

Aug. 14, 1934.

C. A. MILLER

1,970,179

POWER WRENCH

Filed Feb. 10, 1933

Fig. 1.

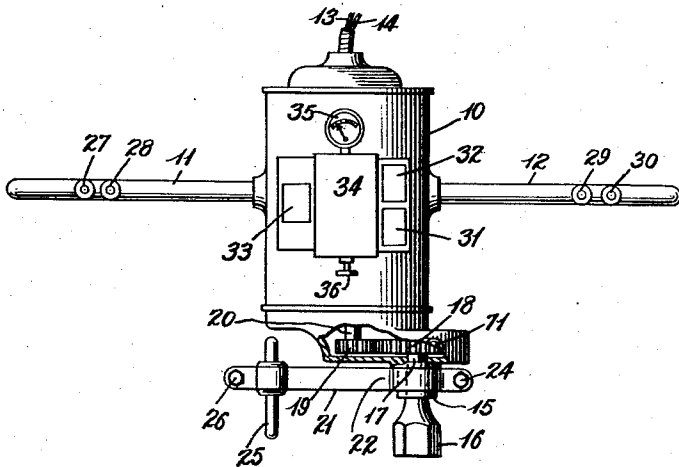


Fig. 2.

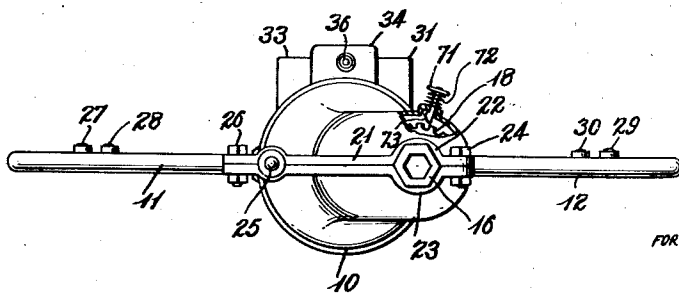
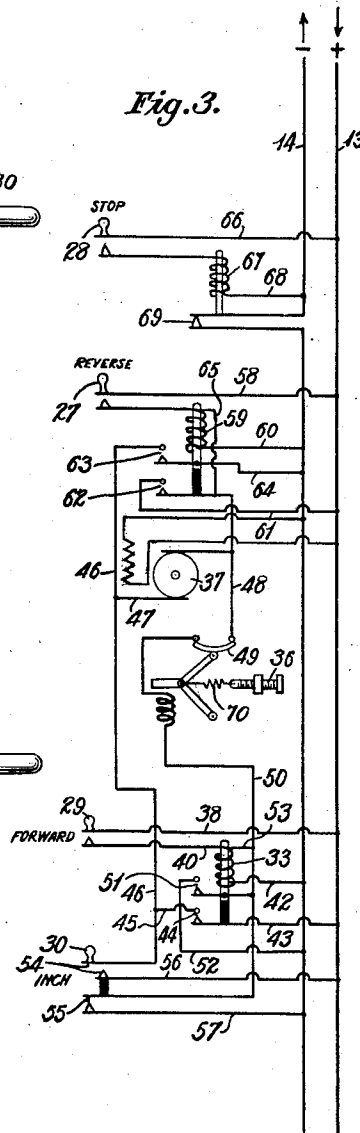


Fig. 3.



Inventor
Charles A. Miller

By *Brown & Phelps*
Attorneys

UNITED STATES PATENT OFFICE

1,970,179

POWER WRENCH

Charles A. Miller, Weatherly, Pa.

Application February 10, 1933, Serial No. 656,177

3 Claims. (Cl. 81-57)

The invention relates to power wrench apparatus and has as an object the provision of an electrically driven and controlled power wrench for tightening or removing nuts.

5 It is an object of the invention to provide a power wrench which may be controlled to tighten nuts to a predetermined degree of stress upon the bolts.

10 It is a further object of the invention to provide a power wrench which will tighten nuts to a predetermined degree of stress and having means to vary the degree of this stress in accordance with the size of the bolt for the service required.

15 It is a further object of the invention to provide an apparatus having means to tighten or remove nuts and means to provide slight motion of revolution of the wrench member so as to be applicable to the nut.

20 It is a further object of the invention to provide a new process of tightening nuts to predetermined degrees of stress.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawing showing an illustrative embodiment of the invention, and wherein:—

- Fig. 1 is a plan view;
Fig. 2 is an end view; and
Fig. 3 is a diagram of circuits.

30 As shown the device comprises a casing 10 housing an electric motor preferably of reversible type operated by direct current. To manipulate the wrench, the casing is shown as provided with handles 11, 12 which are preferably hollow for a reason to be described. Supply wires 13, 14 may be contained in a cable leading into the casing preferably at the end thereof as shown. A bearing 15 is shown rigid with the motor casing in which is revolvably mounted a wrench member 16 upon a shaft 17 carrying a gear 18 in mesh with a gear 19 upon the motor shaft 20. The gears 18, 19 are preferably formed so as to provide a reduction of the speed at which the wrench may be turned relative to the speed of the motor shaft 20.

To react against the torque of the wrench applied to a nut, there is shown an adjustable stop member comprising an arm 21 preferably formed in halves having portions 22, 23 that may be clamped upon the bearing 15 by means of a bolt 24 to make the arm rigid with the casing. The arm is shown as carrying a projecting member 25 which also may be clamped between the halves of the arm 21 as by means of a bolt

26, whereby the projection of the member 25 from the arm may be varied in accordance with requirements.

When the wrench 16 is applied to a nut, the projection 25 may bear against the structure upon which the nut is being applied so as to prevent rotation of the wrench against the torque applied to the nut.

For control of the motor the electric connections include switches which may be of the ordinary push button type and which for convenience are shown as applied to the arms 11, 12. A switch 27 may be connected to provide forward movement of the motor in a tightening direction of the nut, a switch 28 for adjustment of the wrench member or to "inch" the motor, switch 29, which may be utilized to stop the motor when being used to unscrew nuts, and a switch 30 for reversal of the motor to turn the same in the direction to remove nuts.

There are also shown diagrammatically in Figure 1 casings carried upon the motor casing to house relay switches 31, 32, 33, and a casing for an overload switch 34 having projecting therefrom an ammeter 35 and an adjusting screw 36.

The circuits shown in Fig. 3 comprise the power wires 13, 14, the motor being shown diagrammatically at 37. To drive the wrench in the forward or tightening direction, the switch 29 may be closed providing a circuit through wires 13, 38, switch 29, wire 40, solenoid 33, and wire 42 to wire 14. The core of the solenoid being drawn up, the circuit is closed from wire 13 through wire 43, contacts 44, wires 45, 46, to brush 47, motor 37, wire 48, overload switch 49, wire 50, contacts 51, wire 52, to wire 14, at the same time providing a hold-up circuit through solenoid 41 by connection thereof to wire 50 by means of wire 53. The motor will therefore be revolved in a direction to tighten the nut until the load upon the motor due to the tightening stress reaches the amperage for which the overload switch is set, whereupon this switch will open the circuit to stop the motor and to allow the core of solenoid 41 to fall back, thereby breaking the circuits at contacts 44, 51.

If the wrench member is not in proper position of revolution for application to the nut, closure of switch 30 will close the contacts 54, 55, close a shunt about the switch 29 and through the motor from wire 46 through switch 30, contacts 54, and wire 56 to wire 13 and through wire 50, contacts 55, wire 57 to wire 14, thus causing

the motor to operate while the switch is held closed.

In the application of the invention to tightening fish plate bolts upon a railway, I have found that a two-horse power motor is sufficient and that the current to such a motor for the purpose of this "inching" may be controlled by a simple push button type of switch.

To revolve the motor in a direction to unscrew nuts, automatic stopping of the motor is of no interest. The circuit shown for producing this direction of revolution of the motor comprises for starting the motor, wire 58, switch 27, solenoid 59, and wire 60 to wire 14. The core of solenoid 59 being drawn up closes a circuit from wire 13 through wire 61, contacts 62, wire 48, motor 37, wire 46, contacts 63, wire 64, to wire 14. When contacts 63 are closed, a hold-up circuit is applied to solenoid 59 by connection of the solenoid to one of the contacts 62 by wire 65.

To stop the motor when the nut has been completely removed, switch 28 may be closed providing a circuit from wire 13 through wire 66, switch 28, solenoid 67, wire 68, to wire 14, drawing the core of solenoid 67 up and opening the circuit through wire 14 by operation of contacts 69.

The amperage at which the overload switch 49 will open may be set by adjustment of spring 70 by means of a set screw 36.

While I have shown the relays and the overload switch carried upon the motor casing in Figure 1 for the purpose of providing a self-contained tool that may be operated as readily as an electric drill, yet it will be understood that the relay switches and the overload switch may be mounted upon a switchboard at a position remote from the wrench itself and this arrangement has been applied and found convenient in the construction of a fish plate bolt tightening arrangement for use upon railways.

When the wrench is to be used for removing a nut, initial loosening of the nut by means of the motor would apply a severe load to the motor. To enable the nut to be initially loosened by power of the user applied to the handles 11, 12, I have indicated a dog 71 carried upon the gear casing and having an end which may be pressed into engagement with one of the gear teeth of gear 18. The dog 71 is shown as held normally out of engagement with the gear teeth by means of spring 72. To loosen a nut, the dog may be pressed into contact with the gear and strain applied to the handles which will hold the dog into contact until the nut is loosened whereupon the switch 27 may be closed and the gear started into revolution, which revolution by cam action against the surface 73 of the dog will throw the same out of the path of movement of the gear teeth where it will be held by the spring 72.

It will be noted that by the use of hollow handles 11 and 12, the wires to the push buttons carried by the handles may be located inside the handles so as to have all the circuits enclosed and protected.

I am aware that power wrenches have been constructed which transmit power from the power means to the wrench element by means of friction clutches, the slipping of the clutch when the nut has been tightened to the desired

degree being depended upon for preventing over-tightening of the nut. Such devices have the defect that the slippage of the clutch is a very variable matter, depending upon the condition of the friction surfaces and is modified by wear, atmospheric conditions and many other elements which render that type of device unsatisfactory in use. By the present invention, such inaccuracy and irregular results are entirely obviated.

It is found that with a two-horse power motor geared for reduction of substantially twenty to one, and with the overload switch set at 25 amperes, a stress of substantially thirty-six thousand pounds is produced upon the nuts ordinarily used upon fish plates upon railways. By the use of the same motor with the overload switch set as low as one to five amperes, much smaller nuts may be turned to an adjusted stress which is fitted to the service required and it is further found that the results are substantially uniform throughout the nuts tightened with the same device set at the same amperage for throw-out of the switch.

Obviously the shaft 17 may be equipped with means for the application of socket wrenches corresponding to 16 of a variety of sizes readily removable and interchangeable. Such structure forming no part of the present invention is not illustrated herein.

The operation of the device will be clear from the above description. Minor changes may be made in the physical embodiment of the invention within the scope of the appended claims without departing from the spirit thereof.

I claim:

1. Wrench apparatus comprising, in combination: a frame; handles carried by said frame; a reversible electric motor and a rotatable wrench geared to be driven by said motor; said wrench, gearing, and motor carried by said frame; circuit connections for forward drive, reverse drive, jogging drive of said motor and for stopping reverse drive thereof; and switches for controlling each of said circuit connections carried by said handles within reach of an operator grasping said handles.

2. Wrench apparatus comprising, in combination: a frame comprising a casing; handles projecting in opposite directions from said casing; a reversible electric motor and gearing driven thereby housed in said casing; a wrench journaled in said casing to be rotated by said gearing; solenoid operated switches for controlling forward drive, reverse drive and for stopping reverse drive of said motor and an overload switch for stopping forward drive of said motor, carried by said casing; push button switches to control said forward, reverse and stopping switches respectively and for jogging said motor carried by said handles to be under the hands of an operator grasping the same.

3. Wrench apparatus comprising, in combination: a frame comprising a casing; a motor and a rotatable wrench driven thereby carried by said casing; a stop arm clamped upon said frame for adjustment circumferentially of said wrench; a stop pin clamped to said arm projecting substantially parallel with the axis of said wrench and adjustable as to the extent of its projection from said arm.

CHARLES A. MILLER.