POWER DRIVEN WRENCH WITH REVERSE ROTATION LIMITING MEANS

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My invention relates to wrenches and more particularly to power operated wrenches.

It is an object of the invention to provide an improved wrench of this type, adapted particularly to be used with a reversible motor, the motor being driven in one direction for the purpose of rotating the nut in a tightening direction and being reversed for the purpose of loosening the nut to the limited number of turns just mentioned.

It is more specifically an object of the invention to provide a wrench of this type which includes a one-way engaging device which disengages for the tightening direction of rotation but which engages for the loosening rotation and cooperates with motion limiting means to prevent loosening beyond the limited number of turns mentioned.

It is a still more particular object of the invention to provide an improved wrench of this type having an input shaft driven by a reversible motor and connected by gears to an output shaft, with a one-way clutch being disposed on the output shaft to allow its unrestrained rotation in the tightening direction but engaging and cooperating with rotation limiting gearing to prevent rotation beyond the predetermined number of turns of the output shaft in the loosening direction.

The invention consists of the novel constructions, arrangements and devices to be hereinafter described and claimed, for carrying out the above stated objects, and such other objects as will be apparent from the following description of a preferred form of the invention, illustrated with reference to the accompanying drawings.

Fig. 1 is a longitudinal sectional view of a wrench embodying the principles of the invention and shown connected with a conventional air motor;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1, and

Fig. 3 is a sectional view on an enlarged scale taken on line 3—3 of Fig. 1,

like characters of reference designate like parts in the several views.

Referring now to the drawings, the illustrated wrench may be seen to comprise an input shaft 10 and an output shaft 11 at right angles to each other, each rotatably mounted in a casing 12. The shaft 10 is rotatably disposed in a hollow sleeve portion 13 of the casing 12 by means of needle bearings 14. The shaft 11 is rotatably disposed in the casing 12 by means of a ball bearing unit 15 and a bearing sleeve 16.

The input shaft 10 is formed on its end with a bevel pinion gear 17 which is in mesh with a bevel gear 18 disposed on the shaft 11. The gear 18 is non-rotatably fixed with respect to the shaft 11 by means of a hexagonal protrusion 19 formed on the shaft 11 and disposed in a correspondingly shaped hexagon recess 20 in the gear 18. A one way clutch 21 is provided on the shaft 11. The one way clutch 21 comprises an outer shell 22 provided with an inner cylindrical race 23 and an inner hub 24 provided with an exterior cylindrical race 25. The hub 24 is fixed on the shaft 11 by any suitable means, such as a set screw 26. The outer shell 22 has a hub 27 formed integrally therewith, and the hub 27 is rotatably disposed on the shaft 11 by means of a bearing sleeve 28.

The clutch 21 includes a plurality of tiltable grippers 29 disposed between the races 23 and 25. The grippers 29 are provided with slots 30 in their ends, and garter springs 31 are disposed in the slots 30.

A spur gear 32 is fixed on the hub 27 and meshes with a gear 33 which is rotatably disposed on a stud 34 threaded into the sleeve portion 13 of the casing 12. A dowel pin 35 is fixed on the gear 33 and is adapted to abut against a stop bar 36 positioned above the gear 33 in the casing 12.

Any conventional reversible motor may be used for driving the wrench. A standard air motor 37 is illustrated and has an output spindle 38. The spindle 38 is provided with an axially extending tang 39 which fits into a slot 40 provided in the end of the input shaft 10. The motor 37 is provided with a control handle 41 which may be depressed for driving the spindle 38 in one direction and may be released for driving the spindle 38 in the opposite direction.

The wrench is useful for tightening any suitable fastening device such as a nut 42 threadable on a bolt 43. An adapter socket 44 may be used for connecting the output shaft 11 of the wrench with the nut 42 and may have a quadrangular recess 45 for receiving a similarly shaped end 46 on the shaft 11 and may have a hexagonal recess 47 to fit over the nut 42.

The illustrated wrench may be used in operation for tightening the nut 42 on the bolt 43 and then automatically releasing the nut 42 by a predetermined number of turns. The socket 44 is positioned on the nut 42, and the four sided shaft end 46 is disposed in the recess 45 so as to provide a connection between the output shaft 11 and the nut 42. The lever 41 is then depressed so as to drive the output spindle 38 of the motor 37 and the shaft 10 connected therewith by means of the tang 39 in the direction indicated by the arrow 48. The gears 17 and 18 drive the shaft 11 in the direction indicated by the arrow 49, and this rotation of the shafts 10 and 11 continues until the nut 42 is tightened on the bolt 43.

During this rotation of the shaft 11, the one-way clutch 21 may overrun, that is, the hub 24 and the race 25 formed thereon may rotate without any corresponding rotation of the outer shell 22 and the outer race 23; and under these conditions the grippers 29 are tilted against the action of the peripheral garter springs 31 so as to allow rotation of the inner race 22 with respect to the outer race 23.

During this rotation of the shaft 11, however, there is sufficient drag transmitted from the inner race 25 to the outer race 23 through the grippers 29 so that the outer shell 22 is rotated sufficiently as to turn the gear 33 and move the dowel pin 35 into its dotted line position in Fig. 2 in contact with the stop bar 36. The gear 33 is rotated under these conditions in the clockwise direction as seen in Fig. 2 by the shell 22, and the gear 33 is rotated in the counter-clockwise direction, so that the dowel 35 moves into its dotted line position. Further rotation of the gears 33 and 22 and the outer shell 22 is stopped by the pin 35 contacting the stop bar 36, and subsequently tightening rotation of the nut 42 and corresponding rotation of the output shaft 11 takes place with the one-way
3. clutch 21 being completely slipping, the outer race 23 being stationary and the inner race 25 rotating, with the grippers being tilted against the action of the garter springs 31 into their disengaged positions. 

When the lever 41 is released, the output spindle 38 of the motor 37 is driven in the opposite direction, and the shaft 11 and the nut 42 are likewise rotated in opposite directions through the gears 17 and 18. During this phase of the operation, the nut 42 is loosened. For this reverse direction of rotation, the hub 24 fixed on the shaft 11 tilts the grippers 29 into their engaged positions, augmenting the action of the garter springs 31, so that the outer shell 22 is firmly fixed with respect to the hub 24 and the shaft 11. The gears 32 and 33 then rotate in the opposite directions, and the dowel 35 is moved into its full line position as seen in Fig. 2 abutting the stop bar 36 and preventing further movement of the gears 33 and 32 and also of the shaft 11 through the one-way clutch 21 which is engaged at this time. Thus, although the motor 37 tends to rotate the shaft 11 to further loosen the nut 42, the stop dowel 35 and stop bar 36 prevent such further loosening, and the nut 42 has been loosened a predetermined number of turns, such as, for example, one and one-half turns, by the rotation of the gear 33 in moving the dowel 35 from its dotted line position to its full line position as seen in Fig. 2.

My improved wrench advantageously tightens a rotatable locking member, such as for example, a nut, to a predetermined tightness depending on the power and torque exerted by the air motor 37. Then, upon reversal of the air motor, the wrench automatically loosens the nut a predetermined number of turns depending on the dimensions of the stop bar 36 and the location of the dowel 35 in the gear 33. This wrench is particularly adapted for use in connection with the tightening of brake bands, for example, in a transmission which must be tightened and engaged to the brake drum and then must be loosened a predetermined amount so as to provide clearance between the drum and band. In this case, the nut 42 is the tightening member for the band and is released a predetermined number of turns to provide the clearance.

1. In a wrench for use on a tightening element which is rotatable in one direction to tighten it and in the other direction to loosen it, the combination of a rotatable shaft adapted to be connected in driving relation with the rotatable tightening element, a one-way engaging device for limiting rotation of said shaft in a direction to unloosen the tightening element, and lost motion mechanism connected with said one-way device for allowing a predetermined rotation of said shaft in the unloosening direction prior to said one-way device being effective for stopping further rotation.

2. In a wrench for use on a tightening element which is rotatable in one direction to tighten it and in the other direction to loosen it, the combination of a wrench casing, a shaft rotatably disposed in said casing and adapted to be connected in driving relation with the rotatable tightening element, an input shaft rotatably disposed in said casing at right angles to said output shaft, first and second beveled gears providing a driving connection between said shafts, a one-way clutch on one of said shafts, a rotatable third gear, a stationary stop member, a stop element carried by said third gear and adapted to abut against said stop member to limit the rotation of said third gear, and a fourth gear connected with said one-way clutch to be driven thereby and in mesh with said third gear for limiting the rotation of said shafts in a direction to engage said one-way clutch releasing for the opposite direction of rotation of said shafts.

3. In a wrench for use on a tightening element which is rotatable in one direction to tighten it and in the other direction to loosen it, the combination of a rotatable output shaft adapted to be connected in driving relation with the rotatable tightening element, a rotatable input shaft, gearing connecting said shafts in driving relation, a one-way engaging device associated with one of said shafts and engageable when said shaft is rotated in a direction to unloosen said tightening element, and a lost motion stop mechanism connected with said one-way device for allowing predetermined rotation of said shaft in a direction to unloosen said tightening element and then being effective to stop further rotation in the unloosening direction.

4. In a wrench, the combination of a rotatable member adapted to be connected in driving relation with a rotatable tightening element, a one-way engaging device, and a lost motion mechanism, said one-way engaging device and said lost motion mechanism being connected in series so that said one-way device engages and cooperates with said lost motion mechanism to limit the rotation of said member to a predetermined rotation in one direction and said one-way device disengages to allow unlimited rotation of said rotatable member in the other direction.

5. In a wrench, the combination of a wrench casing, a shaft rotatably disposed in said casing and adapted to be connected in driving relation with a rotatable tightening element, a one-way engaging device, and a lost motion mechanism, said one-way device and said lost motion mechanism being connected in series so that said one-way device engages and cooperates with said lost motion mechanism to limit the rotation of said Shaft to a predetermined rotation in one direction and said one-way device disengages to allow unlimited rotation of said rotatable member in the other direction.

6. In a wrench, the combination of a rotatable shaft, a one-way clutch disposed on said shaft, a rotatable gear, a stationary stop member, a stop element carried by said gear and adapted to contact said stop member to limit the rotation of the gear to a predetermined part of a revolution, a second gear connected with said one-way clutch and driven thereby and in mesh with said first named gear so as to limit the rotation of said shaft to a predetermined rotation in a direction to engage said one-way clutch and said one-way clutch releasing for the opposite direction of rotation of said shaft.

7. In a wrench, the combination of a rotatable output shaft adapted to be connected in driving relation with a rotatable tightening element, a rotatable input shaft extending at an angle to said output shaft, first and second beveled gears providing a driving connection between said shafts, a one-way clutch on one of said shafts, a rotatable third gear, a stationary stop member, a stop element carried by said third gear and adapted to abut against said stop member to limit the rotation of said third gear, and a fourth gear connected with said one-way clutch to be driven thereby and in mesh with said third gear for limiting the rotation of said shafts in a direction to engage said one-way clutch releasing for the opposite direction of rotation of said shafts.

8. In a wrench, the combination of a wrench casing, an output shaft rotatably disposed in said casing and adapted to be connected in driving relation with a rotatable tightening element, an input shaft rotatably disposed in said casing at right angles to said output shaft, first and second beveled gears connecting said shafts for providing a driving connection therebetween, a third gear rotatably mounted in said casing, a stop bar carried by said casing, a pin carried by said third gear and adapted to abut said stop bar to limit the rotation of said third gear to a predetermined part of a revolution, a one-way clutch disposed on said output shaft and comprising inner and outer races, said outer race having a plurality of tilttable grippers disposed therebetween, said inner race being connected with said output shaft, and a fourth gear connected with said outer race and in mesh with said third gear so as to limit rota-
in the direction to engage said one-way clutch and said one-way clutch releasing for rotation of said output shaft in the opposite direction.

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