A pair of pivotally connected jaws accommodate a rotatable ring gear of two parts which are locked together when the jaws are closed, but are separated and disposed in the respective jaws when the jaws are opened for application or removal of the wrench to or from a pipe. The ring gear carries adjustable grippers for engaging the pipe, and a motor drive for the ring gear may be a portable electric drill mounted on one of the jaws.

18 Claims, 13 Drawing Figures
MOTOR DRIVEN PIPE WRENCH

This invention relates to new and useful improvements in wrenches, particularly pipe wrenches for screwing or unscrewing threaded pipe, and the principal object of the invention is to provide a pipe wrench which is motor driven so that it may quickly perform its work with little effort on the part of the operator.

As such, the wrench of the invention is powerful and sturdy so as to effectively handle work which otherwise would be difficult to do with a hand wrench. It is easy to use and readily applicable to pipes of different sizes.

With the foregoing more important object and features in view and such other objects and features which may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawings, wherein like characters of reference designate like parts, and wherein:

FIG. 1 is a perspective view showing the wrench of the invention applied to a pipe for turning the same in one direction;

FIG. 2 is a perspective view showing the wrench reversed for turning the pipe in the opposite direction;

FIG. 3 is a side elevational view of the wrench with its jaws open;

FIG. 4 is a sectional view of the wrench with the jaws closed, taken substantially in the plane of the line 4--4 in FIG. 6;

FIG. 5 is a side elevational view of the wrench with the jaws closed;

FIG. 6 is a top plan view of the wrench;

FIG. 7 is a front end view thereof;

FIG. 8 is a fragmentary sectional view, taken substantially in the plane of the line 8--8 in FIG. 5;

FIG. 9 is an enlarged sectional view taken substantially in the plane of the line 9--9 in FIG. 4;

FIG. 10 is a fragmentary sectional view taken substantially in the plane of the line 10--10 in FIG. 9;

FIG. 11 is a fragmentary perspective view of one of the ring gear members and associated guides;

FIG. 12 is an enlarged fragmentary view, partly in section, showing the ring gear member locking means and pipe grippers on the ring gear; and

FIG. 13 is an enlarged fragmentary detail of the ring gear indexing mechanism.

Referring now to the accompanying drawings in detail, the motor driven pipe wrench of the invention is designated generally by the reference numeral 15 and comprises a pair of coating jaws 16, 17 which are pivotally connected together as hereinafter described for movement between an open position shown in FIG. 3 and a closed position shown for example in FIG. 5. The jaws are of a hollow construction to accommodate various internal components of the wrench, and also to receive a driving motor which may be of any suitable type. Conveniently, the driving motor may be that of a portable electric drill 18 which is held in the jaw 16 by suitable clamp means 19, the handle 18a of the drill constituting a convenient handle for the wrench as a whole. The drill motor has a control switch 20 which is arranged so as to turn the motor on and off as well as to run it selectively in either direction of rotation.

The jaws 16, 17 are complementally recessed as indicated at 21' in FIG. 3 so as to define a circular opening 21 when the jaws are closed as in FIG. 5, this opening being adapted to receive the work such as a pipe 22 shown in FIGS. 1 and 2. The outer end portions of the jaws are preferably bevelled as at 23, so that when applying the wrench to the pipe by engaging the pipe with the bevelled portions 23, the jaws 16, 17 may be spread apart and the pipe received in the opening 21 as will be apparent from FIG. 3.

The pivotal connection of the two jaws 16, 17 is effected by a control lever 24 which is pivoted to the jaw 16 as at 25 and is also pivoted to the jaw 17 as at 26 (FIG. 5). This arrangement not only permits the jaws to be pivotally moved between their open and closed positions, but also facilitates longitudinal sliding of the jaws relative to each other when they are closed, as will be hereinafter again mentioned. The jaws are biased to their closed position by a pair of compression springs 27 positioned on a pair of studs 28 which are disposed at the opposite sides of the control lever 24 and are screw-threaded into the jaw 16 as at 28a in FIG. 9. The studs 28 pass through elongated openings 29 in the jaw 17 (see FIG. 10) and the springs 27 react between the jaw 17 and nuts 30 on the studs 28 so as to urge the jaws 16, 17 together. The nuts 30 may be adjusted to vary the strength of the springs and the openings 29, being elongated longitudinally of the jaw 17, permit relative longitudinal movement of the two jaws 16, 17, as already mentioned. As shown in FIGS. 9 and 10, the openings 29 are formed in blocks 31 secured to opposite side walls of the hollow jaw 17. Similarly, the studs 28 are screw-threaded into blocks 31' secured to opposite side walls of the hollow jaw 16. Conveniences, the blocks 31, 31' may be formed integrally with the respective jaws 17, 16, but in any event the blocks are transversely spaced in each jaw to movably receive the control lever 24 therebetween.

As is best shown in FIG. 4, the jaws 16, 17 accommodate a rotatable ring gear 32 which is in register or coaxial with the circular opening 21 defined by the jaws when they are closed. The ring gear consists of two semi-circular parts 32a and 32b which are separately connected together and are arranged so that when the jaws are separated, the ring gear part 32a is disposed within the jaw 16 and the ring gear part 32b is disposed within the jaw 17. This is accomplished by means hereinafter described, and for the moment it may be noted that when the jaws are closed and the ring gear parts are connected together, the ring gear as a whole may rotate bodily within the closed jaws.

As shown in FIG. 12, the ring gear part 32a is recessed and provided with sockets 33 which slidably receive pins 34 carried by brackets 35 on the ring gear part 32b. The sockets 33 and pins 34 are located adjacent a diametric line 36 of division or separation between the ring gear parts 32a, 32b, the pins and sockets being parallel to that diametric line. When for example the jaw 17 with the ring gear part 32b is slid longitudinally in one direction relative to the jaw 16 with the ring gear part 32a, the pins 34 are received in the sockets 33 and the two ring gear parts are locked together as shown in FIG. 12. On the other hand, when the jaw 17 is slid in the opposite direction relative to the jaw 16, the pins 34 are withdrawn from the sockets 33 and the two ring gear parts are unlocked and thus permitted to separate. The relative longitudinal sliding movement of the jaws 16, 17 is effected by moving the control lever 24 in one direction or the other while the
jaws are closed, and the same movement is also used for locking together or unlocking the jaws themselves. This is accomplished by providing the jaw 17 with a rigid hook 36 which projects into the jaw 16 and cooperates with a locking pin 37 in that jaw so that when relative sliding movement of the jaws locks together the two parts of the ring gear 32, the hook 36' lockingly engages the pin 37 and prevents separation of the jaws. On the other hand, when relative sliding movement of the jaws unlocks the ring gear, the hook 36' and pin 37 become separated and opening of the jaws is possible. An electric solenoid 38 is provided in the jaw 17 and operatively connected to the control lever 24 as shown in FIG. 4. The solenoid 38 includes a casing 38a housing the solenoid coil and a plunger 38b projecting from the casing and pivotally connected to the lever 24. The solenoid casing 38a is pivotally mounted on a transverse pivot bolt 38' extending transversely across the lower jaw 17. The solenoid 38 is adapted to be connected to a source of electric power (not shown) by means of plug 72, power cord 71 and an on-off toggle switch 70 which is affixed to the lever 24. Before operating the wrench 15 the toggle switch 70 will be moved to an "on" position to energize the solenoid 38 and bias the lever 24 in a direction which locks the jaws 16 and 17 together. The reversible motor 18 may then be energized by means of the trigger switch 20 to actuate the wrench. After use of the wrench is completed the motor 18 is stopped and the solenoid 38 will be deenergized by moving the toggle switch 70 to the "off" position. The lever 24 may then be rotated in the direction of arrow 65 (FIG. 4) so as to unlock the jaws 16 and 17 and also the two ring gear parts 32a and 32b. The motor 18 is shown in FIG. 4 to include a power cord 74 and plug 73 separate from the solenoid power cord and plug, however, while it has not been shown the solenoid 38 and motor 18 may be connected in parallel to a source of electric power with the solenoid under the control of the motor switch 20 so that when the motor 18 is energized the solenoid will lock the jaws 16 and 17 automatically and when the motor 18 is deenergized the solenoid will unlock the jaws 16 and 17.

As shown in FIGS. 8 and 11, each of the ring gear parts 32a, 32b is provided with a transverse flange 39 which is rotatably disposed between pairs of inner and outer arcuate guides 40, 41 secured to the side walls of the two hollow jaws, thus providing a rotating mounting for the ring gear in the jaws. Additional means for guiding rotation of the ring gear are also provided, including an endless chain 42 which passes around the pair of sprockets 43 in the jaw 17 and engages the teeth of the ring gear 42, as shown in FIG. 4. Moreover, a pair of sprockets 44 in the jaw 16 are each encircled by a chain 45 which also engages the teeth of the ring gear. The action of the separate chains 45 on the sprockets 44 in guiding the rotation of the ring gear is much the same as that of the chain 42 on the sprockets 43, but the two separate chains 45 in the jaw 16 afford therewith a space for a worm gear 46 which engages the ring gear 32 for driving the same.

The worm gear 46 is secured to a shaft 47 which is rotatably journaled in bearings 48 in the jaw 16 and also has a serrated or toothed slip clutch member 49 secured thereto. The member 49 cooperates with a similar slip clutch member 50 which is rotatably positioned on the shaft 47 and is urged against the member 49 by a compression spring 51. The latter is positioned between the member 50 and a driving adaptor 52 which is driven by the drill 18 so that under normal circumstances the drive from the drill is transmitted through the slip clutch members 49, 50 to the worm gear 46 and thus to the ring gear 32. However, when overload occurs, the clutch member 50 slips relative to the member 49 and drive to the ring gear is automatically interrupted.

To engage the work, that is the pipe 22, the ring gear part 32a is equipped with a toothed gripper 53 (FIGS. 3 and 12) which is movably connected to that ring gear part by a pair of parallel pivot links 54, thus affording some self-adjustment of the gripper in accommodating pipes of different sizes. The gripper 53 is intended to rotate the pipe in only one direction of rotation of the ring gear, while in the opposite direction the gripper merely slips along the pipe surface. Similarly, a second gripper 55 is carried by the ring gear part 32b, the gripper 55 being manually adjustable in a holder 56 as by a worm 57. The holder 56 is connected to the ring gear part 32b by a pivot link 57' and is biased in the direction of the work by a spring 58, the pivot link 57' permitting some amount of self-adjustment in addition to the manual adjustment facilitated at 57, again to accommodate pipes of different sizes.

A stop 54' on the ring gear part 32a limits the movement of the toothed gripper 53 to the left as shown in FIG. 4 so the teeth of the gripper 53 will always be directed to bite into the surface of the work which it engages.

An indexing mechanism is provided for the ring gear 32, the operation of which will be hereinafter described. The mechanism consists of a pawl 59 (see FIG. 13) which is pivoted at 60 in the jaw 17 and is biased by a spring 61 toward the ring gear and into a recess 62 formed in the ring gear part 32b. When the ring gear rotates in a direction 63 which causes the wrench to turn the pipe, the pawl 59 skips over the recess 62 and continued rotation of the ring gear is possible. However, when the ring gear is rotated in the opposite direction in which the grippers 53, 55 slip on the surface of the pipe, the pawl 59 enters the recess 62 and abuts the end 62' of the recess, thus stopping further rotation of the ring gear. This stoppage occurs at a point where the ring gear part 32b is wholly within the jaw 17 and the line of separation 36 between the two ring gear parts is co-planar with the line of separation 64 between the two closed jaws 16, 17.

The operation of the invention will now be explained.

Assuming the jaws 16, 17 of the wrench to be closed and locked together as for example in FIG. 5, the drill motor 18 is energized so as to rotate the ring gear 32 in a non-driving direction, that is, in a direction opposite to that which is required for the wrench to rotate the work. This means that the ring gear is rotated in a direction opposite to the arrow 63 in FIG. 13, and eventually the indexing pawl 59 will enter the recess 62 and prevent further rotation of the ring gear in that direction, as already mentioned. As rotation of the ring gear is arrested, the slip clutch 49, 50 will discontinue the drive from the drill 18 to the ring gear and the drill
3,709,072

5

18 may then be stopped by manual actuation of the switch 20. With the ring gear 32 stopped at the point where the indexing pawl 59 abuts the end 62' of the recess 62, the ring gear part 32a will be wholly disposed within the jaw 16 while the part 32b is wholly disposed within the jaw 17, the line of separation of the ring gear parts registering with the line of separation of the two jaws.

The control lever 24 is then moved in the direction of the arrow 65 in FIG. 4, this causing the jaw 17 with the ring gear part 32b to slide longitudinally relative to the jaw 16 with the ring gear part 32a, so that the two ring gear parts become unlocked by withdrawal of the pins 34 from the sockets 33 and also that the hook 26' becomes disengaged from the pin 37 to unlock the two jaws. The wrench may then be applied to the work 22 by opening of the jaws 16, 17 as shown in FIG. 3, so that the work is received between the separated ring gear members. The jaws may then be closed and locked together with simultaneous locking of the two ring gear parts by movement of the lever 24 in a direction opposite to the arrow 65.

The drill motor 18 is then energized to rotate the ring gear 32 in the direction of the arrow 66 (see FIGS. 1 and 2). This direction of rotation brings the grippers 53, 55 into a gripping engagement with the work which is rotated in the same direction as the arrow 66. Depending upon whether the wrench is applied to the work as in FIG. 1 or as in FIG. 2, the same direction of rotation of the ring gear 32 may screw out the pipe 22 from a fitting 67 as in FIG. 1, or may screw the pipe into the fitting as in FIG. 2. In other words, the working rotation of the ring gear 32 is always in the same direction of the arrow 66. Reverse direction of rotation of the ring gear 32 is utilized only on two occasions, one of which is to back up the ring gear sufficiently to release the grip of the grippers 53, 55 from the work, and the other of which is to turn back the ring gear for indexing purposes to assure that the line of separation between the ring gear parts is in register with the line of separation of the jaws and thereby facilitate opening of the jaws as already described.

When the wrench is used for tightening the pipe 22 and the pipe is fully tightened, the slip clutch means 49, 50 interrupt the drive from the drill motor to the ring gear to prevent overload on the motor before the motor is manually shut off by the switch 20.

While in the foregoing there has been described the preferred embodiment of the invention, various modifications and equivalents may be resorted to within the spirit and scope of the invention as claimed.

What is claimed is new is:

1. In a motor driven pipe wrench, the combination of a pair of coacting jaws pivotally connected together for opening and closing movement, said jaws being complementally recessed to define a work receiving opening when the jaws are closed, a two-part ring gear rotatably mounted in said jaws in register with said opening and adapted to have its two parts disposed in the respective jaws when the jaws are opened, work engaging members carried by said ring gear, a motor drive for the ring gear provided in one of said jaws, means for locking together said jaws in their closed position and simultaneously locking together the two parts of said ring gear, and a lever pivotally connecting said jaws together and also facilitating relative longitudinal sliding of the jaws, said jaw locking means and said ring gear locking means being actuated by relative longitudinal sliding of the jaws.

2. The device as defined in claim 1 together with means for indexing rotation of said ring gear at a position wherein the division between the two parts thereof is aligned with the division between the closed jaws.

3. The device as defined in claim 1 together with means for locking together the two parts of said ring gear when said jaws are closed.

4. The device as defined in claim 1 together with means for locking together said jaws in their closed positions.

5. The device as defined in claim 1 wherein said motor drive for said ring gear includes a slip clutch mechanism.

6. The device as defined in claim 1 which is further characterized in that said motor drive for said ring gear is reversible.

7. The device as defined in claim 6 wherein said reversible motor drive rotates said ring gear in one direction for correspondingly rotating the work by said work engaging members, and means responsive to rotation of the ring gear in the opposite direction for indexing the ring gear at a position wherein the division between the two parts of the gear is aligned with the division between the closed jaws, whereby the two parts of the gear may be disposed in the respective jaws when the jaws are opened.

8. The device as defined in claim 1 together with guide means provided in said jaws, said guide means rotatably mounting said ring gear.

9. The device as set forth in claim 8 together with plural independent sprocket and chain back up means for supporting said ring gear in said coacting jaws.

10. In a motor driven pipe wrench, the combination of a pair of coacting jaws pivotally connected together for opening and closing movement, said jaws being complementally recessed to define a work receiving opening when the jaws are closed, a two-part ring gear rotatably mounted in said jaws in register with said opening and adapted to have its two parts disposed in the respective jaws when the jaws are opened, work engaging members carried by said ring gear, a motor drive for the ring gear provided in one of said jaws, guide means provided in said jaws, said guide means rotatably mounting said ring gear, plural independent sprocket and chain back up means for supporting said ring gear in said coacting jaws, said sprocket and chain back up means including a first pair of sprockets in said one jaw with said motor drive, and a second pair of sprockets in the other of said pair of coacting jaws, the sprockets of said first and second sprocket pairs being mounted in the plane of said ring gear with the individual sprockets of one pair being diametrically disposed to a different one of the sprockets of the second pair, a pair of separate sprocket chains encircling the respective sprockets of said first pair and engaging the teeth of said ring gear, a single sprocket chain supported by said second pair of sprockets and engaging said ring gear on the opposite side of said ring gear from said first pair of sprockets.

11. The device set forth in claim 10 wherein said motor drive includes an elongated worm screw tangen-
tially engaging said ring gear between the sprockets of said first pair.

12. The device set forth in claim 1 together with resilient bias means for biasing said coacting jaws closed.

13. The device set forth in claim 1 together with an electrical solenoid means which is energized for pivoting said lever in a direction to slide said coacting jaws into a locked position wherein said jaw locking means and said ring gear locking means are actuated to lock said jaws and ring gear parts together when said motor drive is activated to rotate said ring gears and which is deenergized when said motor drive is deactivated.

14. The device set forth in claim 13 wherein said motor drive includes an electric motor having an activating switch for turning said motor on and off and said solenoid is connected in parallel with said electric motor under the control of said activating switch.

15. The device set forth in claim 14 wherein said electric motor is a portable motor having a pistol grip handle, and releasable clamping means for clamping said motor to said one jaw.

16. The device as set forth in claim 1 wherein the coacting jaws have beveled ends opposite said lever, said beveled ends diverging from the division line between the closed jaws.

17. The device as set forth in claim 12 wherein said jaws are elongated housing sections, each having spaced parallel side walls and transverse walls rigidly connecting said side walls, and bearing means extending between said spaced side walls for rotatably supporting said sprockets.

18. In a motor driven pipe wrench, the combination of a pair of coacting jaws pivotally connected together for opening and closing movement, said jaws being complementally recessed to define a work receiving opening when the jaws are closed, a two-part ring gear rotatably mounted in said jaws in register with said opening and adapted to have its two parts disposed in the respective jaws when the jaws are opened, work engaging members carried by said ring gear, a motor drive for the ring gear provided in one of the said jaws, resilient bias means for biasing said coacting jaws closed, said jaws being elongated housing sections, each having spaced parallel side walls and transverse walls rigidly connecting said side walls, and bearing means extending between said spaced side walls for rotatably supporting said sprockets, said housing sections being V-shaped at one end, said one jaw including said motor drive being open at its end opposite said V-end, and a portable electric motor detachably clamped in said open end.