Aug. 12, 1952 J. C. CURTIS ET AL 2,606,472

POWER-OPERATED GEAR-CONTROLLED TORQUE WRENCH

Filed June 15, 1950

Fig. 1.

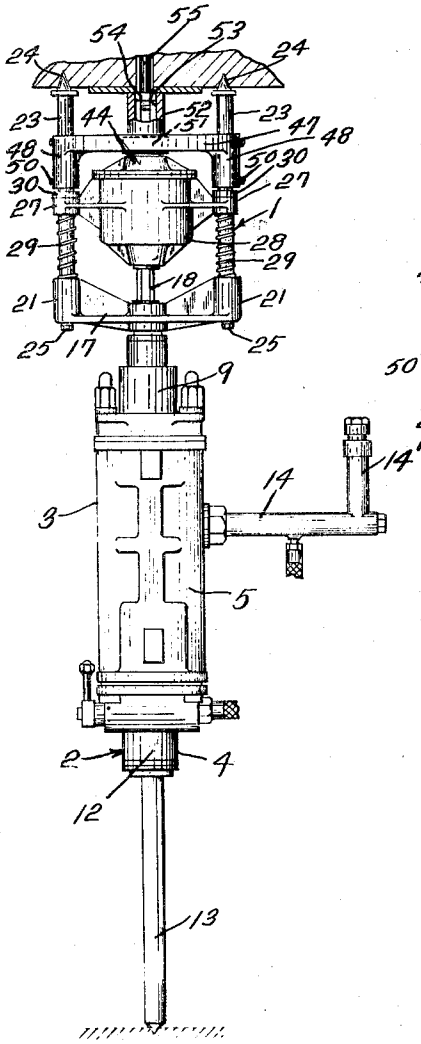


Fig. 2.

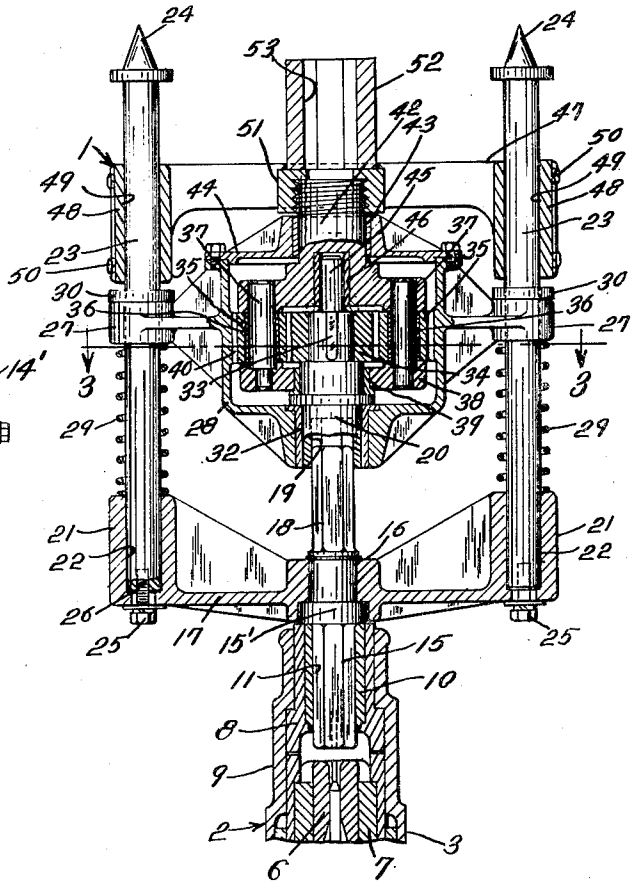
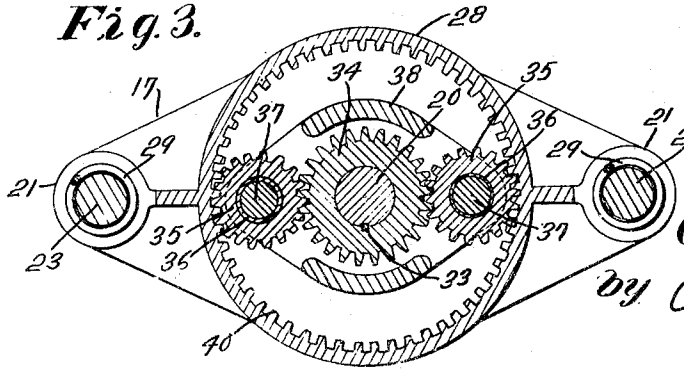


Fig. 3.



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POWER-OPERATED, GEAR-CONTROLLED TORQUE WRENCH

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14 Claims. (Cl. 81—57)

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This invention relates to power wrenches and more particularly to a torque wrench especially, but not exclusively, designed for use with a stoper drill for tightening the nuts of roof anchor bolts for supporting the roof strata of an underground mine or tunnel.

In underground mines or tunnels it is becoming the common practice to support the roof against roof-falls and cave-ins by means of suspension type roof anchor bolts which are inserted in holes drilled in the roof strata to bind together the strata thereby to minimize flexure and thus prevent failure of the roof rock. The holes are frequently drilled in the roof strata by means of pneumatic hammer drills commonly known as stopers, and when the holes are drilled at proper locations anchor bolts of the expanding head type are inserted in the holes and the heads thereof are expanded to secure the anchor bolts firmly in positions. Roof plates are then placed over the projecting lower ends of the bolts, against the roof, and nuts threaded on the bolt ends are tightened, usually by separate power wrenches, to secure the roof supporting plates in proper position. The present invention contemplates improvements over known types of power wrenches in that a wrench is provided which is substituted for the usual drill steel of the stoper drill so that the drill is employed to position, support and drive the wrench. The wrench of the present invention embodies a shank receivable in the rotatable chuck of the stoper drill and this shank drives through gearing a rotatable wrench member which engages the nut of the anchor bolt, and pointed abutment rods are carried by the bottom support of the wrench and are held up against the roof by the usual pneumatic feed leg of the stoper thereby to hold the wrench steady and to absorb torque reaction which is present during operation of the wrench. The rotatable wrench member is yieldingly supported by springs engaging the bottom support and surrounding the abutment rods so that in the event the rotatable wrench member does not properly engage the nut of the anchor bolt, it may yield or spring back without damage to the parts. The gearing for driving the rotatable wrench member is driven by the rotating mechanism of the stoper drill, and the gearing provides a substantial speed reduction between the rotating drill chuck and the wrench member thereby to obtain a relatively powerful rotating torque sufficient properly to tighten the nuts of the anchor bolts.

An object of the present invention is to provide an improved power wrench. Another object

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is to provide an improved torque wrench for tightening the nuts of bolts, and having novel driving means for the rotatable wrench member which engages the nuts. A further object is to provide an improved power wrench which may be firmly supported against the work and which has an improved yieldable mounting for the rotatable wrench member whereby the latter may yield or spring back in the event the nut to be tightened is improperly engaged thereby. A still further object is to provide an improved torque wrench having abutment engaging means whereby the wrench may be firmly held against an extraneous abutment during operation of the wrench and whereby the torque reaction set up during the nut tightening operation is substantially absorbed. Yet another object is to provide an improved torque wrench especially designed for use with a pneumatic hammer drill whereby the drill rotating mechanism may be employed to operate the wrench. A still further object is to provide an improved torque wrench having novel planetary driving gearing and improved mounting means. These and other objects and advantages of the invention will, however, hereinafter more fully appear in the course of the ensuing description.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice:

In this drawing:

Fig. 1 is an elevational view of a pneumatic hammer drill of the stoper type with which the improved torque wrench is associated, showing the wrench in operative engagement with the nut of a roof anchor bolt.

Fig. 2 is an enlarged vertical sectional view taken through the improved wrench and through the front chuck of the associated stoper drill.

Fig. 3 is an enlarged cross section taken on line 3—3 of Fig. 2, illustrating the planetary driving gearing.

In this illustrative embodiment of the invention, as shown in the drawing, the improved torque wrench, generally designated 1, is shown associated with a conventional pneumatic hammer drill of the stoper type, generally designated 2. Evidently, the improved torque wrench may be associated with tools of other types.

The stoper drill 2 is of the type known as a roof bolt hole drill for drilling upright holes in the roof strata of an underground mine or tunnel, and generally comprises a pneumatic hammer motor 3 which is supported and fed toward the work by a pneumatic feed leg 4 which is disposed along one side of the hammer motor in

parallelism with the latter to provide for longitudinal compactness. A drill embodying generally similar features is disclosed in the copending application to J. C. Curtis, Ser. No. 139,612, filed January 20, 1950, and owned by applicants' assignee. The hammer motor 3 includes a motor cylinder 5 which contains a reciprocable fluid actuated hammer piston (not shown) having a front striking bar 6 (Fig. 2) which is adapted to actuate percussively a conventional drill steel. The hammer piston, in the drill of this type, rotates intermittently as it reciprocates and the piston rotation is transmitted through a chuck nut 7 to a chuck 8 rotatably mounted in a front chuck housing 9 of the drill. Secured within the rotatable chuck is a chuck bushing 10 having a polygonal socket 11 for receiving the polygonal shank of the drill steel (not shown) which is employed to drill the holes in the roof strata. The feed leg 4 for feeding the drill steel toward the work during the drilling operation and for holding the wrench up against the room during tightening of the roof anchor bolts comprises a reciprocable feed cylinder 12 containing a feed piston (not shown) having its piston rod 13 extending downwardly from the cylinder and engaging the mine or tunnel floor. The drill has a lateral handle 14 provided with a grasping portion 14' whereby the drill may be positioned and supported with respect to the work, and may be held against rotation about its longitudinal axis during its operation, all in a manner well known to those skilled in the art.

When drilling is completed and it is desired to tighten the roof anchor bolts inserted in the drill holes, the drill steel is removed from the drill chuck and a polygonal shank 15 of the torque wrench 1 is inserted in the socket 11 of the chuck bushing 10 of the drill chuck, as shown in Fig. 2. This polygonal shank 15 has a collar 15' and is rotatably secured at 16 to a transverse bottom support 17 with the latter engaging the collar, and an upper polygonal portion 18 of the shank extends upwardly within a polygonal opening or socket 19 in a rotatable member 20, as later explained more in detail. Thus, an axial self-adjusting or extensible, sliding connection is provided between the parts 18 and 20. The bottom support member 17 has lateral lugs 21 formed with longitudinal bores 22 for receiving the lower portions of parallel abutment engaging rods 23, the latter having upper pointed ends 24. These rods are detachably secured down within the bores of the bosses 21 by screws 25 threaded at 26 within the lower portions of the rods and having cooperating washers engaging the bottom surface of the bottom support 17. Slidably engaging the parallel rods 23 are lateral perforated lugs 27 formed integral with a non-rotatable frame or gear housing 28 and encircling the rods 23 and arranged between the bosses 21 and the lugs 27 are resilient elements desirably in the form of coil springs 29 for constantly urging the housing 28 upwardly along the rods toward a position wherein the lugs 27 abuttingly engage stop collars 30 secured to the rods. The member 20 is rotatably mounted in a bearing sleeve 32 supported within the lower portion of the housing 28 and keyed at 33 to the upper portion of the member 20 is a spur gear 34. This gear at its opposite sides meshes with planet gears 35 journaled on bearing sleeves 36 supported by parallel stub shafts 37 in turn rigidly mounted in a rotatable carrier 38. The lower portion of this carrier is journaled on a bearing sleeve 39 supported by the member 20, as shown in Fig. 2. The planet gears 35 mesh with the teeth of an internal gear 40 secured to the non-rotatable housing 28. Formed integral with the upper portion of the rotatable carrier 38 is a shaft element 42 journaled in a bearing sleeve 43 supported by a top cover 44 detachably secured, as by bolts, to the top of the gear housing 28. The rotatable member 20 has a reduced upward projection 45 journaled in a bearing sleeve 46 supported by the rotatable carrier thereby to provide an upper bearing support for the member 20.

In this improved construction a transverse frame 47 has lateral bosses 48 formed with bores 49 through which the upper portions of the abutment rods 23 extend, and these bosses are secured as by screws 50 or otherwise to the abutment rods whereby the transverse frame rigidly braces the upper portions of the abutment rods. A collar 51 is threadedly secured to the shaft element 42 and secured, as by welding, or otherwise, to this collar is a rotatable wrench member 52 formed with a polygonal socket 53 for receiving a nut 54 of the roof anchor bolts 55 (see Fig. 1).

When the torque wrench has its polygonal shank 15 inserted in the chuck of the stoper drill, as shown in Fig. 2, in place of the usual steel shank, the pneumatic feed leg 2 may be operated in a known manner to move the wrench upwardly toward the roof of the mine or tunnel to bring the points 24 of the abutment rods 23 into firm engagement with the roof as shown in Fig. 1, and the feed leg holds the wrench up against the roof during tightening of the nut of the anchor bolt. As the hammer motor 3 of the stoper is operated to rotate the chuck 8, the shank 15 and the polygonal portion 18 are rotated therewith relative to the bottom support 17 of the wrench and as a result the spur gear 34 is rotated. This spur gear drivingly engages the planet gears 35 causing the latter to revolve about the stationary internal gear 40 as a trackway rotating the carrier 38 therewith at a speed substantially slower than the speed or rotation of the drill chuck. Thus, the shaft element 42 is driven at a reduced speed but with a relatively powerful torque, rotating therewith the wrench member 52. This wrench member engages the nut 54 of the anchor bolt 55. As the torque wrench is fed upwardly toward the work by the pneumatic feed leg 2 of the stoper to bring the points 24 of the abutment rods 23 against the roof and the rotatable wrench member 52 does not properly engage the nut 54 the wrench member may yield or spring back due to the spring mounting for the gear housing 28. As the springs 29 yield, the perforated lugs 27 of the gear housing may slide downwardly along the abutment rods 23 and at that time the member 20 may slide axially rearwardly relative to the polygonal portion 18 of the rotatable shank. Any percussion action of the hammer piston is absorbed by this axial sliding connection between the parts 18 and 20, so that no hammer blows are transmitted to the gear housing. If desired, the shank 15 may be slightly shorter than the conventional drill steel shank, so that the piston striking bar 6 will at no time strike against the shank 15.

As a result of this invention an improved power wrench is provided which is especially designed for tightening the nuts of bolts. By the provision of the planetary speed reducing gearing the wrench may be operated by the rotating mechanism of a conventional stoper drill thereby to impart a powerful rotating torque to the nut to be tightened. By yieldingly mounting the gear-

ing housing and socket wrench member on the bottom support of the wrench the socket wrench member may yield or spring back in the event it improperly engages the nut to be tightened. The abutment engaging rods secured to the bottom support of the wrench firmly engage the roof of the mine or tunnel or other extraneous abutment to hold the wrench steady during its operation and to absorb the torque action set up by the wrench during its operation. The wrench is simple and rugged in design and is readily adapted to use with a conventional hammer drill of the stoper type without change. Other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What we claim as new and desire to secure by Letters Patent is:

1. A torque wrench comprising, in combination, a support, a self-contained speed reducing and wrench unit comprising reduction gearing and a wrench member driven by said gearing, means for yieldingly mounting said self contained unit on said support for movement longitudinally relative thereto whereby said unit may yield rearwardly, a rotatable driving member journaled on said support and adapted for detachable connection with a power source, and an extensible driving connection between said gearing and said rotatable driving member.

2. A torque wrench comprising, in combination, a bottom support, parallel guide members secured to the opposite sides of said support and extending longitudinally in advance of said support, a housing extending between and slidable along said guides, resilient elements encircling said guides for yieldingly urging said housing in a forward direction, a driver rotatably mounted on said support, driving gearing contained in said housing, a self-adjusting driving connection between said driver and said driving gearing for driving the latter in all positions of said housing along said guide members, and a wrench member rotatably mounted on said housing and driven by said gearing.

3. A torque wrench comprising, in combination, a bottom support, a rotatable driver journaled on said support, parallel abutment rods secured to said bottom support at its opposite sides and extending forwardly in advance of said support into engagement with an extraneous abutment, a housing extending between and slidably guided on said parallel rods, springs encircling said rods for urging said housing in a forward direction, gearing contained in said housing, an extensible driving connection between said driver and said gearing, and a rotatable wrench member journaled on said housing and driven through said gearing.

4. A torque wrench comprising, in combination, a bottom support, a rotatable driver journaled on said support and adapted for connection to a power source, parallel abutment rods secured to said bottom support at its opposite sides and extending forwardly in advance of said support into engagement with an extraneous abutment, a housing extending between and slidably guided on said parallel rods, a cross frame extending between and secured to the forward portions of said parallel rods in advance of said housing for laterally bracing said rods, springs encircling said rods for urging said housing in a forward direction along said rods, gearing contained in said housing, an extensible driving connection between said driver and said gearing, and a rotatable wrench member journaled on said housing and driven through said gearing.

5. A torque wrench comprising, in combination, a bottom support, a rotatable driver journaled on said support and adapted for connection to a power source, parallel abutment rods secured to said bottom support at its opposite sides and extending forwardly in advance of said support into engagement with an extraneous abutment, a housing extending between and slidably guided on said parallel rods, springs encircling said rods for urging said housing in a forward direction, gearing contained in said housing, means providing a sliding connection between said driver and an element of said gearing whereby said driver may drive said gearing in all positions of said housing along said parallel rods, and a rotatable wrench member journaled on said housing and driven through said gearing.

6. A torque wrench comprising, in combination, supporting means including a bottom support, a driver journaled on said support centrally of the wrench and adapted for connection to a source of power, a non-rotatable housing, means for yieldingly mounting said housing on said supporting means for movement longitudinally relative thereto, a gear journaled within said housing, a self-adjusting sliding connection between said driver and said gear, planet gears within said housing and meshing with and driven by said gear, a rotatable carrier for said planet gears mounted for rotation within said housing, an internal gear secured to said non-rotatable housing and with which said planet gears mesh, and a rotatable wrench member journaled on said housing and secured to said carrier and driven by the latter through said planetary gearing.

7. A torque wrench comprising, in combination, a bottom support, longitudinal guiding means carried by said bottom support, a rotatable wrench member mounted for guided movement longitudinally along said guiding means, yieldable means for urging said wrench member in a forward direction along said guiding means, and driving means for said wrench member including a driver journaled on said bottom support and adapted for connection with a source of power and an extensible self-adjusting driving connection between said driver and said wrench member.

8. In a torque wrench, the combination comprising a bottom support, longitudinal guiding means carried by said bottom support, a frame guided on said guiding means for longitudinal movement relative to said bottom support, driving means carried by said frame, a driver journaled on said bottom support, and an extensible driving connection between said driver and an element of said reduction gearing, an extensible driving connection between an element of said driving means and said driver, resilient means acting between said bottom support and said frame for urging said frame forwardly along said guiding means, and a rotatable wrench member journaled on said frame and driven through said driving means, said resilient means permitting said frame and wrench member to yield rearwardly along said guiding means in the event said

wrench member improperly engages an element to be tightened.

9. In a torque wrench, the combination comprising a bottom support, longitudinal guiding means carried by said bottom support and engageable with an extraneous abutment for holding said bottom support against rotation, a housing guided on said guiding means for longitudinal movement relative to said bottom support, reduction gearing contained in said housing, a rotatable driver journaled on said bottom support, a sliding driving connection between a gear of said gearing and said driver, springs for urging said housing forwardly along said guiding means, and a rotatable wrench member journaled on said housing and driven through said gearing, said springs permitting said housing to yield rearwardly along said guiding means in the event said wrench member improperly engages an element to be tightened.

10. In combination, a power actuator having a rotatable chuck and an extensible power operated feed leg, and a torque wrench having a bottom support, a rotatable driver engageable with said chuck and rotatable thereby, abutment engaging elements secured to said support and adapted to be held by said feed leg in engagement with an extraneous abutment, a housing on said support, speed reducing gearing contained in said housing and driven by said chuck through said driver, and a rotatable wrench member journaled on said housing and driven through said gearing, said wrench member being adapted to engage an element to be rotated.

11. In combination, a power actuator having a rotatable chuck and an extensible power operated feed leg, and a torque wrench adapted for detachable connection with the actuator and comprising a bottom support, a driver journaled on said support and having a shank receivable in said chuck whereby said chuck may effect rotation of said driver, parallel abutment rods secured to the sides of said bottom support and extending forwardly in advance of said support, said rods being adapted to be moved toward and to be held in engagement with an extraneous abutment by said extensible feed leg of the actuator, a rotatable wrench member adapted for engagement with an element to be tightened, and means on said support and driven by said driver for rotating said wrench member.

12. In combination, a power actuator having a rotatable chuck and an extensible power operated feed leg, and a torque wrench adapted for detachable connection with the drill and comprising a bottom support, a driver journaled on said support and having a shank receivable in said chuck whereby said chuck may effect rotation of said driver, parallel abutment rods secured to the sides of said bottom support and extending forwardly in advance of said support, said rods being adapted to be moved toward and to be held in engagement with an extraneous abutment by said extensible feed leg of the actuator, a housing slidably engaging said parallel rods, springs encircling said rods for urging said housing in a forward direction with respect to said bottom support, reduction gearing contained in said housing, a sliding connection between an element of said gearing and said driver whereby said driver may drive said gearing in all positions of said housing along said abutment rods relative to the actuator, and a rotatable wrench member journaled on said housing and driven through said gearing, said wrench member being adapted to engage an element to be tightened.

13. In combination, a power actuator having a rotatable chuck, and a torque wrench unit adapted for detachable connection with said power actuator and having a rotatable shank receivable in said chuck and rotatable thereby, speed reducing gearing driven by said shank, a rotatable wrench member driven through said reduction gearing, a yieldable mounting for said wrench member on said actuator whereby said wrench member may yield rearwardly relative thereto in the event of improper engagement thereof with an element to be rotated, and a self-adjusting driving connection between said rotatable shank and said speed reducing gearing whereby the drive between the actuator chuck and said wrench member is maintained in all the yielded positions of said wrench member relative to said actuator.

14. In combination, a power actuator having a rotatable chuck, and a torque wrench unit adapted for detachable connection with said actuator comprising speed reducing gearing and a rotatable wrench member driven through said reduction gearing, and being adapted for engagement with an element to be tightened, a rotatable driver provided with a shank receivable in said chuck and rotatable thereby, means for yieldably mounting said wrench unit for movement rearwardly longitudinally with respect to said power actuator, and an extensible driving connection between said driver and said speed reducing gearing whereby the latter may be driven in all longitudinal positions of said wrench unit with respect to said power actuator.

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