

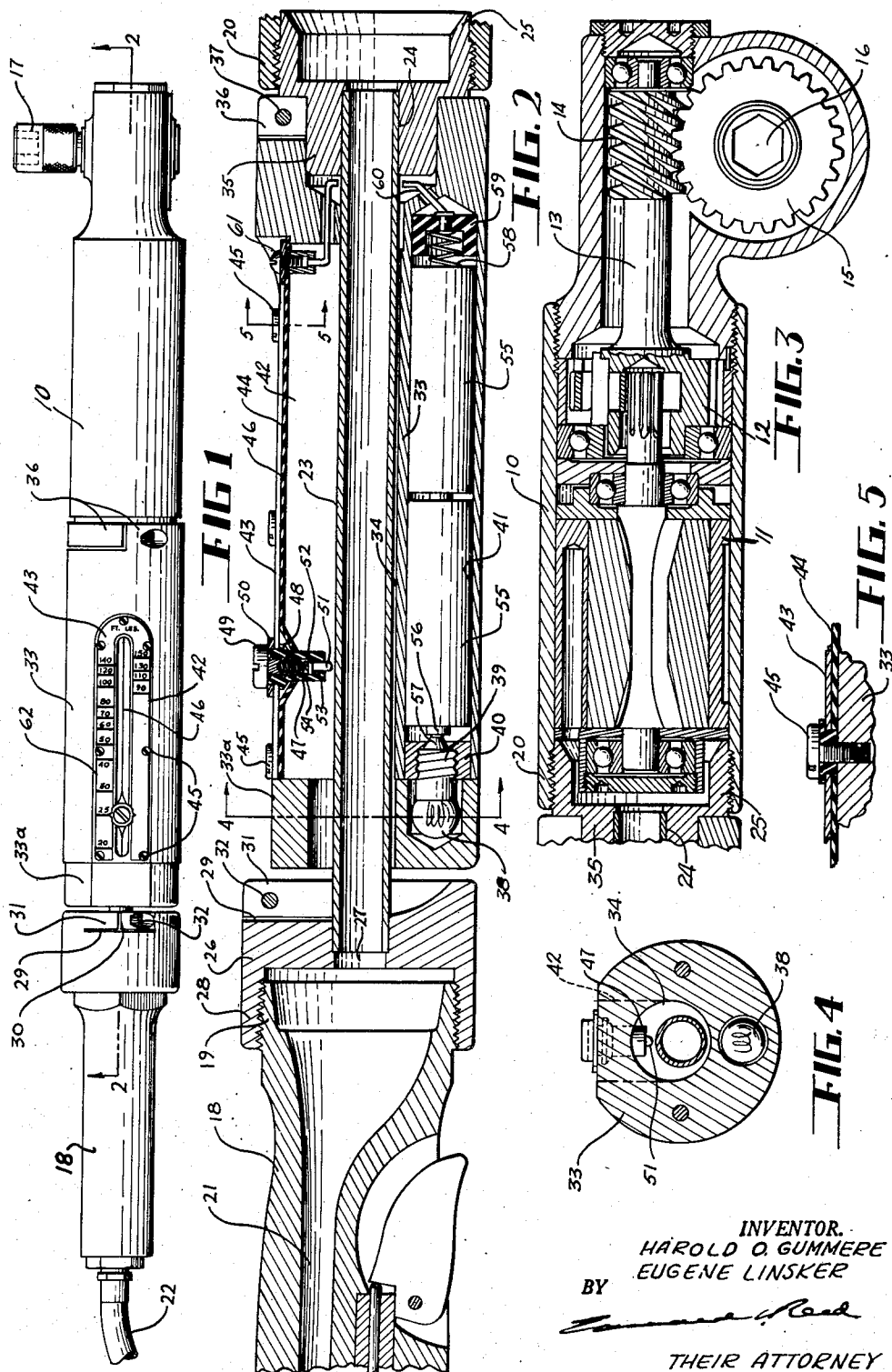
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TORQUE INDICATING POWER OPERATED TOOL

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TORQUE INDICATING POWER OPERATED
TOOL

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This invention relates to a torque indicating power operated tool.

The invention is designed primarily for use in a motor operated wrench of the type in which the motor stalls when the resistance to the rotation of the nut exceeds the power of the motor. Usually the power of the motor of such a wrench is such that it will stall before the nut has been set to the desired tightness and the operator then actuates the wrench manually to further tighten the nut until he believes it to be set to the desired tightness. It is customary for an inspector to thereafter test the nuts which have been so set by applying thereto a torque wrench and to manually tighten such nuts as are not sufficiently tight.

One object of the invention is to provide a power wrench having within itself means whereby the tightness of the nut may be ascertained and the proper tightness thereof assured before the wrench is removed from the nut, without the use of a separate device.

To this end a further object of the invention is to embody a torque testing device in a power wrench.

A further object of the invention is to provide a power wrench with torque testing means including an indicator which will operate only when the nut has been set to the desired tightness.

A further object of the invention is to provide a torque testing mechanism which can be embodied in a power wrench of a known construction without material modification of the nut running mechanism of the latter.

A further object of the invention is to provide such a torque indicating power wrench which is of simple but strong construction and efficient in operation.

Other objects of the invention may appear as the device is described in detail.

In the accompanying drawings Fig. 1 is a side elevation of a wrench embodying the invention; Fig. 2 is a longitudinal sectional view taken on the line 2—2 of Fig. 1 through the torque indicating mechanism and a portion of the handle; Fig. 3 is a section taken on the same line through the motor driven mechanism; Fig. 4 is a section taken on the line 4—4 of Fig. 2; and Fig. 5 is a section taken on the line 5—5 of Fig. 2.

In these drawings we have illustrated one embodiment of the invention and have shown the same as embodied in a power wrench of a known type, but it is to be understood that the invention may take various forms and may be em-

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bodied in wrenches or other power operated tools of various kinds without departing from the spirit of the invention.

The power wrench per se, in which the torque testing mechanism is embodied, is of a known construction and comprises a tubular supporting structure 10 in which is mounted a fluid operated motor 11 which is connected through planetary gearing 12 with a shaft 13. A worm 14 carried by the shaft 13 meshes with a worm gear 15 secured to a shaft 16, to the lower end of which is attached a work engaging member 17, in the present instance a socket member to engage the nut which is to be set. The power wrench further includes a handle 18 which is normally connected with the supporting structure 10 by inserting the screw threaded forward end portion 19 of the handle in the screw threaded rear portion 20 of the supporting structure. The handle is provided with a fluid passage 21 communicating with the fluid operated motor and adapted to be connected with a source of fluid under pressure, as by a flexible hose 22.

In the present embodiment of the invention the torque testing mechanism has been interposed between the supporting structure 10 and the handle 18. This mechanism may take various forms and may be connected with the two parts of the power wrench in various ways but preferably it comprises an elongate member or rod 23 which is connected with the rear end of the supporting structure 10, extends rearwardly therefrom and is connected at its rear end with the handle 18. When, as in the present instance, the invention is embodied in a fluid operated wrench the rod 23 is preferably provided with a longitudinal passage through which fluid may flow from the passage in the handle to the motor, and the rod is here shown as a tubular element. The rod is of a relatively stiff construction but is flexible by force applied to the rear end thereof. The rod may be connected with the supporting structure 10 in any suitable manner and is here shown as tightly seated in a socket 24 forming a part of a connecting member 25 which is screwed into the threaded portion 20 of the supporting structure. Likewise the rear portion of that rod may be connected with the handle 18 in various ways. In the present instance it is mounted in a connecting member or head 26 having an opening 27 into which the rear end of the rod extends and having a rearwardly extending flange 28 to receive the threaded forward portion 19 of the handle. The rod may be secured to the head 26 in any suitable manner, as

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by forming in the head a transverse cut 29 and a longitudinal cut 30 to form clamping members 31 which are drawn into clamping engagement with the rod by a screw 32. It will be noted that the threaded end 19 of the handle 18 is received in rearwardly extending flange 28 in the same manner that the forward end of the connecting member 25 is received in rear portion 20 of supporting structure 10. This construction makes it possible for the removal of handle 18 from the supporting structure 20 and the insertion of the indicator therebetween so that the device is applicable to existing tools, and thus tools may be used with and without the device of the present invention.

The rod may be flexed by a force applied thereby by the handle 18, this handle being supported wholly by the rod and being movable transversely to the rod to flex the latter, and an indicator is associated with the rod and provided with a part arranged in the path of the flexing movement of the rod and spaced from the rod when the latter is in its normal straight position. The indicator may be of any suitable character and the indication may be either visible or audible. Preferably the indicator comprises an indicating element and an adjustable controlling device therefor, this controlling device being supported in the path of the flexible rod as above mentioned. The indicator is supported by the supporting structure 10 and may be connected therewith in any suitable manner. In the present instance a casing 33 extends about the rod between the supporting structure and the handle, and is here shown as having an axial opening or bore 34 through which the flexible element or rod 23 extends and which is of such a character that the rod may flex therein. Preferably the casing is provided with an elongate slot 42 into which the free end portion of the rod may extend when the rod is flexed and which confines the movement of the rod to the desired plane. The casing may be rigidly attached to the supporting structure by providing the same at its forward end with an axial recess to receive a boss 35 on the connecting member 25 in which the socket 24 is formed. In the arrangement shown it is secured to the boss by providing it with clamping members 36 formed in the same manner as the clamping fingers 31 and drawn into clamping engagement with the boss by a screw 37. Preferably the indicator is electrically operated and the indicating element is shown as a small electric lamp 38, the base 39 of which is screwed into and has electrical contact with a socket 40 mounted in the rear end portion of a second longitudinal bore 41 in the body of the casing. The lamp may extend beyond the casing or the latter may have an opening through which the light passes, but preferably the casing is provided with an end portion or cap 33a formed of translucent, and usually transparent, material, said cap having a recess to receive the lamp. Thus the lamp is protected against injury in the handling of the wrench while permitting the light therefrom to be seen by the operator in various positions with relation to the wrench. The controlling device for the indicating element, which in the present instance is a circuit closing device, is mounted on the casing and is preferably adjustable lengthwise of the casing. For this purpose the casing is provided with a guide extending lengthwise thereof and on which the controlling device is movably sup-

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ported. In the present arrangement the guide comprises a metallic plate 43 extending lengthwise of and across the slot 42 in the casing, insulated from the casing by a layer of insulating material, as shown at 44, and secured to the casing by insulated screws 45, as shown in Fig. 5. The guide plate 43 is provided with a longitudinal slot 46 in which the controlling device is adjustably mounted. As here shown the controlling device comprises a tubular member 47 extending through the slot and having a shoulder 48 spaced from the outer end thereof to engage the inner side of the plate and having its outer end provided with an internal screw thread 15 to receive a headed screw 49 by means of which the controlling device may be secured in adjusted positions lengthwise of the casing, a washer 50 being preferably interposed between the head of the screw and the guide plate. A contact member 51 is supported by and extends inwardly from the inner end of the tubular member 47 and is here shown as a stud having a head 52 to engage a shoulder 53 within the tubular member and thus limit the inward movement of the stud. 20 The stud is held normally in its extended position by a spring 54 and when in this position it is spaced an exact distance from the unflexed rod in all adjustments thereof lengthwise of the rod, the guide plate being parallel with the rod. 30 The spring 54 permits the stud to yield in the event the flexing movement of the rod is continued after it has engaged the stud. Current is supplied to the indicator by a battery supported within the casing and here shown as comprising a plurality of dry cells 55 in the second bore 41 of the casing. The rear terminal 56 of the battery contacts a second terminal 57 of the lamp 38. The front terminal of the battery is connected by a spring 58 with a conducting member 59 mounted in the bore 41 and connected by a conductor 60 and a screw 61 with the conducting guide plate. Thus one side of the circuit is grounded on the casing and the rod 23 being electrically connected with the casing forms a part of the circuit. 45 When the rod is flexed into engagement with the contact member of the indicator controlling device the current flows from the battery through the conductor 60, the guide plate 43, controlling member 47, rod 23, casing 33 and socket 40 to the lamp and from the lamp through the terminals 57 and 56 to the battery.

In the operation of the torque indicating power wrench the handle 18 is grasped in the hand of the operator, the work engaging member 17 is placed about the nut which is to be set and fluid is admitted to the motor to operate the latter and to run the nut toward its seat. When the resistance to the rotation of the nut becomes greater than the power of the motor, the motor stalls. 55 Upon the stalling of the motor the reaction thereof tends to move the wrench about the axis of the nut engaging member in a direction opposite the direction in which the latter is rotated by the motor, this movement being resisted by the operator who grasps the handle 18. Prior to the operation of the wrench the indicator controlling device is adjusted along the guide plate to an indication corresponding to the value of the torque required to set the nut with the required tightness, this value being preferably indicated in foot pounds, as shown at 62 in Fig. 1. When the motor stalls the operator manually actuates the wrench to further tighten the nut and the torque in- 70 creases as the resistance to the rotation of the

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nut increases until the rod flexes sufficiently to engage the contact member 51 and operate the indicator, that is illuminate the lamp 38, and the operator then knows that the nut has been set with the desired tightness. It will be obvious that the greater the torque required to completely set the nut the greater will be the flexing of the rod and that the distances which successive portions of the rod are moved by the flexing thereof decreases progressively from the rear portion of the rod toward the forward end thereof. Thus by positioning the contact member at a fixed distance from the rod and adjusting the same in a path parallel with the rod it can be adjusted to indicate a torque of any selected value within the range of the apparatus.

While we have shown and described one embodiment of our invention we wish it to be understood that we do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, power means connected to said structure at one end for rotating said work engaging member with relation to said structure and having an overhanging end opposite said connected end, manually operable handle means connected to said overhanging end for rotating said structure and said work engaging member about the axis of said member when the power of said power means is insufficient to rotate said member, and means carried by said handle means for indicating the value of the rotative force asserted thereby on said work engaging member.

2. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, power means connected to said structure and located adjacent said work engaging member for rotating said work engaging member with relation to said structure, manually operable handle means connected to said power means on the side remote from said work engaging member for rotating said work engaging member and said structure about the axis of said movable member when the power of said power means is insufficient to impart further rotation to said work engaging member, said manually operable handle means including a normally stationary element having supporting connection with said structure and having a part movable with relation to said structure by force applied to said work engaging member by said manually operable handle means, and an indicator operable by said movable part of said element when the force applied to said work engaging member is of a predetermined value.

3. A power operated tool as defined in claim 2 including means for adjusting said indicator for operation by the movement of said part of said element to a selected one of a plurality of positions.

4. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a fluid motor carried by said structure and drivingly connected with said work engaging member to rotate said member with relation to said structure, a rod forming a fluid flow conduit connected at one end with said structure and having at the other end thereof means for preventing the movement of said rod and said structure by the reaction of said motor

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when the rotation of said work engaging member by said motor has been interrupted, a handle for applying force to the free end of said rod and said structure in a direction to rotate said work engaging member in the direction in which it was rotated by said motor, said rod being flexible by force so applied thereto, an indicator adjacent said rod and operable by the flexing of said rod when the force applied thereto is of a predetermined value, and means for connecting a fluid supply to said handle for delivery through said rod to said motor.

5. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a fluid operated motor carried by said structure and drivingly connected with said work engaging member, a tubular member secured at one end to said structure, extending rearwardly therefrom and communicating at its forward end with said motor, a handle secured to the rear portion of said tubular element, said tubular element being operable by said handle to move said structure and said work engaging member about the axis of said member when the rotation of said member by said motor has been interrupted, said handle having a fluid passage communicating with said tubular element and adapted to be connected with a source of fluid under pressure, said tubular element being flexible by force supplied thereto, and an indicator supported by said structure and controlled by the flexing of said tubular element.

6. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a fluid operated motor carried by said structure and drivingly connected with said work engaging member, a tubular member secured at one end to said structure, extending rearwardly therefrom and communicating at its forward end with said motor, a handle secured to the rear portion of said tubular element, said tubular element being operable by said handle to move said structure and said work engaging member about the axis of said member when the rotation of said member by said motor has been interrupted, said handle having a fluid passage communicating with said tubular element and adapted to be connected with a source of fluid under pressure, said tubular element being flexible by force supplied thereto, and an electrically operated indicator supported by said structure and including a contact member spaced from said tubular element in the path of the flexing movement of the latter.

7. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a motor carried by said structure and drivingly connected with said work engaging member, a rod secured at one end to said structure and extending rearwardly therefrom, a handle secured to the rear portion of said rod and operable to impart movement to said structure and said work engaging member about the axis of said member when the rotation of said member by said motor has been interrupted, said rod being flexible by force applied thereto by said handle, a casing extending about said rod between said structure and said handle and supported by said structure, an electrically operated indicator carried by said casing and including an indicating element and a circuit closing device adjustably supported on said casing and having a contact member spaced from said rod in the path of the flexing movement thereof, a battery in said casing, and electric connections

between said indicating element, said contact member and said battery.

8. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a motor carried by said structure and drivingly connected with said work engaging member, a rod secured at one end to said structure and extending rearwardly therefrom, a handle secured to the rear portion of said rod and operable to impart movement to said structure and said work engaging member about the axis of said member when the rotation of said member by said motor has been interrupted, said rod being flexible by force applied thereto by said handle plus a metallic casing supported by said structure and extending about said rod between said structure and said handle, a metallic guide carried by and insulated from said casing, an indicating element supported by said casing and having one terminal grounded thereon, a contact member supported by said guide in spaced relation to and in the path of the flexing movement of said rod and electrically connected with said guide, a battery in said casing having one terminal in contact with the second terminal of said indicating element, and a conductor connecting the other terminal of said battery with said guide.

9. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, a fluid operated motor carried by said structure and drivingly connected with said work engaging member, a tubular element secured at one end to said structure, extending rearwardly therefrom and communicating at its forward end with said motor, a handle secured to the rear portion of said tubular element and operable to rotate said work engaging member when the rotation thereof by said motor has been interrupted, said handle having a fluid passage communicating with said tubular element and adapted to be connected with a source of fluid under pressure, said tubular element being flexible by force applied thereto, a casing supported by said structure between the same and said handle, said casing comprising an elongate metallic structure having a longitudinal bore through which said tubular element extends and in which said tubular element may have flexing movement, said elongate structure having a second longitudinal bore, a metallic guide member supported by and insulated from said elongate structure, an electric indicating element supported on said elongate structure with one terminal electrically connected therewith, a contact member supported by said guide member in spaced relation to and in the path of flexing movement of said tubular element and electrically connected therewith, a contact member supported by said guide member in spaced relation to and in the path of flexing movement of said tubular element and electrically connected with said guide member, a battery in said sec-

ond bore having one terminal thereof in contact with the second terminal of said indicating element, and a conductor connecting the second terminal of said battery with said guide member.

10. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, power means carried by said structure and permanently connected for driving said work engaging member, said structure having a socket at one end thereof, a handle detachably securable to said socket for manually rotating said structure and said work engaging member about the axis of said member when the power required to rotate said work engaging member exceeds the power of said power means, and a torque indicating device insertable between said handle and said socket for transmitting the manual rotating force of said handle and providing an indication of the amount thereof.

11. In a power operated tool, a supporting structure, a rotatable work engaging member carried by said structure, fluid power means carried by said structure and having a driving end for driving said work engaging member, said structure having a socket adjacent the end of said power means opposite said driving end and having means for receiving a fluid flow for operating said power means, a handle detachably securable to said socket for manually rotating said structure and said work engaging member about the axis of said member when the power required to rotate said work engaging member exceeds the power of said power means, means on said handle for connection to a fluid supply, torque indicating means providing an indication of the amount of force applied manually to said work engaging member, a casing for receiving and supporting said torque indicating means, means in said casing for transmitting a fluid flow therethrough, and means for detachably receiving and supporting said casing in manual force transmitting and indicating relation between said handle and said socket and for transmitting said fluid flow therethrough.

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