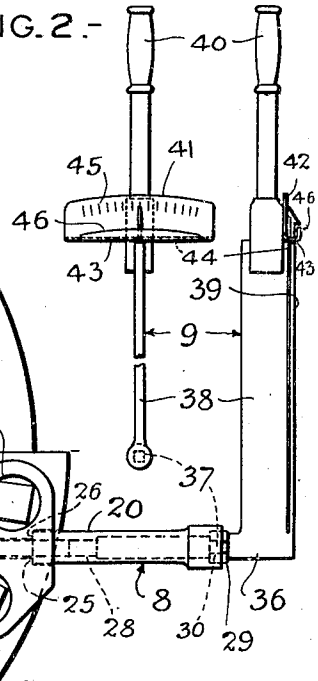
TORQUE-REDUCING WRENCH

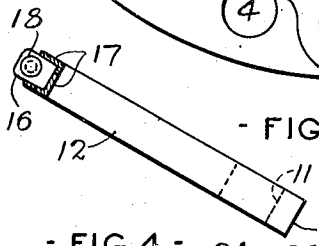
Filed Nov. 29, 1945 2 Sheets-Sheet 1

- FIG. 1.-



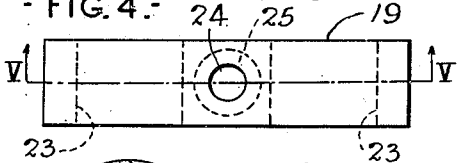
- FIG. 2.-



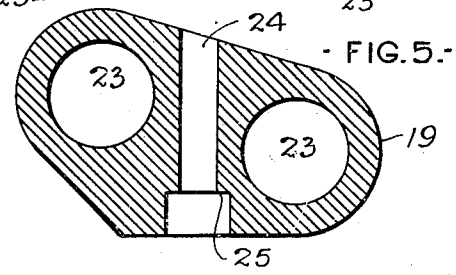


- FIG. 3.-

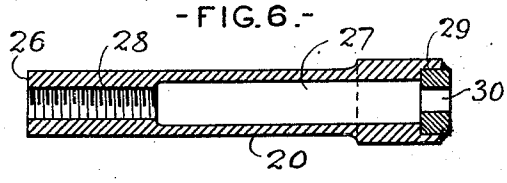
- FIG. 4.-



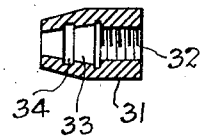
- FIG. 5.-



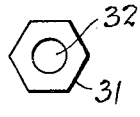
- FIG. 6.-



- FIG. 7.-



- FIG. 8.-



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Dec. 27, 1949 G. B. FARKAS 2,492,470

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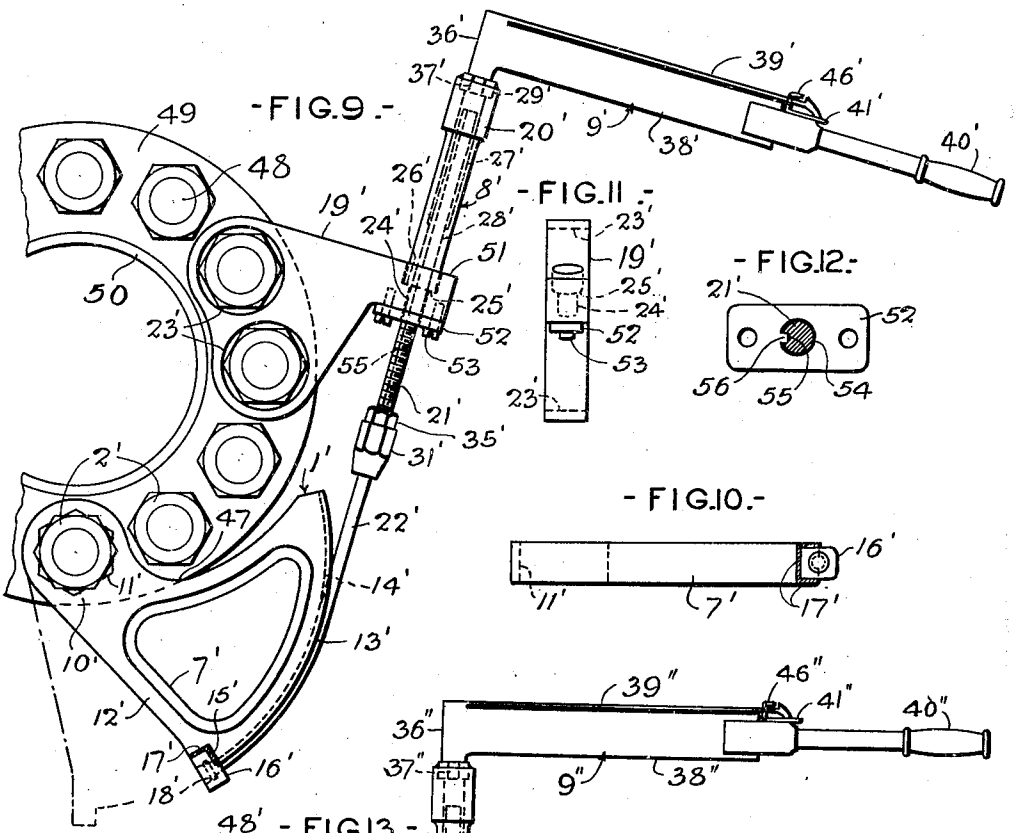
Filed Nov. 29, 1945 2 Sheets-Sheet 2

- FIG. 9 -

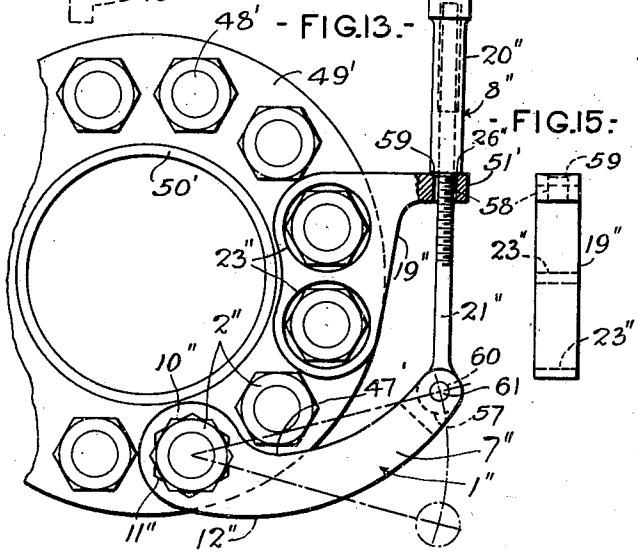


- FIG. 11 -

- FIG. 12 -

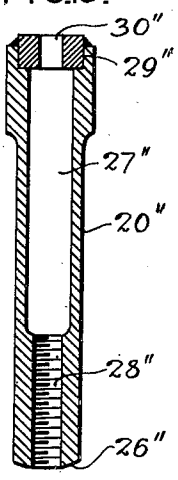
- FIG. 10 -

- FIG. 13 -

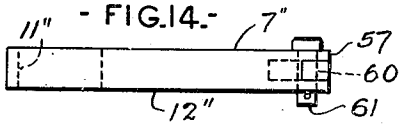


- FIG. 15 -

- FIG. 16 -



- FIG. 14 -



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2,492,470

UNITED STATES PATENT OFFICE

2,492,470

TORQUE-REDUCING WRENCH

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Application November 29, 1945, Serial No. 631,619

1 Claim. (Cl. 81—53)

1

This invention relates to a torque-reducing wrench, and more particularly to such a wrench having a torque indicator.

An object of the present invention is to provide a wrench which has a torque reducer, enabling a man to turn a threaded fastener, such as a nut or a setscrew, to tighten it, or loosen it when tightened, by applying less manual force than required when using a conventional straight wrench to perform the same task.

A further object is to provide a torque reducer wrench, as aforesaid, having a lever with a socket for receiving the fastener and a torque reducer having a member fixed against movement toward the lever and a member connected at one end to the lever and having a threaded connection at its other end with the first mentioned member, one of the members being rotatable about the axis of the threaded connection for turning the lever.

A further object is to provide a wrench as aforesaid, having a lever with a socket for receiving the fastener, and a torque reducer for turning the lever, having a support adapted to abut a stationary part of the structure to which the fastener is applied, a member abutting the support and adapted to be rotated relative thereto, and means connected at one end to the lever and having a threaded connection at its other end with the member whereby the lever is turned during rotation of the member.

Another object is to provide a wrench as aforesaid having a torque-indicating crank or handle for operating the torque reducer whereby the force being exerted upon the fastener can be determined.

Other and further objects of this invention will appear from the following description, the accompanying drawings and the appended claim.

Referring to the drawings forming a part of this application, Figure 1 is an end view of a structure, parts being broken away, having fasteners of a type adapted to be tightened by the wrench of the present invention, the wrench being shown in operative position with its lever at starting position, the position of the lever at the end of its travel being indicated in dot-dash lines; Fig. 2 is a foreshortened end view of a torque-indicating handle forming a part of the wrench, taken from the right of Fig. 1; Fig. 3 is a view of the wrench lever and associated parts taken from the left of Fig. 1; Fig. 4 is an enlarged end view of the supporting member of the torque reducer, taken from the left of Fig. 1; Fig. 5 is a section on the line V—V

2

of Fig. 4; Fig. 6 is an enlarged axial section through the rotatable member of the torque reducer; Fig. 7 is an enlarged axial section through a cable-fastening device; Fig. 8 is an end view of the cable-fastening device taken from the right of Fig. 7; Fig. 9 is a view, similar to Fig. 1, showing another embodiment of the invention, applied to a different type of structure, which is shown fragmentarily, the lever being shown at the end of its travel and its starting position being indicated in dot-dash lines; Fig. 10 is an end view of the lever of Fig. 9, with associated parts, taken from the left thereof; Fig. 11 is an end view of the supporting member of the torque reducer of Fig. 9, taken from the right thereof; Fig. 12 is an enlarged view of a plate for preventing rotation of the torque reducer screw, the screw being shown in section; Fig. 13 is a view, similar to Fig. 9, showing another embodiment of the invention, parts being shown in section, the lever being shown at the end of its travel and the angle of swing being indicated in dot-dash lines; Fig. 14 is an inverted plan of the lever of Fig. 13; Fig. 15 is an end view of the supporting member of the torque reducer of Fig. 13, taken from the right thereof; and Fig. 16 is an enlarged axial section through the rotatable member of the torque reducer of Fig. 13.

The wrench shown in Fig. 1 is indicated generally by the reference numeral 1. It is shown, by way of example, in starting position for tightening set screws 2, having square heads 3, which screws are threaded in threaded orifices 4 (only part of the screws being assembled) in a semi-circular clamp ring 5 of a conventional heat exchanger, the clamp ring being utilized for tightly pressing the head 6 of the heat exchanger in place. The heat exchanger forms no part of the present invention and no further description thereof is deemed necessary.

The wrench includes a lever 7, a torque reducer 8, and a pressure- or torque-indicating crank or handle 9. The lever 7 at its axis has a part 10 provided with a socket 11 which is adapted to fit on the heads 3. A triangular arm 12, open through its middle portion, is integral with the part 10 and has a curved outer face or edge 13 spaced radially of the axis of the socket 11. Face 13 contains a groove 14 extending from one end thereof to the other end thereof. At one end of the face 13, the left end as viewed in Fig. 1, a right angular shoulder 15 is formed in the lever and a block 16 is secured in this shoulder by welds 17. Block 16 has a

tapered bore 18 with its small end adjacent and in line with the groove 14.

The torque reducer includes a support 19, a rotatable member 20, a non-rotatable screw 21 and a flexible wire cable 22.

The support 19 is of block formation and has two circular holes 23 adapted to be imposed on two adjacent heads 3 at a distance from the fastener to be tightened, as is clearly shown in Fig. 1. The support is provided with a bore 24 having portions of two different diameters providing a shoulder 25 which is disposed at the side of the support remote from the lever 7 (the forward side).

The rotatable member 20 is tubular and has its end 26 (rear end) disposed in the shouldered portion of the bore 24 and rotatably bearing against the shoulder 25 with the bore 27 of the member 20 in line with the bore 24. Bore 27 has threads 28 adjacent the support 19. The other end of the rotatable member has welded therein a fitting 29 provided with a square center socket 30.

The screw 21 is externally threaded throughout its length and is screwed at one end into the threads 28. A fitting 31 having an internally threaded bore 32 is screwed onto the other end of the screw 21. This fitting also has a tapered chamber 33 provided with a groove 34 in its defining face. One end of the cable 22 is disposed in this chamber and secured to the fitting in any usual way as by zinc or other suitable metal which fills the chamber around the end of the cable therein and fills the groove 34, firmly securing the fitting and cable together. A lock nut 35 is threaded on the screw 21 against the fitting to prevent the screw 21 from turning out of the fitting when the rotatable member 20 is rotated.

The cable 22 at its forward end is secured in the bore 18 of the block 16 in a manner similar to that described in connection with its attachment to the fitting 31.

In normal starting position as shown in Fig. 1, the cable 22 engages the entire groove 14 but as the lever swings the cable straightens out at its forward end and leaves the groove 14 adjacent the fitting 31. Where it is desired to provide a lever for different size or different shaped fastener heads, the arm 12 at its axis may be adapted to receive any one of a set of socket members of appropriate sizes and shapes. On the other hand in such cases another lever having a suitable socket may be attached to the torque reducer screw 21. In such case, the nut 35 is loosened, the screw 21 unscrewed from the fitting 31 and then the substitute lever attached to the screw 21 by a reversal of this procedure.

The torque reducer may be operated by a conventional wrench or any suitable means, but it is preferably operated by the torque-indicating crank 9, as shown, so that the torque applied can be determined. The crank 9 may be of any make commercially available and the typical design includes a boss 36 having a square fitting 37 disposed in socket 30, a heavy but flexible arm 38 extending from the boss at right angles to the rotatable member 20, a needle 39 secured to the boss and extending in line with the arm 38, and an extension 40 secured to the other end of the arm. A right angle plate 41 is secured by means of one leg 42 thereof to the extension 40 adjacent its connection with the arm 38 and at right angles to the arm. The other leg 43 projects outwardly from the extension 40 and is provided with a slot 44 through which the needle 39 projects. The upper end of the needle cooperates with a scale 45 to indicate the torque being applied. The leg 43, outwardly of the slot, is bent to provide a curved retaining wall 46 for the needle, the slot thus forming a guide for the needle.

The operation of the wrench is as follows:

To tighten a screw 2, the wrench is placed substantially in the position shown in Fig. 1 with the forward edge of the lever at right angles to the screw 21. This is presuming the screw 2 has been tightened by a straight wrench somewhat less than is finally desired, it being the purpose of the torque reducing wrench to give the screw 2 its final and usually predetermined degree of tightening. This initial tightening should preferably dispose the head of the screw 2 angularly as shown in Fig. 1.

With the placing of the wrench in this position, the tightening force is most effectively applied. To maintain this effectiveness as the tightening proceeds, the lever 7 should not be turned to a position beyond that shown in dot and dash lines. If further tightening is required, the lever 7 should be removed from the screw 2, the member 20 reversely rotated back off the screw 21 and the lever 7 again mounted on the screw 2 at approximately the position shown in Fig. 1, whereupon the tightening procedure is continued. The forward point of contact of the cable 22 with the arm 7 for suitable effectiveness should continue in a line through the axis of the lever at right angles to the screw 21. This condition will be maintained until the lever is turned to its dot and dash position.

The rotating of member 20 to turn the lever is accomplished in an obvious manner by turning the crank 9. The needle will indicate the force being applied, due to the bending of the crank arm, until finally the force being indicated corresponds to the desired tightening of the screw 2 as predetermined. This insures that the screw 2 will not be tightened beyond the critical point.

The wrench is similar on opposite sides so that it may be reversed to loosen a screw 2 by the aforesaid procedure. The wrench shown in Figs. 1–8 is particularly adapted to be employed where it is most convenient, and where there is sufficient room, to have the lever within the outer periphery of the structure to which the fastener is being applied.

Ordinarily the screw 21, and therefore the cable 22, will have no tendency to turn during the turning of the member 20, but should such undesirable turning tend to take place, it may be prevented by placing a straight wrench on the fitting 31 and letting it bear against the head 6. Or, if desired, the torque reducing wrench may be provided with means preventing turning of the screw 21 relative to the support 19. Such a means is shown in connection with the embodiment of Figs. 9–12 and it will be understood that this means can also be incorporated in the embodiment of Figs. 1–8 if desired.

The wrench aforedescribed enables one man to manually turn a fastener which he could not turn with an ordinary straight wrench, the controlling factor here being the torque reducer which requires a large amount of rotation to effect a small amount of rotation of the lever.

The wrench 1′ shown in Figs. 9–12 is especially adapted to be used where it is desirable to have the lever 7′ disposed outside of the circumference of the structure to which the fastener is being applied. The lever 7′ distinguishes from the

lever 7 mainly in having a deep indentation 47 in the forward end wall to clear the fastener 2' next to the fastener 2' being tightened, as is clearly shown in Fig. 9. The fasteners 2' are hexagonal nuts on bolts 48 passing through the flange 49 of a pipe 50. Because of the pipe 50, the lever 7' must extend outwardly from the circumference of the flange instead of inwardly as in Fig. 1.

The support 19' distinguishes from the support 19 in having an extension 51 in which the bore 24' and shoulder 25' are formed. Furthermore a plate 52 is secured to the portion of the support facing the lever 7' by tap screws 53. This plate has an orifice 54 through which the screw 21' extends. The screw 21' distinguishes from the screw 21 by having a longitudinally extending slot 55 and the plate 52 has a tooth 56 extending into the orifice 54 and disposed in the slot 55. The tooth 56 prevents the screw 21' from turning when the rotatable member 20' is rotated.

Parts of the wrench of Figs. 9–12 corresponding to like parts of the wrench of Figs. 1–8 are indicated by like references with an accent added. The plate 52 can be employed in the embodiment of Figs. 1–8 if desired, as aforesaid, in which case the screw 21 would have a slot similar to the screw 21'.

The operation of the wrench of Fig. 9 is similar to that of Fig. 1. The lever is shown in its extreme forward position and the dot and dash lines indicate the preferred initial position.

The structure of Fig. 13 is similar to that of Fig. 9 and the wrench of Figs. 13–16 is associated with the structure in a similar manner. Like parts of the structure and corresponding parts of the wrench are indicated by the same reference numerals with an accent added. The crank is similar to the crank of Fig. 9 but the other parts of the wrench of Fig. 13 each differ somewhat from the previously described corresponding parts of the wrench of Fig. 9.

The lever 7'' has a part 10'' provided with a socket 11'' suitable for hexagonal nuts, bolts, or the like. The lever further has a curved arm 12'' having a fork 57 at its outer end, aligned orifices being formed in the branches of the fork. The rotatable member 20'' has a convexly spherical end 26''. In other respects it is similar to the member 20'. The support 19'' has the two holes 23'' and an extension 51' but the extension is provided with a bore 58 and the face of the support adjacent the member 20'' is provided with a spherical seat 59, for receiving the end 26'' in place of the shoulder 25' for the end 26'.

The screw 21'' has an eye 60 on its end adjacent the lever, and this eye is disposed between the branches of the fork and pivotally secured thereto by a pin 61. Screw 21'' can angle in bore 58, the bore having a somewhat larger diameter than the screw 21'', the joint formed by the spherical end 26'' and its seat 59 permitting this angle. The eye 60 prevents the screw 21'' from rotating with the rotatable member 20'' but permits the aforesaid angling.

The operation of the wrench of Fig. 13 is similar to the operation of the wrench of Fig. 9. The arm 7'' is provided with a pronounced recess or indentation for the same purpose as the indentation 47 and is shown in its extreme forward position, and the dot and dash lines indicate the angle of swing of the arm 7'' from its preferred initial position.

In Figs. 1 and 9 it will be noted that the screws 21 and 21' respectively are associated with their respective levers 7 and 7' to maintain a desirable constant leverage during the turning of the fasteners, and this is substantially so with the wrench of Fig. 13, when swung through the angle shown.

While there have been hereinbefore described approved embodiments of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention, and that all such changes and modifications as fall within the scope of the appended claim are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

A manually-operable torque-reducing wrench for tightening and loosening a row of threaded fasteners such as nuts and bolts, comprising a socket for turning one of said fasteners; a lever connected to said socket for turning same having an arcuate groove it its outermost edge; a stationary member adapted to be anchored on at least two other of said fasteners spaced angularly from said one fastener, said member having a bore directed toward said lever; a flexible cable connected at one end to the end of said lever remote from said stationary member and seating in said groove; threaded means connected at one end to the other end of said cable and extending at its other end through said bore; a rotary member abutting said stationary member at the side thereof remote from said lever and being threaded on said threaded means; and a hand operated crank for turning said rotary member for drawing said lever toward said stationary member.

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