

[54] ROTARY HAND TOOL

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Conn.[22] Filed: **May 6, 1974**[21] Appl. No.: **466,970****Related U.S. Application Data**[63] Continuation of Ser. No. 286,342, Sept. 5, 1972,
abandoned.[30] **Foreign Application Priority Data**

Sept. 10, 1971 Australia..... 6254/71

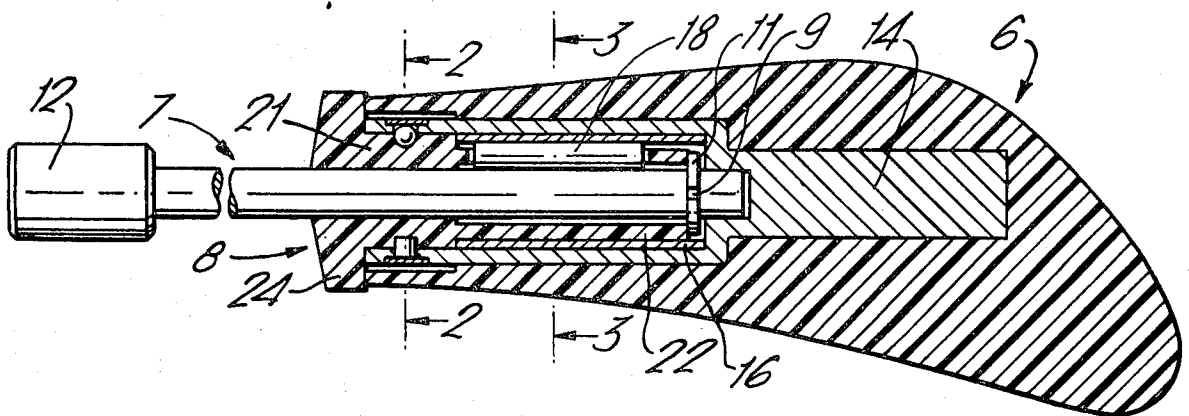
[52] U.S. Cl. **81/59.1**; 145/76; 192/44[51] Int. Cl.²..... **B25B 13/46**; B25B 15/04;
B60M 1/24[58] Field of Search 81/59.1; 145/70, 75, 76;
192/44, 45; 279/30[56] **References Cited****UNITED STATES PATENTS**

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Chilton[57] **ABSTRACT**

A screw-driver or like hand tool with functions in similar fashion to a ratchet screw-driver. The shank is coupled to the handle by a mechanism comprising a housing fitted to the handle, a bore in the housing which is non-cylindrical to define three channels spaced circumferentially of the shank and having outwardly converging side walls and three rollers in rolling contact with the handle end of the shank and disposed one within each end of the channels. The rollers can be positioned so that on rotation of the handle in one direction they are forced inwardly against the shank by virtue of their engagement with the channels to couple the handle and the shank, whereas on reverse rotation of the handle the rollers are free to roll on the shank. The rollers can alternatively be positioned for reverse operation of the screw-driver.

4 Claims, 7 Drawing Figures

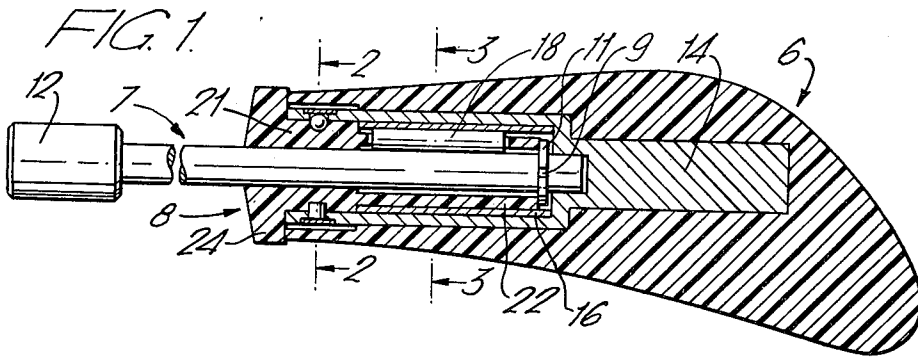
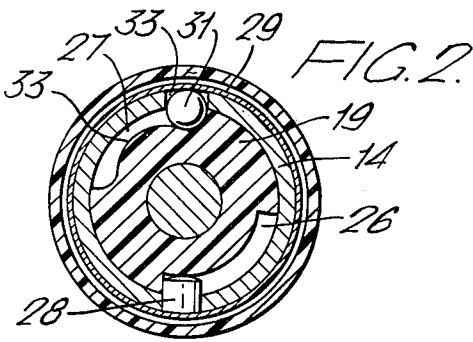


FIG. 5

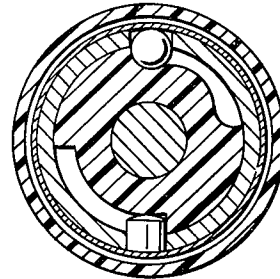
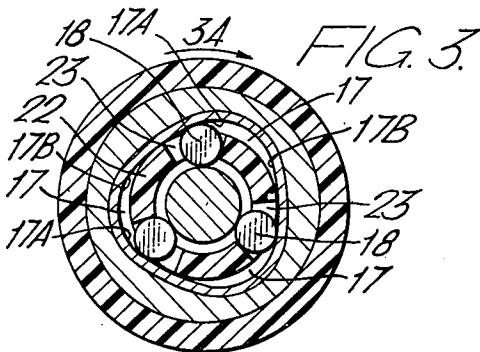


FIG. 6

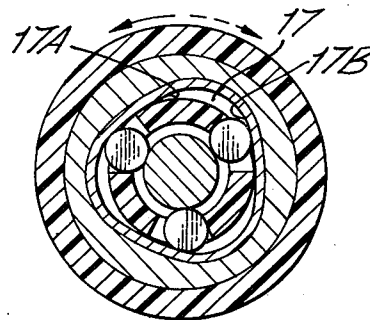
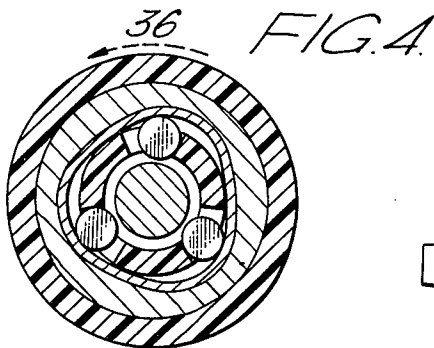
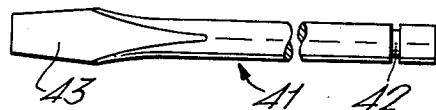


FIG. 7



ROTARY HAND TOOL

This is a continuation of application Ser. No. 286,342, filed Sept. 5, 1972, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to rotary hand tools and has particular but not exclusive application to screw drivers.

2. Description of Prior Art

One very common form of screw driver is the ratchet screw driver in which the shank of the driver is coupled to the handle via a ratchet mechanism which can be set so that when the handle is rotated in one direction it will drive the shank but if rotated in the reverse direction it will rotate freely on the shank. The ratchet mechanism can alternatively be set so that the handle will drive the shank when rotated in the reverse direction and will rotate freely in the forward direction. The present invention provides an alternative mechanism which provides these functions but which can be more robust and reliable in operation than a conventional ratchet mechanism. The mechanism of the present invention is also relatively silent in operation.

SUMMARY OF THE INVENTION

According to the invention there is provided a rotary hand tool comprising a handle, a shank, and a coupling mechanism to couple the handle to the shank, wherein there is associated with the handle a pair of wall portions which converge in a direction away from the axis of the shank and wherein the coupling mechanism comprises a rolling element in rolling contact with the handle end of the shank and located between said wall portions, and rolling element positioning means conditionable alternatively to position the rolling element against one or other of the wall portions, such that when the roller is against one of said wall portions rotation of the handle in one direction causes said one wall portion to bear against the rolling element and force it inwardly against the shank to provide a coupling action between the handle and the shank whereas on reverse rotation of the handle the rolling element is free to roll on the shank, and when the rolling element is against the other wall portion rotation of the handle in the reverse direction causes that other wall portion to bear against the rolling element to force it inwardly against the shank to provide a coupling action between the handle and shank whereas on rotation of the handle in said one direction the rolling element is free to roll on the shank.

Preferably, said rolling element is an elongate roller and said wall portions define a channel extending longitudinally of the shank.

More particularly, it is preferred that said channel is one of a plurality of channels associated with the handle and spaced circumferentially around the shank and said roller is one of a like number of rollers disposed one to each of the channels. The rolling element positioning means may then comprise a roller positioning member holding the rollers in circumferentially spaced relationship and rotatable about the handle end of the shank, and detent means to hold the roller positioning member alternatively in one of two rotational positions relative to the handle, each roller being held against one side wall portion of the respective channel when

the roller holder member is in one of its rotational positions and against the other channel side wall portion when the roller holder member is in the other of its rotational positions.

BRIEF DESCRIPTION OF DRAWINGS

In order that the invention may be more fully explained, a preferred form of screw driver will now be described in some detail with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal cross-section through the screw driver;

FIG. 2 is a cross-section on the line 2—2 in FIG. 1;

FIGS. 3 and 4 are both cross-sections on the line 3—3 in FIG. 1 showing how the handle of the screw driver can drive the stem in one direction but will rotate freely in the reverse direction.

FIG. 5 is a further cross-section corresponding to that of FIG. 2 but shows a roller cage member of the screw driver moved relatively to the handle to reverse the drive and free rotation directions;

FIG. 6 is a further cross-section corresponding to that of FIGS. 3 and 4 but is taken with the screw driver in the same condition as illustrated in FIG. 5; and

FIG. 7 is a broken elevation of an alternative type of shank which could be fitted to the screw driver.

DESCRIPTION OF PREFERRED EMBODIMENT

The illustrated screw driver comprises a handle assembly including a handle member 6, a shank 7, and a mechanism 8 for coupling those two parts together. Handle member 6, which is formed to a pistol grip shape, may be moulded in a cellulose acetate or some other plastics material. Shank 7 is in the form of a cylindrical metal rod having a groove 9 adjacent one end to receive a retaining clip 11 and it is formed at its other end with a blade 12.

Mechanism 8 has a housing 14 which fits snugly into a stepped bore in the handle member 6 and is permanently coupled to the handle member. Housing 14, which may conveniently be die cast in zinc, has a non-cylindrical central bore into which a correspondingly formed mild steel liner 16 is pressed. The thus lined part of the bore departs from cylindrical shape such that three longitudinally extending channels are formed at equal intervals around its circumference. More particularly, the inner peripheral surface of the lined bore departs outwardly from a cylindrical surface at three positions around its circumference to define the channels 17, which have outwardly converging side wall portions 17A, 17B. Three rollers 18 are disposed within the lined body bore. These rollers make rolling contact with the inner end of shank 7 and are held spaced around the shank by a roller positioning member 19 such that one roller engages each of the internal lobes 17 of the lined bore in the body 14.

Roller positioning member 19 comprises a relatively solid outer part 21 and a relatively thin-walled tubular inner part 22 in which slots 23 are formed to receive the rollers 18 so that part 22 serves as a roller cage. The extreme outer part of the roller positioning member has a flange 24 which forms an end capping to the handle 6. As will shortly be explained, the coupling mechanism is set by rotation of the roller cage relative to the handle and the outer periphery of the flange 24 may be serrated or knurled so that it can be firmly gripped.

In the plane on which the cross-section of FIG. 2 is taken roller cage portion 21 has two generally oppositely disposed circumferential slots 26, 27. Slot 26 receives the inner end of a retaining pin 28 which extends through a hole in body 14 and is held in position by a circumferential retaining spring 29 fitted around the outer end of the body 14. Retainer pin 28 locates roller cage 19 with respect to body 14 in the axial direction but the cage and body can be rotated relative to one another through about 65°. During such relative rotation pin 28 will traverse the length of slot 26 and at the same time a detent ball 31 disposed in a hole 32 in body 14 will traverse the opposite groove 27. The root of groove 27 is raised or humped at 33 between its ends so that in passing from one end of its groove to the other the ball must force the retaining spring 29 outwardly in order to traverse the hump 33. Thus ball 31 and groove 27 provide a detent action whereby the cage member 19 will be held in position at either of its extremes of rotation relative to the body 14.

When the roller positioning member 19 is in the rotational position shown in FIGS. 2, 3 and 4 (i.e. rotated anticlockwise relative to the handle and body 14 when seen in the direction of those views) the rollers 18 are disposed against the channel wall portions 17A which extend back in the anti-clockwise direction from the apices of the internal lobes.

If the handle 6 and body 14 are then rotated in the clockwise direction as indicated by arrow 34 in FIG. 3, channel wall portions 17A bear against rollers 18 and force them inwardly against the inner end of shank 7. The inward forces on rollers 18 are quite sufficient to cause the rollers to grip shank 7 and to drive it with the handle 6 and body 14. If, however, the handle is rotated in the reverse direction indicated by the broken arrow 36 in FIG. 4 the body line 17 does not bear against the rollers 18 which therefore are not forced inwardly and simply roll on the shank 7 so that the handle will rotate freely about the shank. Thus the screw-driver can be used to drive a screw in exactly the same fashion as a conventional ratchet screw driver but it will be substantially silent in operation.

By rotating the roller cage member 19 through 65° relative to the handle 6 and body 14 in the clockwise direction the detent ball 31 is moved to the other end of the detent slot 37 as shown in FIG. 5, and the rollers 18 are displaced across the three channels 17 to engage wall portions 17B which extend from the apices in the clockwise direction as shown in FIG. 6. The operation of the mechanism will then be reversed in that rotation of the handle in the anti-clockwise direction will cause channel wall portions 17B to bear against the rollers and cause them to grip the shank 7 whereas on clockwise rotation the handle will rotate freely about the shank.

The rollers are conveniently formed from hardened steel rod and the liner 16 may be formed of case hardened mild steel tubing to provide a hard wearing surface. Roller positioning member 19 may be moulded from a plastics material. Nylon is particularly suitable since it is tough and will slide easily over adjacent surfaces of other parts.

FIG. 7 illustrates an alternative form of shank 41 which could be fitted to the screw driver in place of the shank 7. It is similar to shank 7, having a groove 42 adjacent one end to receive the retaining clip 11 but it has a different type of blade tip 43.

It has been found that the inward forces on the roller generated by the wedging action on the channel wall portions are quite sufficient to provide a very strong coupling between the handle and the shank and the illustrated screw driver is very positive in operation. It is also of very robust construction and has fewer parts than a conventional ratchet mechanism. Conventional ratchet mechanisms comprise pinions and pawls and their effective life is often determined by pinion failure. It is anticipated that the illustrated construction will provide much longer service. This construction has, however, been advanced by way of example only and many modifications could be made to it. For example, it is not essential that the coupling mechanism have three channels and respective rollers. The number of channels and rollers could readily be increased and it would also be possible to devise a construction with as little as one channel and roller set. It would also be feasible to substitute balls for the rollers and in this case the channels might be replaced by recesses of generally hemispherical or other convenient shape.

The form of the handle and the means for indexing the position of the rollers could, of course, be readily varied. Moreover the invention is not limited to the construction of screw drivers and can be applied to other hand tools. The outer end of the shank could, for example, be adapted to receive spanner sockets. It is accordingly to be understood that the invention is in no way limited to the illustrated constructional details and that many variations will fall within the scope of the appended claims.

I claim:

1. A rotary hand tool comprising an elongated tool shank with a generally cylindrical coupling portion, a longitudinally extending operating handle assembly supporting the tool shank for rotation about the axis of the cylindrical coupling portion and having a longitudinally extending handle member and a coupling mechanism for selectively coupling the handle member to said coupling portion of the tool shank for rotating the tool shank with the handle member, the coupling mechanism comprising a plurality of rolling elements angularly spaced about said generally cylindrical coupling portion of the tool shank and in rolling contact therewith, a longitudinally extending rigid cast housing mounted in the handle member having an axially extending generally polygonal bore, a generally polygonal hard thin metal tubular liner of generally constant wall thickness throughout its extent conforming to and secured within the generally polygonal bore of the cast housing to define a generally polygonal chamber receiving the coupling portion of the tool shank, the generally polygonal bore having a generally polygonal cross-sectional configuration with a plurality of at least as many rounded concave corners as the number of rolling elements and the generally polygonal tubular liner having a corresponding plurality of rounded concave corners defining angularly spaced cavities about the coupling portion of the tool shank loosely receiving individual rolling elements therein and angularly spaced hard metal liner wedging surfaces for each rolling element extending generally tangentially from the respective rounded corner on opposite sides of the respective rolling element for selective engagement with the rolling element for wedging it against the generally cylindrical coupling portion of the tool shank, and rolling elements positioning means comprising a collar sur-

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rounding the elongated tool shank coaxially of the cast housing and the tool shank and having an outer end portion at an outer end of the cast housing bore and a tubular portion projecting from the outer end portion inwardly of the bore and the liner, said tubular portion being provided with detent means constantly interlocking the collar to the cast housing for rotating the collar with the housing, said detent means providing alternative first and second detent positions, said collar in its first detent position holding each rolling element relative to the respective liner wedging surfaces for rotating the tool shank with the handle member in a first angular direction only, said collar in its second detent position holding each rolling element relative to the respective liner wedging surfaces for rotating the tool shank with the handle member in the reverse angular direction only.

2. The rotary hand tool of claim 1 wherein said thin metal liner engages the bore with a press fit connection.

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3. The rotary hand tool of claim 1 wherein the collar comprises a rolling element positioning portion holding the rolling elements in circumferentially spaced relationship about the coupling portion of the tool shank in surface confronting relationship with alternative wedging surfaces of the thin metal liner respectively, each rolling element being held against the respective alternative angularly spaced wedging surfaces of the liner with the positioning member in its two alternative angular positions respectively.

4. The rotary hand tool of claim 3 wherein the cast housing bore has a generally cylindrical section surrounding said tubular portion of the collar, and wherein the detent means interlocks the generally cylindrical section of the cast housing and the tubular portion of the collar for holding the collar alternatively in its said first and second angular positions relative to the handle member.

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