OVERLOAD RELEASE FOR TORQUE WRENCH

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Application March 30, 1954, Serial No. 419,755
5 Claims. (Cl. 192—150)

This invention relates to power tools, and more particularly to fluid operated torque wrenches.

Fig. 1 is a partial view taken on the line 1—1 of the invention to provide a power wrench construction which quickly and directly utilizes the rotary motion produced by a developed predetermined maximum torque to automatically shut down the motor.

Another object is to provide a wrench with a simplified spring adjusting mechanism for predetermining a desired torque.

A further object is to provide a wrench of simple and compact construction which affords a high degree of sensitivity of shut down to a predetermined torque.

Other objects will be pointed out in the following description of the accompanying drawings, which illustrate a preferred embodiment of the invention in which similar numerals refer to similar parts in the several views.

Fig. 1 is a side view, partly in section, of an angle torque wrench constructed in accordance with the practice of the invention.

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 1 looking in the direction of the arrows.

Fig. 4 is a partial view taken on the line 4—4 of Fig. 1 looking in the direction of the arrows, and

Fig. 5 is a cross-sectional view taken on the line 5—5 of Fig. 1 looking in the direction of the arrows.

Referring to Fig. 1 of the drawings, the invention is shown as applied to an angle wrench, although it could be applied to any other type of power wrench. The wrench shown is adapted to deliver torque to a wrench socket 20, which in this case is driven by a conventional air motor 21 operating through planetary gearing 22 a drive shaft 23, which rotates a socket holding spindle 24 through bevelled gearing 25. This mechanism is contained in a casing comprising a valve housing 26, a motor housing 27 and a shaft and gear housing 28.

More particularly, the motor 21 comprises a vanetype rotor 29 mounted on a shaft 30. The planetary gearing 22 comprises a sun gear 31 formed integrally with the motor shaft 30, two planet gears 32 mounted on pins 33 driven into a suitable spider formed at the motor end of the shaft 23, and a ring gear 34 integrally formed on the rear portion of a bore 35 in a spring carrier 36.

Although the spring carrier 36 is rotatably mounted on the shaft 23, it is the relatively stationary part of the planetary gear 22 and provides resistance so that the planet gears 32 cause the shaft 23 to rotate. However, when this resistance, to be described hereinafter, is overcome, the resulting motion of the spring carrier 36 is utilized to close a normally-open shut-down valve 37 to stop the motor 21.

For the purpose of spring carrier 36 is rotatably mounted on shaft 23 with a bushing 38 pressed into a forwardly projecting sleeve portion 39 of the spring carrier 36. A shoulder 40 thus formed on the spring carrier 36 contains an aperture 41, which receives the hooked end 42 of a helical torsion spring 43 encircling the shaft 23 and supported at its rear end (toward the motor) by the sleeve portion 39 of the spring carrier 36. The forward hooked end 44 of the spring 43 engages an aperture 45 in the rear shoulder 46 of a worm gear operated spring 47 rotatably mounted in a bore 48 of the gear housing 28.

Located transversely to the axis of shaft 23 is a worm 49 contained in a blind hole 50 and adapted to engage a worm gear 51 formed integrally with the forward end of the outer peripheral surface 52 of spring carrier 47.

Thus, it will be seen that suitable spring adjusting means is provided, whereby any desired resistance to rotation of the spring carrier 36 may be maintained. At the same time, the pre-adjusted torsion of spring 43 is utilized to hold the worm 49 against the bottom of hole 50. Likewise, the teeth on worm 49 are cut with the proper hand helix so that the spring torsion keeps the worm 49 at the bottom of hole 50, when the worm is turned to increase said spring torsion. For this purpose a hexagonal opening 53 is provided at the outer end of worm 49, permitting the insertion of a wrench.

In order to maintain such a predetermined torque resistance of spring carrier 36, two lug 54, located at diametrically opposite points and formed integrally with the rear surface 55 of the spring carrier 36, are provided to engage two matching abutments 56 interiorly mounted in the motor housing 27. As long as the torque transmitted through the planetary gearing remains less than that of the pre-adjusted spring 43, spring carrier 36 is held against the abutments 56. However, when the torque, due to the resistance of the wrench socket 26, exceeds this value, spring carrier 36 is caused to rotate away from abutments 56. This motion is utilized to automatically close the shut-down valve 37 to stop the motor.

To accomplish this, a notch 57 is provided in the rear portion of the outer peripheral surface 58 of spring carrier 36 to engage the hooked end 59 of a longitudinally extending control rod 60 mounted in the motor housing 27. Clamped to the rear end of rod 60 is a spring 61 adapted to depress a valve stem 62, thereby closing valve 37 and shutting off the flow of motive fluid through the suitably contained ports 63 and 64. Opposing the seating of valve stem 62, is a pre-compressed spring 65 located below the seating surface 66 on spring carrier 36.

The drive shaft 23 is supported at its motor end by the anti-friction bearing 67 mounted in motor housing 27 and at its forward end by the anti-friction bearing 68 in the gear housing 28. Suitably keyed to a reduced portion 69 of the forward end of shaft 23 and adjacent to bearing 68 is a bevelled gear 70 driving a mating bevelled gear 71 fixedly mounted to spindle 24, which is supported at right angles to shaft 23 by conventional anti-friction bearings 72 mounted in housing 28.

Before the wrench is put into operation, suitable torque resistance of spring carrier 36 is produced by adjusting the torsion of spring 43 by means of the worm 49. In order to predetermine a maximum desired torque resistance of spring carrier 36, a torque wrench of any well known construction may be connected to wrench socket 20 while the spring is adjusted. Thus the wrench is conditioned to produce any desired amount of tightening when the torque is tightened, since any torque encountered which exceeds the predetermined torque resistance of spring carrier 36 causes shut-down of the motor 21.

In operation, motor 21 is started by opening a manually-operated throttle valve (not shown), thereby admitting motive fluid from the supply source through the manually-open shut-off valve 37 to the motor 21. Since spring carrier 36 is now stationary, the motor torque is transmitted through the planet gears 32 to shaft 23 and thence
to spindle 24. When the nut being tightened has attained the required degree of tightness, the predetermined torque resistance of spring carrier 36 is overcome and the carrier 36 is caused to rotate away from abutments 56, thereby actuating control rod 60 to seat valve stem 62 and shut off the flow of motive fluid to motor 21. Upon stoppage of the motor, the wrench is removed from the nut. This allows spring 43 to return spring carrier 36 to its original position, at the same time permitting spring 65 to unseat valve 66 and reopen valve 37. It is understood that when the motor has been automatically shut down, the manually-operated throttle valve (not shown) will be closed by the operator before the wrench is put into subsequent operation.

Thus, it will be seen from the above described construction that the rotary motion of a simply adjusted torque is directly transmitted to the shut-down switch, thereby affording an efficient automatic shut-down mechanism with a high degree of sensitivity.

1 claim:

1. A torque wrench comprising a casing containing a motor, a shut-down valve for said motor, a drive shaft driven by said motor for rotating a spindle, gearing for transmitting torque from said motor to said drive shaft, said gearing including a ring gear rotated in one direction by a predetermined torque transmitted thereto from the drive shaft, an operative connection on the casing actuated by the ring gear when rotated in the aforementioned direction to close shut-down valve, a torsion spring encircling said drive shaft and connected at one end to the ring gear to prevent rotation thereof in the aforementioned direction below said predetermined torque, a valve actuated in response to a predetermined torque transmitted thereto from the drive shaft to close said shut-down valve, an adjustable spring carrier rotatable on the drive shaft and rotatably mounted in the casing, a normally stationary torsion spring encircling the drive shaft and freely disposed between the drive shaft and said casing, an abutment within the casing and engaging the ring gear for limiting rotation thereof caused by said spring in the direction opposite to the aforementioned direction.

2. A torque wrench comprising a casing containing a motor, a shut-down valve for said motor, a drive shaft driven by said motor and adapted to rotate a spindle, planetary gearing connecting the motor to said drive shaft, an operative connection on the casing actuated by the ring gear having a notch on the periphery thereof and rotated in one direction by a predetermined torque, a shut-down valve for said motor, said gearing including a ring gear engaging said operative connection and being rotatable on the drive shaft in one direction to actuate said operative connection in response to a predetermined torque transmitted thereto from the drive shaft to close said shut-down valve, and an abutment within the casing and engaging the ring gear for limiting rotation thereof caused by said spring in the direction opposite to the aforementioned direction.

3. A torque wrench comprising a casing containing a motor, a shut-down valve for said motor, a drive shaft driven by said motor for rotating a spindle, gearing for transmitting torque from said motor to said drive shaft, said gearing including a ring gear rotated in one direction by a predetermined torque transmitted thereto from the drive shaft, an operative connection on the casing actuated by the ring gear when rotated in the aforementioned direction to close said shut-down valve, a normally stationary torsion spring encircling said drive shaft and connected at one end to the ring gear to prevent rotation thereof in the aforementioned direction below said predetermined torque, a valve actuated in response to a predetermined torque transmitted thereto from the drive shaft to close said shut-down valve, an adjustable spring carrier rotatable on the drive shaft and rotatably mounted in the casing, a normally stationary torsion spring encircling the drive shaft and freely disposed between the drive shaft and said casing, an abutment within the casing and engaging the ring gear for limiting rotation thereof caused by said spring in the direction opposite to the aforementioned direction.

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