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Whitehouse

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[54] **POWER TOOL TORQUE INDICATING DEVICE**

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[52] **U.S. Cl.** ..... **73/136 A,** 73/139

[51] **Int. Cl.** **G011 3/04,** G011 5/24

[58] **Field of Search** .. 73/139, 136 A, 136 B, 136 C, 73/1 C, 88 F

[56] **References Cited**

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3,084,540	4/1963	Larkin	73/136 A
3,104,544	9/1963	Guiot	73/136 A
3,339,405	9/1967	McDowall	73/136 A
3,666,021	5/1972	Whitehouse	73/139 X

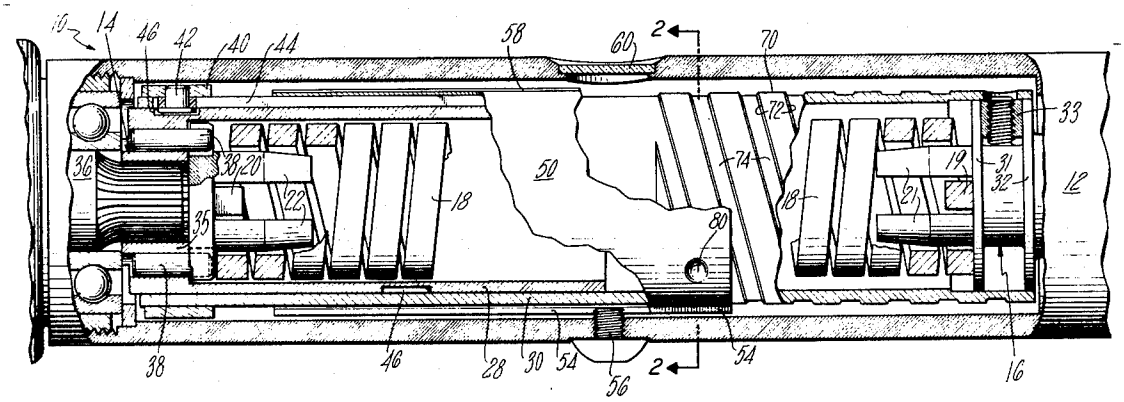
Primary Examiner—Charles A. Ruehl

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[57] **ABSTRACT**

A pneumatic power tool drive mechanism having coaxial drive and driven rotors and an intermediate torsion spring and relatively rotatable in accordance with the transmitted torque. A torque indicating device of the power tool comprises an axially reciprocable and non-rotatable torque scale operator actuated in one axial direction in accordance with the relative angular displacement of the drive and driven rotors to indicate the applied torque and urged in the opposite axial direction to reset the torque scale operator through the engagement of dimples on the torque scale operator with a helical cam on the driven rotor.

9 Claims, 3 Drawing Figures



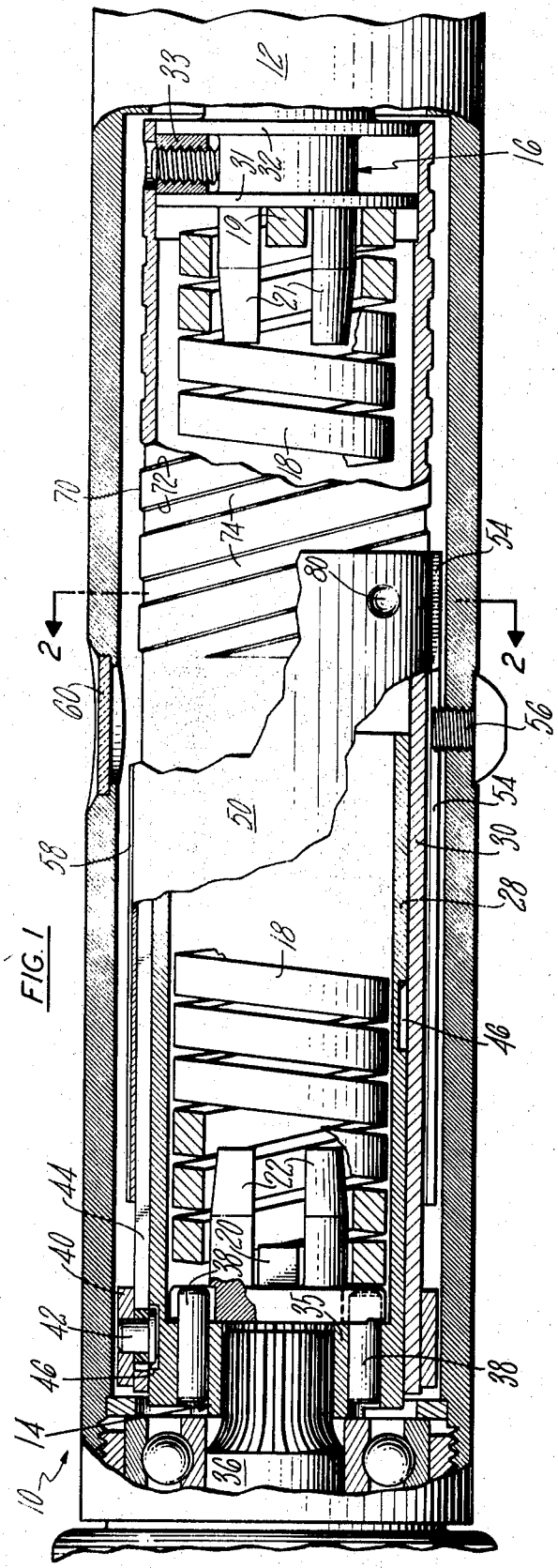


FIG. 1

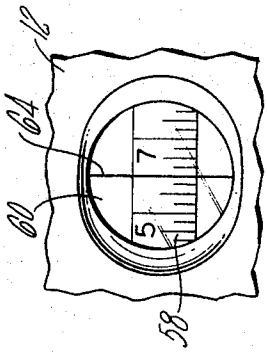


FIG. 3

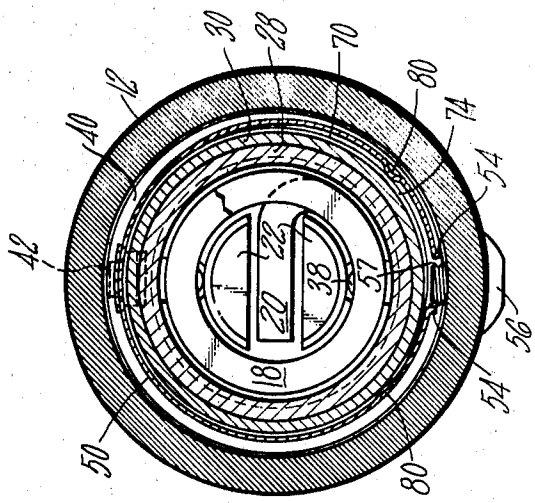


FIG. 2

POWER TOOL TORQUE INDICATING DEVICE

BRIEF SUMMARY OF THE INVENTION

The present invention relates generally to power tools for example of the type shown in my U.S. Pat. No. 3,666,021 dated May 30, 1972 and entitled "Power Tool Having Proportioning Transmission" and relates particularly to a new and improved power tool torque indicating device for indicating the applied torque of the power tool.

It is a principal aim of the present invention to provide a new and improved torque indicating device for a power tool for automatically indicating the applied torque of the power tool during the operation of the power tool.

It is another aim of the present invention to provide a new and improved torque indicating device for a power tool for setting fasteners or the like which registers the peak applied torque of a power tool operation and which is automatically reset to register the applied torque of a subsequent power tool operation.

It is a further aim of the present invention to provide a new and improved power tool torque indicating device capable of accurately and continuously indicating the torque being applied by the power tool during the operation of the tool and for indicating the peak applied torque after the power tool is deactivated.

Other objects will be in part obvious and in part pointed out in more detail hereinafter.

A better understanding of the invention will be obtained from the following detailed description and the accompanying drawing of an illustrative application of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a partial longitudinal view, partly in section and partly broken away, of a pneumatic power tool incorporating an embodiment of a torque indicating device of the present invention;

FIG. **2** is a transverse section view, partly broken away and partly in section, of the power tool taken substantially along line **2—2** of FIG. **1**; and

FIG. **3** is a partial longitudinal view, partly broken away, of the power tool showing an indicator of the torque indicating device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing in detail, there is shown in part a pneumatically driven power tool **10** of the type shown in the aforementioned U.S. Pat. No. 3,666,021. The power tool **10** is shown comprising an elongated housing **12** having a drive mechanism with a rotary drive rotor **14** rotatably mounted within the housing **12** and driven by a suitable air motor (not shown) in the counterclockwise direction as viewed in FIG. **2**, a rotary driven motor **16** rotatably mounted within the housing **12** coaxially with the drive rotor **14** and an intermediate generally helical torsion spring **18** interconnecting the rotary drive and driven rotors **14, 16.**

The helical torsion spring **18** provides for transmitting the drive torque from the drive rotor **14** to the driven rotor **16,** and for this purpose the radially inturned ends **19, 20** of the torsion spring **18** are received within slots in the bifurcated inner ends **21, 22** of the

rotors **14, 16** respectively. It can be seen therefore that the drive and driven rotors rotate generally together and that any angular displacement of the drive rotor **14** relative to the driven rotor **16** loads the torsion spring **18** and is directly proportional to the torque being transmitted through the drive mechanism. The drive torque is in turn a function of the rotational resistance or drag on the driven rotor **16.** Also, as fully explained in my U.S. Pat. No. 3,666,021, the static drive torque applied through the drive mechanism is a function of the static drive torque of the driving air motor (not shown); and the peak torque applied as the power tool is stalled, for example accompanying setting a fastener, may exceed the static drive torque due to an additional torque increment caused primarily by the inertia of the drive motor (not shown) of the power tool as the power tool is decelerated to a stall.

The drive and driven rotors **14, 16** have coaxial telescoping or interfitting tubular sleeves **28, 30** respectively. The driven rotor sleeve **30** is mounted upon axially spaced flanges **31, 32** of a spool portion of the driven rotor **16** and is secured for rotation therewith by a set screw operated wedge **33.** The drive rotor sleeve **28** has an inner hub **35** mounted on the splined end of a drive shaft **36** of the drive rotor **14,** and the bifurcated inner end **22** of the drive rotor **14** is keyed to the hub **35** of the sleeve **28** by pins **38** such that the sleeve **28,** shaft **36** and bifurcated end **22** rotate together. Also, as can be seen in the drawing, the driven rotor sleeve **30** extends substantially to the opposite end of the drive rotor sleeve **28** such that the sleeves, though relatively rotatable, provide mutual support.

An actuating slide or collar **40** is mounted on the driven rotor sleeve **30** for rotation with the sleeve **30** and for axial movement along the sleeve **30.** A follower **42** is mounted on the inside of the collar **40** for receipt within an axial slot **44** in the driven rotor sleeve **30** and an outer helical groove **46** in the drive rotor sleeve **28.** Accordingly, the collar **40** is adapted to be axially shifted from its normal position shown in FIG. **1,** to the right as shown in FIG. **1,** in proportion to the relative angular displacement of the drive and driven rotors **14, 16** and therefore in accordance with the torque transmitted through the drive mechanism.

A generally C-shaped sheet metal indicator slide or operator **50** is mounted on the outer sleeve **30** to be actuated in one axial direction, to the right as shown in FIG. **1,** by the collar **40.** The circumferential ends of the C-shaped indicator slide **50** are formed to provide outturned edges or lips **54,** and a screw **56** is mounted on the housing **12** to extend into the slot **57** formed between the edges **54** to prevent rotation of the indicator slide **50** while permitting the indicator slide **50** to move axially back and forth within the housing **12.** A torque scale **58,** which for example may be a suitable decal, is mounted on the indicator slide **50** in alignment with a window **60** in the housing **12** and such that the scale may be readily read with a cross hair **64** of the window **60.** The torque scale **58** is preferably calibrated to give a direct reading of the applied torque (e.g., in ft., lbs.) at the output end (not shown) of the pneumatic power tool.

It can be seen that as the indicator slide **50** is actuated in only one axial direction by the collar **40,** to the right as seen in FIG. **1,** the torque scale will provide a reading of the peak applied torque as for example when the power tool is stalled when setting fasteners. Typi-

cally, when the power tool is stalled when setting fasteners, the power tool is thereafter deactivated (by closing a valve, not shown, to disconnect the air pressure source from the pneumatic drive motor) while it is still connected to the fastener and such that the torsion spring is unwound or unloaded by rotating the drive rotor **16** backwards, in the clockwise direction as viewed in FIG. **2**, until the torsion spring returns to its normal or unloaded condition. The power tool is then removed from the fastener. As a result, the collar **40** returns to its normal position shown in FIG. **1**, and the torque scale operator **50** remains in its displaced position, for example as shown in FIG. **1**, so that the torque scale continues to register the peak applied torque of the prior power tool operation, for example as shown in FIG. **3**.

The driven rotor sleeve **30** is formed with an external helical land or thread **70** having tapered lateral edges **72** and defining an intermediate helical groove **74**. The indicator slide **50** is formed with a pair of cooperating generally radially inwardly projecting dimples **80** which are adapted to ride within the groove **74**, and for this purpose the indicator slide **50** is formed to grip the helical land **70** lightly like a leaf spring. The helical land **70** functions as a helical cam and the dimples **80** function as cam followers engageable with the helical cam to urge the indicator slide **50** to the left as shown in FIG. **1** to return the indicator slide **50** to its zero or normal position. The dimples **80** are preferably provided relatively close to the circumferential ends of the slide **50** and such that the circumferential ends of the slide **50** can flex outwardly slightly to permit the dimples **80** to ride over the land **70**. Accordingly, the indicator slide **50** can be positively actuated to the right as seen in FIG. **1** by the collar **40** notwithstanding any opposing bias on the slide **50** by the cam **70**. The land **70** preferably extends axially only as far as is necessary to return the indicator slide **50** to its normal or zero position and such that the dimples **80** remain out of engagement with the land **70** with the indicator operator **50** in its zero position.

Accordingly, the dimples **80** and helical cam **70** cooperate to urge the indicator slide **50** to the left as seen in FIG. **1** while the driven rotor **16** is rotating and at any time the indicator operator is axially displaced from its zero position. Thus, the torque scale **58** will continuously provide for registering the existing applied torque as long as the driven rotor **16** is rotating. When tool stall occurs the return bias provided by the cam **70** and dimples **80** is deactivated and the indicator slide **50** will be effective in indicating any peak applied torque accompanying power tool stall. Thus, as previously described where for example the power tool is used for setting fasteners and the power tool is deactivated before it is removed from the fastener, the torque scale will continue to register the peak applied torque of the prior power tool operation. When the power tool is subsequently reactivated, the indicator slide **50** is automatically reset into engagement with the collar **40** to return the indicator slide **50** to zero or to register the then existing applied torque, as the case may be.

As will be apparent to persons skilled in the art, various modifications, adaptations and variations of the foregoing specific disclosure can be made without departing from the teachings of the present invention.

I claim:

1. In a power tool having a rotary drive mechanism with generally coaxial rotary drive and driven members and intermediate torque transmitting means interconnecting the rotary drive and driven members and permitting relative angular displacement thereof in accordance with the torque being transmitted therethrough, a torque indicating device comprising torque indicating means operable for indicating torque, a torque indicator operator for operating the indicating means, the torque indicator operator being reciprocably mounted in association with the drive mechanism for movement in one direction for increasing the torque indication and for movement in the opposite direction for decreasing the torque indication, first actuator means for actuating the torque indicator operator in said one direction in accordance with said relative angular displacement of the rotary drive and driven members for indicating the torque transmitted through the drive mechanism, and second actuator means operable by the rotation of one of the rotary members for actuating the torque indicator operator in the opposite direction when the indicated torque is greater than the transmitted torque.

2. A power tool according to claim **1** wherein the rotary drive and driven members respectively comprise coaxial portions in telescoped relation, and wherein the first actuator means comprises an axially reciprocable slide for actuating the indicator operator in said one direction, and means for axially shifting the slide back and forth in accordance with the relative angular displacement of the rotary drive and driven members.

3. A power tool according to claim **1** wherein the torque indicator operator is mounted for movement generally parallel to the axis of rotation of the rotary drive and driven members and wherein the second actuator means comprises cam means and follower means interconnecting the indicator operator and said one rotary member and operable to urge the indicator operator in its said opposite direction upon said rotation of said one rotary member.

4. A power tool according to claim **3** wherein said one rotary member has said cam means and the indicator operator has said follower means.

5. A power tool according to claim **4** wherein the indicator operator has at least one projection providing said follower means and engageable by the cam means of said one rotary member to urge the indicator operator in its said opposite direction.

6. A power tool according to claim **4** wherein the indicator operator comprises a generally C-shaped member partially surrounding said one rotary member and the follower means is provided adjacent at least one circumferential end of the C-shaped member.

7. A power tool according to claim **1** wherein said one rotary member is the driven rotary member.

8. In a power tool having an elongated housing with an indicator window therein, a rotary drive mechanism mounted within the housing having longitudinally spaced generally coaxial rotary drive and driven members and intermediate torque transmitting means comprising spring means interconnecting the rotary drive and driven members, a torque indicating device comprising a torque indicator mounted for axial reciprocable movement within the housing in operative alignment with the indicator window, actuator means for shifting the torque indicator in one axial direction in proportion to the relative angular displacement of the

drive and driven members for indicating the torque being transmitted through the drive mechanism, and torque indicator return means interconnecting the torque indicator and one of the rotary members and operable by the rotation of said one rotary member for shifting the torque indicator in the opposite axial direction.

9. A power tool according to claim **8** wherein the indicator return means is operable by the rotation of said one rotary member for biasing the torque indicator in said opposite axial direction and wherein said actuator means is operable to shift the torque indicator in said one axial direction against the bias of the indicator return means.

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