ABSTRACT OF THE DISCLOSURE

This invention relates to drivers for setting fasteners, such as threaded screws and nuts. A driver, according to the present invention, includes an overrunning clutch adapted to rotate a fastener-engaging tool member in one direction, thereby driving an engaged fastener in the one direction, and further adapted to be rotated in an opposite, or back-off direction, whereby the tool member is de-coupled from rotational movement with the clutch. The clutch is preferably an overrunning roller clutch. The driver may be backed off and driven with infinitely variable incremental movements.

The invention additionally relates to a pulsating power means for the wrench.

This application is a continuation-in-part of patent application, Ser. No. 587,320, filed Oct. 17, 1966, now abandoned, for “Drivers for Setting Fasteners,” and assigned to the same assignee as the instant application.

This invention relates to drivers for setting fasteners, such as threaded screws and nuts. Wrenches and screw drivers are well known examples of such drivers.

It is an object of the present invention to provide a driver for setting fasteners with a fastener-engaging tool member and an overrunning clutch for engaging the fastener-engaging tool member so as to rotate with the driver in one direction and for disengaging the tool member when the driver rotates in an opposite direction.

Another object of the present invention is to provide a driver for driving a tool member, which driver has a back-off and a drive movement, and which driver is capable of small and infinitely variable incremental back-off and drive movements. With such an arrangement, a mechanic is no longer constrained by surrounding structure to backing off a driver through a specific number of degrees before taking another "bite" on the work. Instead, he may make as many small "bites" as he wishes and back off through any number of degrees to achieve the desired results.

An optional and desirable object of the present invention is to provide a driver for driving a tool member, which driver is operated by a motor, and which can operate incrementally to take advantage of the small-increment feature of the drive itself.

According to the present invention, a driver is provided for rotatily engaging a fastener tool member in one direction, thereby causing the tool member to rotate an engaged fastener in the one direction. The driver is further adapted to be rotated in the opposite, or back-off direction, thereby decoupling the tool member from rotational movement with said overrunning clutch.

An optional feature of the present invention resides in the use of a roller type of overrunning, or one-way clutch assembly having cam-bearing surfaces on an outer member connected to a driver of a fastening tool. A roller-retaining means contains a plurality of rollers which are adapted to engage the tool member to rotational movement with said cam-bearing outer member when the driver is rotated in the driving direction, and the rollers are further adapted to release the tool member from rotational movement when the driver is rotated in the back-off direction. The clutch thereby allows incremental back-off and drive movement of the driver through angles of any size.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation, partly in cutaway cross-section which illustrates a hand driver according to a preferred form of the present invention;

FIGS. 2 and 3 are cutaway views partly in cutaway cross-section taken along lines 2-2 and 3-3 respectively, in FIG. 1 showing different operating conditions of the wrench of FIG. 1;

FIG. 4 is a side elevation, partly in cutaway cross-section, of another embodiment of a wrench according to the present invention using a tool element which is directly insertable in the overrunning clutch;

FIG. 5 is a side elevation, partly in cutaway cross-section, of still another form of the invention showing a screw driver using the principles of the invention;

FIG. 6 is a side elevation of still another embodiment of a wrench according to the present invention characterized in the use of an extendable, reversible adapter for providing the capacity of driving bothcounter clockwise and clockwise;

FIG. 7 is a perspective view of a power-driven wrench according to still another form of the invention;

FIG. 8 is a top elevation of the wrench illustrated in FIG. 7; and

FIG. 9 is a cutaway top elevation of another form of a power-driven wrench according to the present invention.

FIG. 1 illustrates a preferred form of a wrench according to the present invention having a body 10 (sometimes called a "driver member") and a lever handle 11 attached thereto. A cylindrical passage 12 extends through body 10. An overrunning roller clutch 13 is located within passage 12 and is integrally connected to body 10. A coupling 14 has a cylindrical shaft 15 set within roller clutch 13. Body 10, roller clutch 13 and shaft 15 are co-axially aligned about a common axis. Annular shoulders 16 and 17 on coupler 14 are located at each end of shaft 15 and abut the ends of the roller clutch to retain shaft 15 within the roller clutch, thereby retaining coupling 14 to roller clutch 15. When so assembled, passage 12, roller clutch 13 and shaft 15 are axially aligned so that handle 11 may be rotated about the axis to drive or back-off the wrench.

Adapters 18 and 19 project from annular shoulders 16 and 17 of coupler 14 opposite shaft 15 and carry ball detents 20 and 21, respectively. Adapters 18 and 19 are adapted to receive suitable tool elements or socket members as are indicated by numbers 22 and 23. Ball detents 20 and 21 provide suitable locating and retaining means for attaching tool elements 22 and 23 to adapters 18 and 19.

FIGS. 2 and 3 illustrate an overrunning roller clutch 13 within wrench housing 10. One convenient example of a clutch 13 is available from the Torrington Company, Torrington, Conn., as Model Number RC-162110. Clutch 13 comprises a one-piece retaining and actuating cage 24 fixed to housing 10. Located between the two end surfaces 24a on cage 24 are a plurality of peripheral teeth 25 forming sloping wedge-shaped cam-bearing surfaces 30. Longitudinal bars 26 extend between the ends of cage 24, and an integral roller-retaining step 27 is located on the inner edge of each bar. An integral bifurcated leaf spring 28...
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FIG. 6 illustrates another form of a wrench according to the present invention. Overrunning roller clutch 13 is integrally connected to body 10 of the wrench. Coupler 36 passes through passage 37 within roller clutch 13 and carries a pair of annular shoulders 38 and 39. Ball detent 40 is located medial the two ends of coupler 36. Coupler 36 is constructed so that when shoulder 38 abuts one end of roller clutch 13, ball detent 40 extends beyond the surface of coupler and out of passage 37 to retain the coupler in place. Ball passage 40 is retained by compression fitting it into coupler 36 to allow the coupler to be moved to the position shown by dashed lines 36e. When the coupler is in the position shown by the dashed lines, shoulder 39 abuts the opposite end of roller clutch 13, while ball detent 40 retains the coupler in a position by extending beyond the surface of coupler 36 outside of passage 37.

A pair of adapters 41 and 42 are integrally formed within each end of coupler 36. Adapters 41 and 42 are adapted to receive suitable tool elements or sockets (not shown). One adapter is fitted with a tool element for driving a fastener, while the other adapter is used for removing a fastener. The assembled tool element and coupler (sometimes called “tool member”) are rotated by rotational movement of the handle and body 10.

FIG. 5 illustrates a screw driver according to the present invention. Overrunning roller clutch 13 is integrally connected to handle 43 (sometimes called “tool member”) of the screw driver. Coupler 44 carries an annular shoulder 45 for abutment against one end of overrunning clutch 13. Shaft 15 extends from shoulder 45 of the coupler through overrunning clutch 13 and carries a threaded portion 46 which mates with coupler 47. Coupler 47 has an end portion 48 which abuts the opposite end of roller clutch 13. Suitable adapters 49 and 50 are formed at the opposite ends of couplers 44 and 47, respectively. Couplers 44 and 47 are adapted to axially rotate with shaft 15 in handle 43 of the screw driver. Suitable ball detent receiving means 51 and 52 are located in each of the adapters 49 and 50 respectively. A suitable screw driving blade 53 is provided having a mating adapter 54. Adapter 54 carries a ball detent 55 and is mateable with either adapter 49 or 50 so that ball detent 55 is received within ball detent receiving means 51 or 52, as illustrated. The assembled coupler and blade 53 (sometimes called a “tool member”) are rotated by rotational movement of handle 43.

The screw driver illustrated in FIG. 5 is useful for driving and removing screws, depending on which of the adapters the screw driving blade 53 is connected to. The screw driver is operated by imparting radial motion to handle 43 round the axis of the tool in a manner similar to that imparted to “ratchet” wrenches and screw drivers. Like the wrench illustrated in FIGS. 1, 4 and 6, the screw driver may be backed off and then driven through any arbitrary angle.

FIGS. 7 and 8 illustrate a power-driven wrench according to the present invention. Overrunning clutch 60 is mounted to driver member 61 and has a passage 62 formed about axis 63 for receiving a suitable fastener socket (not shown). The fastener socket assembly is preferably of the type described and illustrated in any of FIGS. 1-6. Integrally formed with driver member 61 is lever arm 64. Driver member 60 is journaled to housing 65 and is free to rotate about axis 63.

An actuating level 66 is rotationally mounted by fulcrum means 67 to housing 65. The fulcrum means, for example, be a bearing. An actuating handle 68 is threaded through passage 69 in actuating lever 66 and is fixedly located by lock nut 70. End 71 of adjustment screw 68 is contiguously to one side of lever arm 64. Spring bias means 72, retained within retainer 73 in housing 65, is adapted to be contiguous to the opposite side of lever arm 64 from the adjustment screw 68. Spring bias means 72, which may, for example, be a coil spring, biases lever arm 64 against end 71 of the adjustment screw.
Motor means 74, which may, for example, be a compressed air motor, is mounted to housing 65 and is operated by lever 75 to rotate shaft 76. Cam 77 is mounted to shaft 76 and is placed contiguous to cam-follower 78, which in turn is mounted to actuating lever 66 by shaft 79. The motor and cam arrangement provide a source of pulsating power to lever arm 64. Other suitable sources of pulsating power may be used, such as poppet and other reciprocators.

In operation of the power driven wrench, when motor 74 is energized, it rotates cam 77 about axis 82. The camming motion against the contiguous cam-follower 78 causes actuating arm 66 to reciprocate about fulcrum point 67 so as to reciprocate lever arm 64 about axis 63 as in a "walking beam." Spring bias means 72 biases lever arm 64 against screw 68. A reciprocal motion is imparted to driver member 61, thereby driving the overrunning clutch in alternate clockwise and counterclockwise directions. The overrunning clutch controls the driving of the fastener in a manner hereinbefore described.

The projection of the adjustment screw from the actuating lever may be adjusted by turning the screw in threaded passage 69 and fixing the projection by action of lock nut 70. The adjustment screw thereby controls the angular position of lever arm 64. Furthermore, adjustment screw 68 may be positioned through other passages 80 along actuating lever 66 to thereby vary the torque output on driver 61.

FIG. 9 illustrates a modification of the cam means used for reciprocating actuating lever 66 of the power driven wrench. Face cam 81 is connected to shaft 76 of the motor (not shown) and is placed contiguous to cam-follower 78 which is mounted to actuating lever 66 by shaft 79 in the manner hereinbefore described. As shaft 76 rotates, face cam 81 causes actuating lever 66 to reciprocate about pivot point 67 in the manner hereinbefore described.

The present invention thus provides a driver which is quiet, efficient, inexpensive and requires little maintenance. The operation of the rollers on the wedging surface provides positive action on the driving tool and virtually eliminates backlash. The back-off and drive movements may be of any arbitrary incremental angle, as the roller clutch provides positive drive and back-off movements through any arc.

The fastening tool is useful as a hand tool, and also as a power-driven tool where a source of driving movement is available.

This invention is not to be limited by the embodiments shown in the drawings and described in the description which are given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. A driver adapted to rotate a fastener about an axis, said driver comprising: a tool member being adapted to engage a fastener for turning the same; a driver member having a first axis and adapted to rotate in either of two directions about said first axis; an overrunning clutch connected to one of said members and connectable to the other of said members, said overrunning clutch being adapted to rotate said tool member upon rotational movement of said driver in one of the said two directions; a housing; a lever arm connected to said driver member normal to said first axis and capable of rotating about said first axis relative to said housing, and actuating means mounted to said housing to pulsate said lever arm about said first axis relative to said housing, said actuating means comprising an actuating lever having a second axis about which it may pulsate, bias means for biasing said lever arm against said actuating lever at a first point remote from first and second axes, and pulsating means for pulsating said actuating lever.

2. A driver according to claim 1 wherein said pulsating means comprises cam means connected to said actuating lever at a second point remote from said first point and from said second axis, said cam means being adapted to be rotated to pulsate said actuating lever.

3. A driver according to claim 1 further including adjustment means mounted to said actuating lever, said bias means biasing said lever arm against said adjustment means, said adjustment means being capable of providing adjustment of the torque delivered to said driver member.

References Cited

UNITED STATES PATENTS

2,726,563 12/1955 Blackburn 81—58.1
2,711,110 6/1955 Brame 81—58.1
3,204,496 9/1965 Ingram 81—59.1
3,256,758 6/1966 Medesha 74—125.5 X
3,329,185 7/1967 Hetlich et al. 81—59.1 X

FOREIGN PATENTS

882,159 7/1953 Austria.

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