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HAND-POWER TOOL

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2 Sheets-Sheet 1

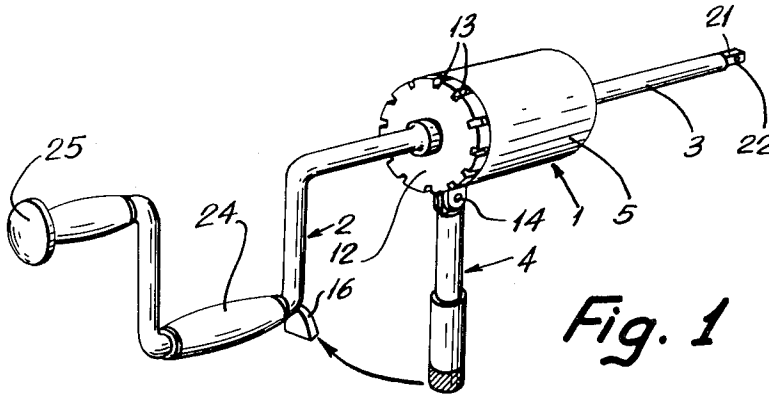


Fig. 1

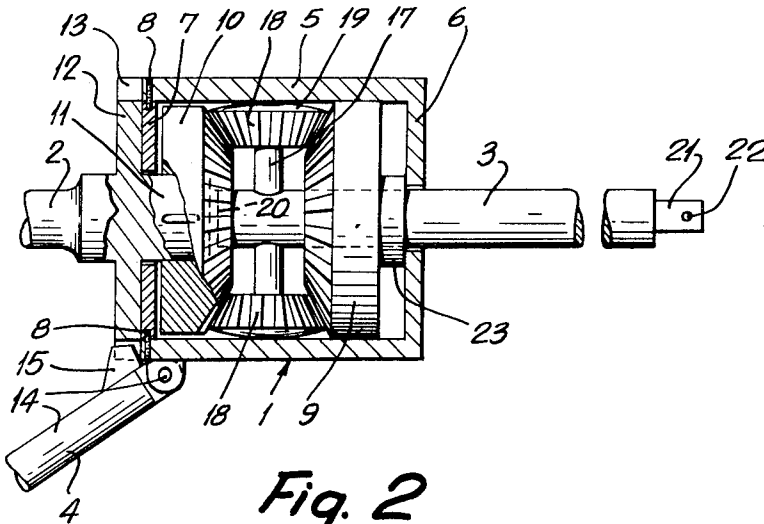


Fig. 2

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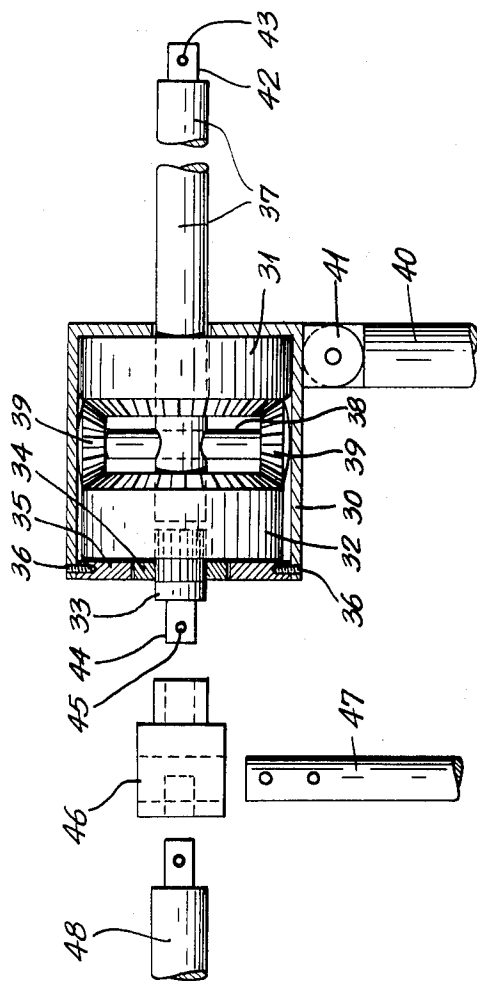


Fig. 3

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HAND-POWER TOOL

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6 Claims. (Cl. 81-57)

The present invention relates to rotary tools and, more particularly, to a manually-operated rotary tool incorporating demultiplication means between the tool itself and the manually-operated driving means, to obtain either increased or decreased speed of rotation of the tool itself with attendant decrease or increase of the torque output.

A more specific object of the present invention resides in the provision of a hand-power tool, which is specially adapted for tightening and removing nuts or bolts securing tire wheels to trucks and for other similar application wherein a relatively large torque has to be obtained from a manually-operated tool.

Another object of the present invention resides in the provision of a tool of the character described, having means for quickly and positively locking the demultiplication means to thereby obtain a direct drive between the input and output of the tool.

Yet another object of the present invention resides in the provision of a tool of the character described, which is of relatively simple and inexpensive construction, which occupies a small space compared to the torque available, and which may be fitted with different types of implements, such as socket wrenches, screwdrivers, and the like.

The tool in accordance with the present invention is characterized by the combination of a torque wrench, ratchet drive, centre bit crank arm, torsion bar, or the like torque increasing, manually rotatable implement with a gear box for further doubling the torque available from the above-noted manually rotatable element, to thereby obtain a very powerful manual tool for turning nuts, bolts, and the like, said gear box being further characterized by the provision of a retaining handle pivotally connected to the gear box and adapted to abut a stationary object for maintaining stationary the casing of the gear box during operation of the tool, said handle being collapsible when the tool is not in use.

The foregoing and other important objects of the present invention will become more apparent during the following disclosure and by referring to the drawings, in which:

FIGURE 1 is a perspective view of the first embodiment of the power tool in accordance with the invention;

FIGURE 2 is a partial and broken-away elevation, with some parts in longitudinal section, of the first embodiment; and

FIGURE 3 is a partial and broken-away elevation, with some parts in longitudinal section, of a second embodiment.

Referring now more particularly to the drawings in which like reference characters indicate like elements throughout, the tool in accordance with the first embodiment comprises a speed changing unit, generally indicated at 1, connected at one end to a manually-operated crank 2 and at the other end to an output shaft 3. The unit 1

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is further provided with a retaining handle 4. The unit 1 comprises a cylindrical housing 5 closed at one end by an integral end wall 6 and at the other end by a removable closure disc 7, secured to the housing by means of set screws 8. A first crown gear 9 is disposed adjacent end wall 6 and is rigidly secured to housing 5 by means of rivets or the like.

A second crown gear 10 is disposed near closure 7 and is rotatable within housing 5. The gear teeth of both crown gears 9 and 10 face one another and are bevelled.

The crank 2 has an enlarged cylindrical end portion 11 passing through a central bore made in closure 7 and keyed to crown gear 10. End portion 11 has a radially protruding disc-shaped flange 12 slidable on end closure 7 and provided at its peripheral edge with a plurality of angularly equally spaced notches 13.

Retaining handle 4 is of the telescopic type and is pivoted at 14 to ears integral with the casing 5. Handle 4, near its pivoted end 14, is provided with an integral tooth 15 which, upon pivoting handle 4 towards crank 2, engages a notch 13 of flange 12 to thereby lock the crank 2 against rotation relative to casing 5.

In the casing locking position of handle 4, the latter preferably engages and is retained by a resilient clip 16 secured to a lateral leg of crank 2.

Output shaft 3 freely extends axially of casing 5 and through a central bore of crown gear 9 and its inner end 20 enters and is rotatable within the central bore of crown gear 10, being journaled in said gear box.

A cross shaft 17 extends through a transverse bore of output shaft 3 within the space between the two crown gears 9 and 10. The free ends of cross shaft 17 terminate adjacent the inner face of casing 5.

A pair of bevelled pinions 18 are mounted for free rotation on cross shaft 17 on both sides of output shaft 3 and mesh with the crown gears 9 and 10. Pinions 18 have an outer convex face 19 to limit friction between the same and the inner face of casing 5.

Output shaft 3 is preferably provided with a square end 21 provided with a spring pressed ball 22 to engage within the square cavity of a socket wrench, screwdriver, or the like tool bit, and retain the same on output shaft 3.

Crank 2 is similar to those of center bits, being provided in its offset portion with a rotatable gripping sleeve 24 and at the free end thereof, with a rotatable hand grip 25, in the form of a disc member with a convex outer face.

Crown gear 9 may extend to and make contact with integral end wall 6, or be separated therefrom by a bushing 23, as shown in the drawings.

The first embodiment in accordance with the invention is used as follows:

For instance, for removing the tire wheel of a truck, a suitable type of tool implement is secured to end 21 of output shaft 3, such as a socket wrench, in order to engage the nuts or bolt heads of the truck wheel. Handle 4 is pivoted to its unlocking position and extended so that its outer end will engage the ground when the tool implement engages a nut of the truck wheel, and the crank 2 is held with the two hands and rotated in the same manner as a center bit, to unscrew the nut. During this rotation, the casing 5 is held stationary due to the action of the retaining handle 4 which abuts the ground, but

both hands of the operator are available to rotate the crank. Crown gear 10 rotates and causes rotation of pinions 18 against the reaction member constituted by crown gear 9, secured to casing 5 which is held stationary.

Pinions 18 rotate output shaft 3 through cross shaft 17 and, consequently, the tool implement directly secured to shaft 3. During this movement, a demultiplication of the rotational speed takes place; that is, the tool implement will rotate at a lower speed than crank 2, thus obtaining a great torque at the tool itself. In practice, a demultiplication of 2 to 1 is obtained.

Furthermore, due to the offset portion 24 of crank 2, the torque output is relatively considerable and thus wheels of heavy trucks are easily removed with the tool of the present invention, while using only human power.

Once the nuts have been loosened, the handle 4 is simply pivoted against crank 2 with its outer end engaging clip 16 and its tooth 15 engaging a notch 13 of flange 12, thereby obtaining a direct drive to speed up unscrewing of the loosened nut. To secure the wheel, the reverse procedure is effected, the demultiplication effect of the unit 1 being used only when the nuts need to be tightened.

Obviously, the tools in accordance with the first embodiment is not limited to the application above described, but is applicable to other uses whenever it is desired to obtain a relatively large torque with human power. One can always arrange to have a stationary abutment surface for abutting retaining handle 4.

It is noted that by reversing the position of unit 1 with respect to output shaft 3 and crank 2, one will obtain increased speed of rotation of the output shaft with an attendant decrease in output torque relative to the input torque.

The tool of the second embodiment shown in FIGURE 3 comprises, as in the first embodiment, a cylindrical housing 30, closed at one end by an integral apertured wall. A crown gear 31 having bevelled teeth is disposed within and secured to casing 30 by rivets, welding, or the like.

Casing 30 further houses a crown gear 32 freely rotatable therein and the bevelled teeth of which face the teeth of crown gear 31. An input stud shaft 33 has a fluted portion engaging a fluted axial bore of crown gear 32 and an inwardly fluted collar 34 surrounding the same and serving as a journal for stud shaft 33.

Bearing collar 34 is rotatable within the central opening of a closure disc 35 for casing 30, said closure disc being secured to the casing by set screws 36.

An output shaft 37 extends axially of casing 30, freely passing through an axial bore of crown gear 31 and being journaled within a central bore of crown gear 32 at its inner end.

A cross shaft 38 extends through a transverse bore of output shaft 37 within the space between crown gears 31 and 32; the free ends of cross shaft 38 terminate adjacent the inner face of casing 30. A pair of bevelled pinions 39 are mounted for free rotation on cross shaft 38 on both sides of output shaft 37, said pinions having outer convex faces.

A retaining handle 40, preferably of the telescopic type, is pivoted at 41 to ears integral with casing 30 adjacent the closed end thereof, opposite crown gear 31.

Output shaft 37 is terminated by a square end 42 provided with a laterally protruding spring pressed ball 43 for fitting within a square cavity of a suitable tool implement, such as a socket wrench, screwdriver, or the like.

Input stud shaft 33 is similarly terminated at its outer end outside casing 30 with a square end 44 provided with a laterally protruding spring pressed ball 45.

A connector element 46 is designed to be removably connected to square end 44 of input shaft 33 by having a square bore for receiving said square end 44, and is also designed for receiving the end of a torsion bar 47, or the like, which fits within a transverse through bore of

connector 46. Finally, connector element 46 has a square hole at its outer end for receiving the square end of a ratchet drive or torque wrench drive, part of which is shown at 48.

The tool in accordance with the present invention enables to obtain a speed reduction between the input and output shafts of 2 to 1 and a consequent doubling of the available torque.

A suitable tool implement is secured to end 42 of output shaft 37. The casing 30 is held stationary by means of retaining handle 40, and the input shaft 33 is rotated either by the torsion bar 47 or by a ratchet wrench, or the like, 48. The bevelled crown gear 31 acts as a reaction element for pinions 39 during rotation of the latter by bevelled crown gear 32.

As in the first embodiment, the lever arm provided by torsion bar 47 or ratchet wrench 48 and the like, increases the available torque at the input shaft and said increased torque is doubled by the unit housed in casing 30.

While preferred embodiments in accordance with the present invention have been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit or scope of the appended claims.

What I claim is:

1. In a hand-power tool, a casing, first and second crown gears disposed within said casing and having bevelled teeth spacedly facing one another, said first crown gear secured to said casing, said second crown gear freely rotatable therein, a central shaft co-axial with said casing and said crown gears, freely passing through a bore made in said first crown gear and journaled at its inner end within a cavity made in said second crown gear, a cross shaft secured to said central output shaft and extending on both sides of the latter in the space between said first and second crown gears, pinions freely rotatably mounted on said cross shaft on opposite sides of said central shaft and in meshing engagement with said first and second crown gears, an input shaft co-axial with said central shaft and protruding from said casing and secured to said second crown gear and rotatable with respect to said casing, a cover removably secured to said casing and freely surrounding said input shaft for holding said second crown gear in said casing, a retaining handle secured to said casing and extending outwardly laterally therefrom, and lever arm means connected to said input shaft and manually rotatable, said central output shaft having means at its outer end for removably securing a rotary tool implement.

2. A hand-power tool as claimed in claim 1, wherein said retaining handle is pivotally connected to said casing for pivotal movement between an extended position extending laterally of said casing at substantially right angles to said central output shaft and a retracted position extending alongside said casing substantially parallel to said central output shaft.

3. A hand-power tool as claimed in claim 2, wherein said input shaft has a disc-shaped flange integral therewith and disposed adjacent one end of said casing, said flange having a plurality of spaced notches at the periphery thereof, a tooth integral with said retaining handle adjacent the pivoted end thereof and engageable with any one of said notches in the retracted position of said retaining handle, to thereby lock said input shaft with said casing, said tooth clearing said notches in the extended position of said retaining handle.

4. A hand-power tool as claimed in claim 3, wherein said manually rotatable lever arm means consist of a centre bit crank arm and further including resilient clip means secured to said centre bit crank arm and resiliently engaging said retaining handle in the retracted position of the latter.

5. In a hand-power tool as claimed in claim 1, wherein said input shaft is a stud shaft having an outer square

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end and further including a connector element having aligned square cavities, one of which is adapted to removably receive the square end of said input stud shaft and the other of which is adapted to removably receive the square end of a torque wrench, ratchet drive and the like manually rotatable driving implement, said connector element further including a transverse bore for removably receiving one end of a torsion bar.

6. In a hand power tool as claimed in claim 5, wherein said retaining handle is pivotally connected to said casing for pivotal movement between an extended position laterally away from said casing and substantially at right angles to said central output shaft, and a retracted position extending alongside said casing and substantially parallel to said central output shaft.

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