United States Patent

[11] **3,554,251**

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[21] Appl. No. **752,952**
[22] Filed **Aug. 15, 1968**
[45] Patented **Jan. 12, 1971**
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[54] **DETACHABLE BIT RATCHET HAND TOOL**
3 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **145/75,** 279/23
[51] **Int. Cl.** **B25g 3/12**
[50] **Field of Search** 145/75, 72, 70; 279/23, 102; 81/60, 61, 62, 63.1

[56] **References Cited**

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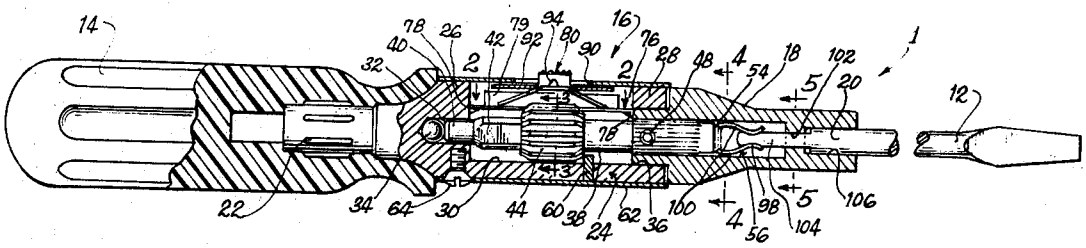
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ABSTRACT: A detachable bit ratchet hand tool having an axially aligned handle bit and adapter and a ratchet means coupling the handle and bit adapter for selective combination, reverse and forward driving, and a spring in said adapter for quick-connect and quick-release engagement of tool bits.



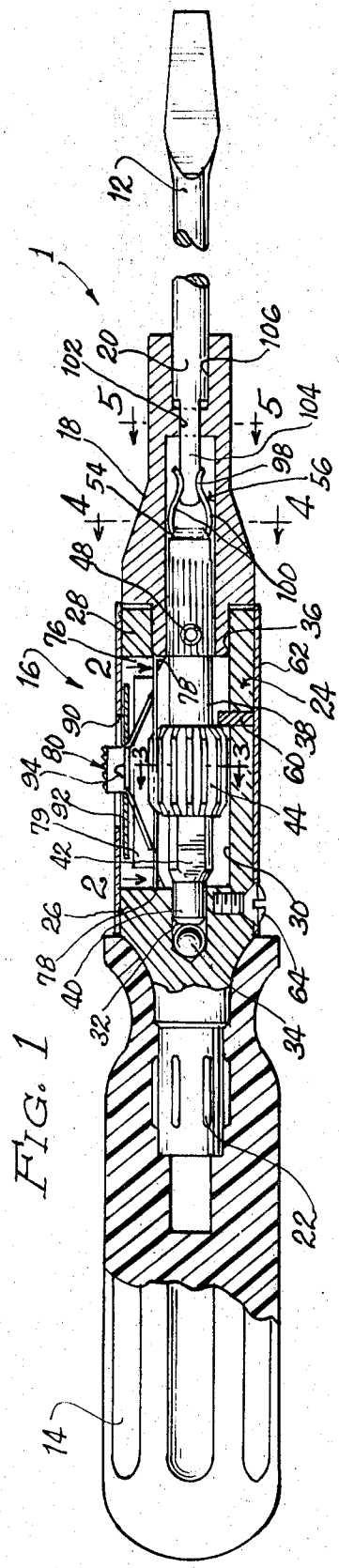


FIG. 1

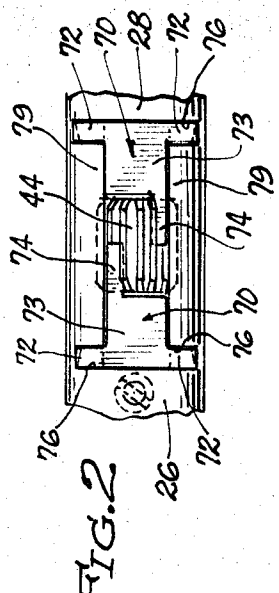


FIG. 2

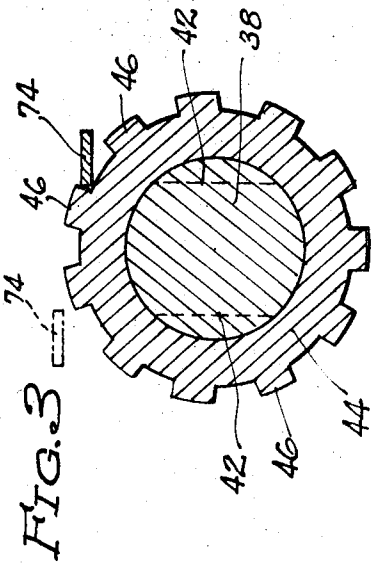


FIG. 3

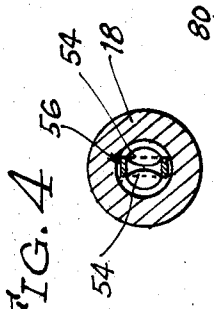


FIG. 4

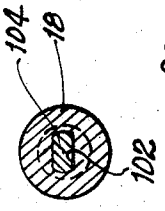


FIG. 5

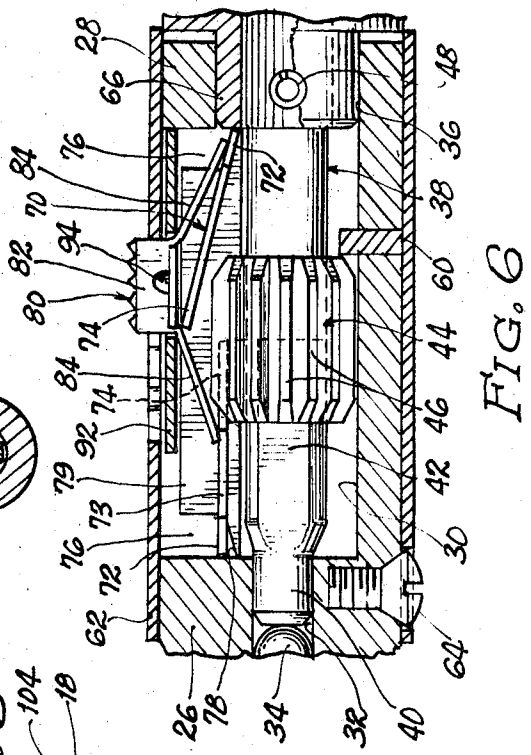


FIG. 6

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DETACHABLE BIT RATCHET HAND TOOL

This invention relates to a detachable bit ratcheting hand tool mechanism and, more particularly, to the construction of a hand tool incorporating a ratchet mechanism having provision for quick insertion and removal of a tool bit. Moreover, this invention contemplates operation and assembly of the tool with a selection of tool bits whose heads may vary in design and function.

The complex mechanical equipment of today is so constructed, that service of it generally requires a vast array of hand tools, which may only differ in the design and function of the associated bit heads. In order for a technician performing assembly, installation or maintenance work to have this required array of hand tools, he frequently must purchase a substantial number of separate, single purpose hand tools whose bits vary only in head design and function. Especially when he desires hand tools which combine the efficiency of a ratchet mechanism and the function of a particular bit, the technician is put to great expense. Such single purpose tools also presented problems of space consumption and weight in transporting them from one job location to another.

While it is recognized that rachet-type replaceable bit hand tools have been available in the market, it is an advantage of this invention to provide a simpler, more efficient, and less expensive tool which combines the advantages of a ratcheting hand tool, for such as screwdrivers, nut drivers, taps, while providing a means for permitting the quicker and easier removal and replacement or substitution of snap-in bits.

Another important advantage of this invention is that it provides a detachable bit hand tool wherein the handle, ratcheting mechanism and snap-in bit are so firmly combined that the assembly works together as efficiently as a one piece tool.

Other features and advantages of the invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which show the structure embodying preferred features of the present invention and the principles thereof, and what is presently considered to be the best mode in which to apply these principles.

FIG. 1 is a longitudinal view, partially in section, of a hand tool of this invention retaining a screwdriver bit;

FIG. 2 is a fragmentary top view of FIG. 1 with certain portions removed for clarity, viewed as though taken substantially along line 2–2 of FIG. 1;

FIG. 3 is a cross-sectional view taken substantially along the line 3–3 of FIG. 1;

FIG. 4 is a cross-sectional view taken substantially along the line 4–4 of FIG. 1;

FIG. 5 is a cross-sectional view taken substantially along the line 5–5 of FIG. 1; and

FIG. 6 is an enlarged view of a portion of FIG. 1 illustrating the tool in one selected driving position.

Referring now to the drawings, and in particular to FIG. 1, a ratchet hand tool 10 incorporating the features and advantages of the present invention is shown cooperatively assembled with a detachable bit 12. Bit 12 is illustrated herein in the exemplary form of a screwdriver blade. Tool 10 has a handle portion or grip 14, an axially aligned adapter 18 and a ratchet mechanism 16 coupling grip 14 to adapter 18 and in line therewith. Adapter 18 retains the shank 20 of bit 12 within tool 10.

Grip 14 of tool 10 is of any appropriate shape and is formed by molding a suitable material, such as a cellulose acetate and cellulose butyrate resin (sold by Eastman Chemical under the tradename "Tenite-Butyrate") or other materials well known for the purpose. The illustrated grip has a conventional fluted exterior that serves to aid in gripping and in preventing slippage in use. Preferably grip 14 is molded with a bore adapted to receive a grip-received extension 22 of ratchet housing 24. Extension 22 is properly sized, proportioned and constructed with respect to the grip bore so that it is tightly and frictionally held against removal from the bore.

Ratchet housing 24, forwardly of extension 22, comprises a cylindrical body comprising a rear segment 26, a forward section 28 and an intermediate open cavity 30 for mounting or supporting the tool operating mechanism.

Rear segment 26 defines an axial bore 32 frictionally retaining a ball bearing 34. Forward section 28 defines a cylindrical bearing opening 36 which is coaxial with bore 32 to cooperate therewith in rotatably journaling the driving portion of the tool.

The driving portion of tool 10 which is adapted to rotate with respect to grip 14 includes a shaft 38 having a rear end 40 proportioned to be rotatably journaled within axial bore 32 and to thrust against ball bearing 34. Preferably rear end 40 is chamfered to provide a smooth fit within bore 32 and to provide proper seating against ball bearing 34.

Moving to the right, as seen in FIGS. 1 and 6, shaft 38 increases in diameter whereat it is provided with one or more flats 42. A pinion 44 having a plurality of teeth 46 is corotatably secured to shaft 38, the pinion defining a central opening complementary to flats 42 to corotationally key the pinion to the shaft. The size of the shaft of flats 42 and the complementary bore of pinion 44 are proportioned so that pinion 44 becomes press fit on the shaft to prevent axial movement of the pinion therealong. In that manner pinion 44 is corotatably and permanently positioned with respect to shaft 38.

Moving again to the right in FIG. 1, shaft 38 defines a bore adapted to receive a roll pin 48 and to the right thereof defines a longitudinally knurled section adapted to be press fit into adapter 18. In this manner adapter 18 is corotatably secured to shaft 38. At the very end of shaft 38 a pair of staking prongs 54 are provided. Prongs 54 are staked inwardly to grip and anchor spring 56 to the end of shaft 38. A chordal key 60 is provided to prevent axial removal of the interconnected adapter 18 and shaft 38 from ratchet housing 24. Key 60 conforms at one edge to the shape of the external surface of housing 24 and at its other edge presents a chordal segment closely adjacent pinion 44 internally of housing 24. Chordal key 60 is frictionally held in a complementary slot in ratchet housing 24 and is secured against accidental removal by se sleeve 62 which is secured in covering relation to ratchet housing 24 by screw 64 received in a complementary threaded opening in ratchet housing 24. When pinion 44 and the associated shaft 38 are so restrained against axial movement, shaft 38 and interconnected adapter 18 are journaled for rotation within axial bore 32 and within coaxial bearing opening 36 in forward section 28. Cylindrical bearing segment 66 of adapter 18 is rotatably received within opening 36 and rear end 40 is rotatably journaled in coaxial bore 32.

To provide for selective forward, reverse or combination driving, means cooperable with pinion 44 are provided. Those means comprise a pair of pawls 70 and means for selectively engaging the pawls with the teeth 46 of pinion 44.

As best seen in FIGS. 1 and 2, each of the pawls 70 is a planar stamping having a pair of ears 72, a main body section 73 and a pinion engaging pawl segment 74 projecting into the projected cylinder of the pinion teeth 46. In the combination driving position, the pawl segment 74 of each of the pawls 70 projects into said projected cylinder of the pinion teeth which, as will be explained, prevents rotation of the pinion and connected shaft to adapt the tool 10 for combination driving FIG. 1).

As seen in FIGS. 1, 2 and 6, ears 72 of pawls 70 are seated in recesses 76 in ratchet housing 24. Two pairs of such recesses are provided, one pair adjacent each of the rear segment and forward section of housing 24. These recesses have outwardly and downwardly sloping floors 78. The sloping floors terminate inwardly (as viewed in FIGS. 1 and 6) in upward extensions 79 of the open cavity defining portion 30 of ratchet housing 24, which extensions serve to prevent movement of the pawls axially of the tool to retain them in recesses 76. Extensions 79 also serve to restrain lateral movement of the pawls 70 because they lie adjacent main body section 73.

Pawl segments 74 are selectively engageable with and disengageable from teeth 46 of pinion 44 via a finger or thumb operable selector member 80 made of spring steel. Selector member 80 comprises a central ribbed thumb piece 82 from which depend integral spring arms 84. Arms 84 project out-

wardly and downwardly at angles of about 20° from thumb piece **82** and are urged against the confronting surfaces of pawls **70**, i.e., main body sections **73**. The ends of the arms **84** are adapted to slide along those surfaces. When the end of one of the arms is moved to the vicinity of ears **72** and there overlies the sloping floors **78** of one of the recesses **76**, arm **84** will pivot the ear-end of the pawl **70** downwardly toward sloping floors **78**, thereby elevating the pawl segment out of engagement with pinion teeth **46** as illustrated in phantom in FIG. **3** and in FIG. **6**.

Referring further to FIG. **3**, as pinion **44** moves counterclockwise, teeth **46** will contact the remaining engaged pawl segment **74**. As a tooth **46** contacts pawl segment **74**, tooth **46** will bias it upwardly against the action of the spring arm acting against it, thereby allowing the pinion and the corotatable shaft and adapter to move with respect to the handle grip **14**. However, when, as viewed in FIG. **3**, pinion **44** is moved in a clockwise direction it is stopped by pawl segment **74**, which is restrained from lateral movement by adjacent extension **79**, thereby preventing relative rotation of the grip with respect to the pinion, the associated shaft and adapter, as well as bit **12**. This will provide for forward driving. Reverse driving will be obtained by sliding movement of the selector member **80** to operate against the pawls oppositely as illustrated in FIG. **6**.

As seen in FIGS. **1** and **6**, the thumb piece **82** of selector member **80** projects through an axial slot **90** in sleeve **62**. A protective collar **92** defining an opening substantially coextensive with thumb piece **82** overlies arms **84** and covers them through the entire length of movement of thumb piece **82** within slot **90**. Thumb piece **82** preferably defines a pair of opposed dimples **94** which are receivable with pairs of complementary notches (not shown) extending inwardly of the periphery of slot **90**. The dimples are received within the notches to releasably position thumb piece **82** in its three positions of adjustment. The centermost pair of notches positions the thumb piece so that both pawl segments **74** are interlocked with the pinion teeth for combination driving FIGS. **1** and **2**), whereas the two outermost pairs of the notches retain thumb piece **82** in a position in which the pawl segments are arranged, alternatively, to allow forward and reverse driving, one of which positions is illustrated in FIG. **3** and the other of which is illustrated in FIG. **6**, respectively. When the mode of driving is to be change, downward pressure against the thumb piece will disengage dimples **94** and the associated pair of notches to allow sliding movement of the selector member to one of the other driving positions.

As stated, staking prongs **54** are staked over (FIG. **4**) to retain and position spring **56** at the end of shaft **38**. Spring **56** is generally horseshoe or U-shaped in side view (FIG. **1**) and has a pair of confronting arms **100** which are adapted to grip a complementary end portion of bit **12**. Thus the end of bit **12** is provided with a pair of opposed concave recesses **98** into which the spring arms urge the ends of arms **100**, thereby to snap-engage the ends within recesses **98** to resist removal of the bit. The tips of arms **100** are bowed outwardly to cam the arm ends apart as the end of bit **12** is inserted.

Adapter **18** defines a socket to receive the end of bit **12** and a keyway **102** spaced away from and forwardly of spring **56** (as viewed in FIG. **1**). Keyway **102** is proportioned to slidably receive the end **104** of bit **12** which is provided with a pair of opposed flats to orient the bit end **104** with respect to arms **100** and to corotatably secure bit **12** to adapter **18**. Thus bit **12** is supported at two spaced pi points, is corotatable with adapter **18** and is axially restrained against removal from hand tool **10**. Preferably shank **1 20** of bit **12** is of a diameter which mates with adapter bore **106** to minimize the possibility of wobble, although the extended axial length of keyway **102** is generally sufficient for that purpose.

It is clear that bits other than the screwdriver blade bit illustrated may be used in accordance with this invention. For example, Phillips bits, nut driver bits, spline bits, Robertson bits, and the like, each having an appropriately configured tool insertion end may be used. In each instance, a quick pull releases the bit end from spring **56** and a quick push reinserts a new bit, making the tool of this invention universal for a wide variety of bits.

Thus, it is clear that the ratchet hand tool of this invention presents many advantages not heretofore available in a single tool.

I claim:

1. A detachable bit hand tool comprising an axially aligned grip and bit adapter, ratchet means coupling and in line with said grip and said adapter, said ratchet means comprising a shaft, a pinion corotatably secured thereto, a pair of pawls and selector means in engagement with said pawls, said selector means being movable to combination, forward and reverse driving positions in which positions the pawls are selectively engaged with and disengaged from said pinion, and a bit holder comprising a generally U-shaped spring anchored to one end of said shaft and positioned within said adapter, said adapter defining a socket confronting said U-shaped spring to receive one end of a bit, a bit, said bit and said socket defining interlocking keying means to corotatably seat and retain said bit within said adapter, whereby when said selector means is moved to combination driving position, the handle and adapter are locked for corotation and when said selector means is moved to reverse and forward driving positions the grip and adapter are locked for corotation in one direction of rotation only.

2. In the detachable bit hand tool of claim **1** in which said shaft defines a pair of prongs staked over to anchor said U-shaped spring to said shaft.

3. In the detachable bit hand tool of claim **1** in which said U-shaped spring is horseshoe-shaped and said bit end defines concave sections snap-connectable to said spring for quick-release and quick-connection of the bit to the hand tool.