July 30, 1963 C. KOSTKA 3,099,177

COMBINED RATCHET AND DIRECT DRIVE HAND OPERATED ROTARY TOOLS

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FIG.2

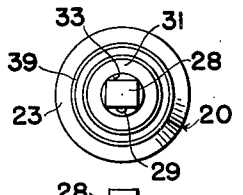


FIG.3

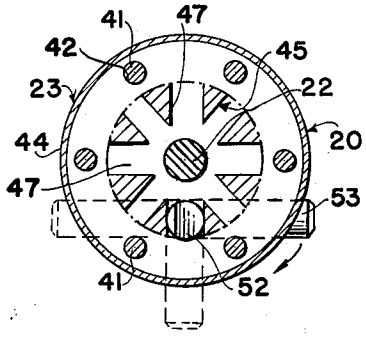
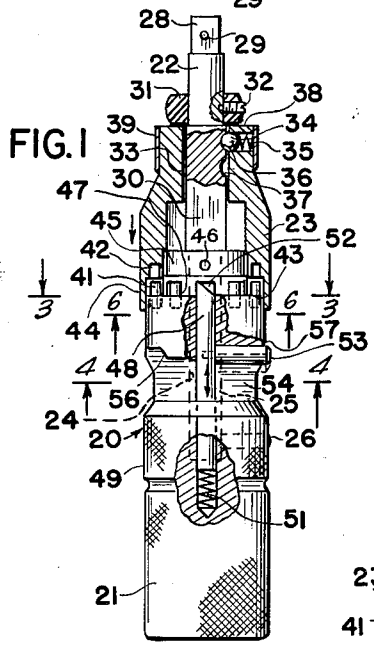


FIG.1



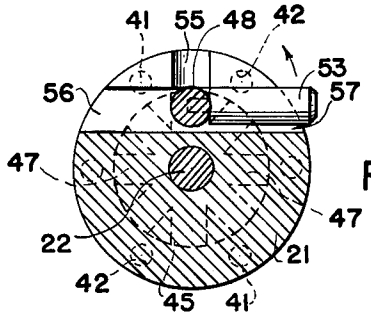


FIG.4

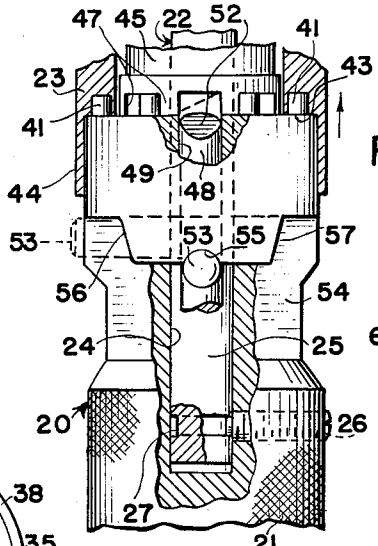


FIG.5

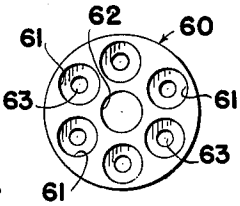
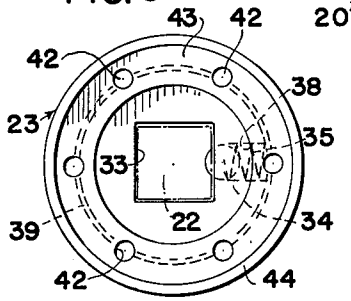


FIG.7

FIG.6



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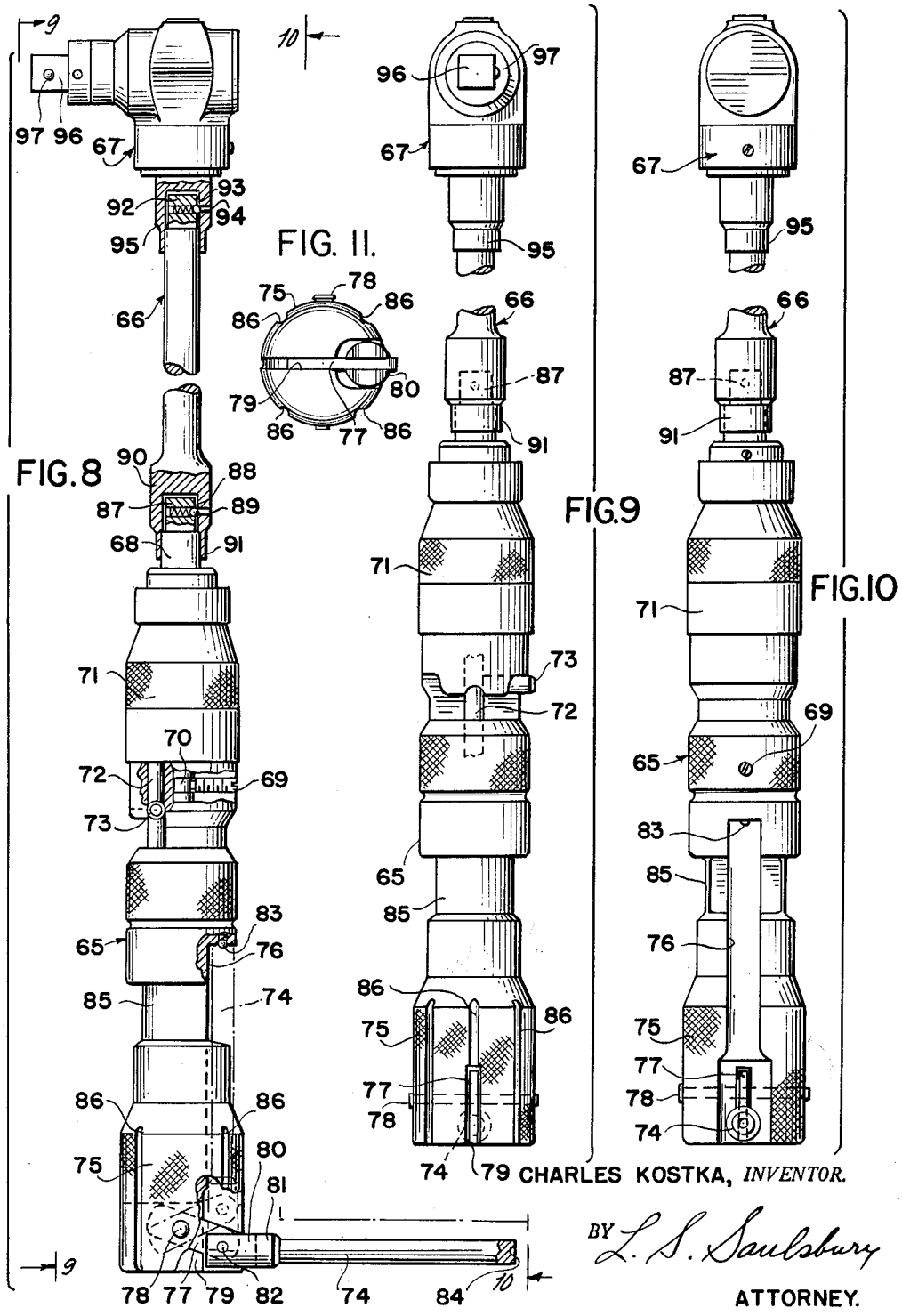
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COMBINED RATCHET AND DIRECT DRIVE HAND OPERATED ROTARY TOOLS

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4 Claims. (Cl. 81—63.2)

The invention relates to hand rotary tools and more particularly to an improved four-way ratchet handle and extension construction for socket wrenches, screw drivers, reamers and the like.

It is the principal object of the present invention to provide a hand rotary tool comprised of only a few and simple parts forming a rugged, reliable, four-way ratchet handle for manually imparting two-way rotary movement either directly or through intermediate extension pieces to socket wrenches, screw drivers, reamers and the like.

It is another object of the invention to provide a hand ratchet tool with an improved coupling means effecting direct drive between the handle and the drive spindle thereof and any intermediate extension pieces connected thereto to make the handle and extension piece solid for non-ratchet use of the hand tool.

It is still another object of the invention to provide a four-way rotary tool which is fool proof in operation and serviceable with standard and conventional socket wrench elements and which will be practical and highly efficient in use.

It is a further object of the invention to provide a hand rotary tool of the socket wrench type with a lever arm grip that can be pulled out of the side of the handle when needed to impart increased turning power to the tool.

Other objects of the invention are to provide in a hand ratchet rotary tool of the socket wrench type, having the above objects in mind, which is of simple construction, has a minimum number of parts, easy to assemble, inexpensive to manufacture, durable, easy to adjust for ratchet operation in opposite directions and between ratchet and direct drive, of pleasing appearance and effective in use.

For still other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which:

FIGURE 1 is a front elevational view of a four-way ratchet handle of the socket wrench type with parts broken away and in section to show the interior thereof, the ratchet selector lever being positioned to turn the handle in a counterclockwise direction when viewed in FIG. 3,

FIG. 2 is a front end plan view of the ratchet handle shown in FIG. 1 and looking upon the squared end of the socket drive spindle,

FIGS. 3 and 4 are enlarged sectional views of the ratchet handle taken respectively on lines 3—3 and 4—4 of FIG. 1,

FIG. 5 is an enlarged fragmentary elevational view of the ratchet handle, with parts in section, and particularly of the direct drive clutch in full engagement with the spindle drive shaft for operation of the handle as a solid unitary structure and with the ratchet pin retracted to the neutral position,

FIG. 6 is a plan view of the direct drive clutch part removed from the assembly and as viewed generally on line 6—6 of FIG. 1, the drive spindle being shown in phantom therewithin,

FIG. 7 is a bottom plan view of a modified form of the ratchet wheel removed from the assembly.

FIG. 8 is a collective side elevational view of a modified four-way ratchet handle coupled to an intermediate extension piece and angle gear coupling for driving a socket wrench at an angle with respect to the handle,

the handle being modified in form to have a built-in torsion grip lever shown in full lines as extended at right angles to the handle with parts broken away to show the interior of the handle,

FIGS. 9 and 10 are collective front and rear elevational views of the ratchet handle, extension piece and angle gear coupling as viewed respectively along lines 9—9 and 10—10 of FIG. 8, and

FIG. 11 is an end view of the handle extension housing the torsion grip lever.

Referring now particularly to FIGS. 1 to 6 of the drawing, 20 represents a four-way ratchet handle for a rotary tool that comprises generally a handgrip portion 21, a drive spindle 22 and a cup-shaped direct drive clutch part 23, all arranged in coaxial alignment. As is clear from FIG. 5 the handgrip portion 21 has an axial bore 24 that extends downwardly from its upper end to a mid-point therein and receives for free rotation a lower portion 25 of the drive spindle 22 of circular section. The drive spindle 22 while suitably retained for free rotation is held against axial movement by set screw 26 extending into annular groove 27 in the spindle lower portion 25.

The drive spindle 22 has a male coupling portion 28 of square section at its upper end with a spring pressed ball detent 29 therein of conventional construction and is adapted for engagement with a standard socket wrench, extension piece, angle drive coupling and the like in a well understood manner.

The cup-shaped clutch part 23 as seen in FIG. 1 is mounted to turn with and axially slide on an intermediate portion 30 of the drive spindle 22 between an uppermost position and against a set collar 31 secured by a set screw 32 and a lowermost position engaging the upper end face of the handgrip portion 21. As best shown in FIGS. 1 and 6, the spindle intermediate portion 30 is of square section and extends through a correspondingly-shaped axial bore 33 in the upper end of the direct drive clutch part 23. In both the uppermost and lowermost positions, the cup-shaped clutch part 23 is retained by a ball detent 34 resiliently urged by a spring 35 to extend into either an upper depression 36 or a lower depression 37 in the spindle intermediate portion 30. The ball detent 34 and spring 35 are held in a hole 38 drilled radially in the upper end of the clutch part 23 by a ferrule 39 press fitted thereabout.

The cup-shaped direct drive clutch part 23 encloses a ratchet mechanism disposed between the handgrip portion 21 and the spindle part 22 and serves as the direct drive clutch for engaging the handgrip portion 21 directly to the drive spindle 22. The clutching action is effected through a series of pins 41 equally spaced in circular fashion and projected upwardly from the end face of the handgrip portion in registry for seating in complementary holes 42 in an interior shoulder 43 adjacent the lower end of the cup-shaped direct drive clutch part 23. The lower open end of the cup-shaped clutch part 23 has a depending skirt portion 44 into which the upper end of the handgrip portion 21 telescopes for complete enclosure of the ratchet mechanism.

The ratchet mechanism comprises a ratchet wheel 45 that is fixd to the spindle lower portion 25 by a set screw 46 and is shouldered against the lower end of the square intermediate portion 30 of the spindle 22. The ratchet wheel 45 is located adjacent the upper end face of the handgrip portion 21 and is sized to fit concentrically within the pins 41 projecting upwardly from the end face. The ratchet wheel 45 faces the handgrip portion end face and has radially-extending ratchet grooves 47 over the sides of which a pawl pin 48 may engage to turn the spindle 22 in one direction or ratchet in the opposite direction.

The pawl pin 48 is eccentrically positioned in a bore 49 in handgrip portion 21 that extends parallel to the axial bore 24. This pawl pin is normally urged upwardly by a compression spring 51 to project its end cam face 52 on the upper end thereof against the ratchet wheel 45. A laterally-extending finger actuation knob 53 is fixed to a mid-point of the pawl pin 48 for turning the pin face 52 to three selective positions. This finger knob 53 operates in a cut-out space 54 in the handgrip portion 21 that exposes the mid-length of the pawl pin 48 and has in its upper surface three cradles 55, 56 and 57 in which the finger knob 53 may be selectively positioned. As best seen in FIGS. 4 and 5, cradles 56 and 57 are in axial alignment with each other while cradle 55 extends at right angles with respect thereto and is offset downwardly to hold the pawl pin 48 in its retracted and neutral position to have the drive spindle 22 free to rotate. With the pawl pin 48 turned to locate the finger knob 53 in the dotted line position shown in FIG. 5 in cradle 56 the pawl pin 48 is set to turn any attached socket to the right and clockwise; with the pawl pin 48 turned to locate the finger knob 53 in the cradle 57 as shown in FIGS. 1 and 4, in full line, the pawl pin 48 is set to turn the wrench socket to the left and counterclockwise.

In operation, if the cup-shaped clutch part 23 is pulled axially toward handgrip portion 21, that is, in the direction of the arrow as shown in FIG. 1, and by slightly turning the clutch part with respect to the handgrip portion, pins 41 will seat in holes 42 and ball detent 34 will engage lower depression 37 of the drive spindle 22. In this position, as best shown in FIG. 5, the rotary tool 20 will serve as a solid tool for turning socket wrenches or the like coupled to square male coupling extension 28 of the spindle 22 in the well known manner.

To utilize the ratchet mechanism for a ratchet operation, the clutch part 23 is pushed axially away from handgrip portion 21 that is, in the direction of the arrow shown in FIG. 5, until clutch part 23 abuts the set collar 31 and the ball detent 34 engages the upper depression 36 in the spindle part 22. In this position, the pins 41 are disengaged from the openings 42 as shown in FIG. 1 and clutch part 23 is free to rotate with respect to handgrip portion 21 except for any ratcheting interconnection between the ratchet wheel 45 and the pawl pin 48.

When the finger knob 53 is placed in the neutral cradle 55, as shown in full lines in FIG. 5, end inclined cam surface 52 of pawl pin 48 is completely retracted from the ratchet wheel grooves 47 and permits free rotation of the spindle 22 and the cup-shaped clutch part 23 with respect to the handgrip portion 21. By positioning finger knob 53 in cradle 57 as shown in FIGS. 1 and 4, the end cam surface 52 of pawl pin 48 extends into the ratchet wheel grooves 47 to permit positive drive in a counterclockwise direction looking at FIG. 4 but pawl pin 48 will be forced to retract against spring 51 by the action of cam surface 52 on the sides of grooves 47 permitting relative rotation between handgrip portion 21 and drive spindle 22 when the handgrip portion 21 is rotated in a clockwise direction. This ratcheting action is reversed by placing finger knob 53 in cradle 56 as shown in broken lines in FIG. 5. With the finger knob 53 in the neutral cradle 55 as shown in FIG. 5 and the cup-shaped clutch part 23 in the position shown in FIG. 1, the handgrip portion 21 and the spindle 22 run free of one another.

In FIG. 7 there is shown a modified form of ratchet wheel 65 in which the pawl engaging side of the wheel is formed with a series of circumferentially-spaced openings 61 which may be suitably drilled therein, the sides of the openings cooperating in the same manner with pawl pin cam surface 52 as the sides of the grooves 47 of the ratchet wheel 45 cooperate therewith. This ratchet wheel 60 has a central opening 62 for receiving the lower portion 25 of the spindle 22 and will be fixed thereto by a set screw in the same manner that the wheel 45 is fixed by the set screw 46. Small holes 63 extend from the large openings 61 to keep them free of dirt.

In FIGS. 8, 9, 10 and 11, there is illustrated the use of a modified ratchet handle 65 constructed to embody the invention and taken with an extension piece 66 and angle drive coupling 67. The ratchet handle 65 is coupled to the intermediate extension piece 66 and angle drive coupling 67 and to which in turn is coupled any interchangeable rotary tool part such as a socket wrench, screw driver, reamer and other similarly operated attachments.

Within the ratchet handle 65 is a drive spindle 68 secured for rotation therein but against axial displacement by a set screw 69 entering a groove 70 in the lower end of the spindle. A cup-shaped clutch part 71 encloses a ratchet mechanism like that disposed in the ratchet handle 20. A pawl pin 72 is vertically slidable in the handle 65 and operable by a finger actuation knob 73 to control the ratcheting operation in the same manner as described above with reference to the pawl pin 48 and knob 53.

To improve the versatility of handle 65, a built-in retractible torsion grip lever 74 is provided in an elongated lower section 75 of the handle 65, the lever 74 being arranged to pivot outwardly to a laterally-extended position at right angles to handle extension 75, shown in FIG. 8, from a retracted position in an elongated seating cavity 76 arranged to extend longitudinally of handle extension 75. For connecting the torque lever 74 to the handle extension 75 for pivotal movement, a short link 77 is mounted on a pivot pin 78 at one end thereof and located in a diametrically-extending slot 79 extending laterally from a widened lower end of the lever seating cavity 76. The opposite end of the short link 77 extends into a slot 80 formed in an enlarged end 81 of the lever 74 and is connected thereto by a pivot pin 82. The double pin pivoting action of the short link 77 permits the torque lever 74 to swing from its retracted position in the cavity 76 shown in broken lines in FIG. 8 to its operative right angle extended position shown in full lines in FIG. 8.

Releasable retention of the torque lever 74 in the cavity 76 is provided by a ball detent 83 located in the upper end wall of the cavity 76 to engage notch 84 in the free end of the torque lever 74. Suitable clearance for finger gripping lever 74 for removal from its retracted position is accomplished by an annular groove 85 about the handle 65 and cutting across a midportion of the cavity 76. The annular groove 85 facilitates the handgripping of the handle 65 and enhances the decorative appearance of the handle 65. Also, surface longitudinally-extending parallel grooves 86 in the handle extension 75 facilitate the gripping of the handle and enhance the appearance thereof.

A further feature of the invention lies in the manner by which the connections of the releasable coupling components are designed to prevent accidental separation and eliminate any buckling at the coupling upon exertion of pressure both axial and rotary. As clearly seen in FIG. 8, a male coupling extension 87 of square section of the spindle 66 has a ball detent 88 that releasably engages an opening 89 in a female coupling portion 90 of the extension piece 66, which is square shaped and sized to drivingly receive the coupling portion 87. The diameter between the diagonal corners of the square extension 87 is the same as the diameter of the round portion of the spindle 68 therebelow. A skirt portion 91 extends downwardly beyond the square female coupling portion 87 to tightly surround the adjacent round portion of the spindle 68 in telescoping fashion and provide a rigid coupling connection therewith, the internal diameter of the skirt opening being substantially that of the round portion.

The angle coupling 67 may be of the type described and claimed in the United States Patent No. 2,589,822 of the present inventor, but is here shown as my improved coupling more fully described in my co-pending application Serial No. 73,114, filed December 1, 1960, relating to hand rotary tools and angle connections therefor.

The upper end of the extension piece **66** has a male coupling extension **92** of square section and a ball detent **93** engageable with a small opening **94** in a female coupling portion **95** of the angle drive coupling **67**. The angle drive coupling **67** has extending at right angles to the female drive coupling portion **95** a male coupling portion **96** having a ball detent **97**. To this male coupling portion **96**, another extension piece, socket wrench, screw driver, reamer or like work part can be coupled.

By selectively setting the cup-shaped clutch part **71** to its extended position and the finger knob **73** of pawl pin **72** for connection with an internal ratchet wheel, the ratchet handle **65** will operate in the same manner as hereinbefore described for ratchet handle **20** and will serve to deliver rotary motion to the male coupling portion **96** of the angle drive coupling **67** having an axis of rotation at right angles to that of handle **65** and at a remote distance therefrom.

When torque is required to effect the drive, the ratchet handle is more readily manipulated by grasping the extended torsion grip lever **74** in the fist, the same having previously been swung into its extended position by gripping a midportion thereof in the region of annular groove **85** by thumb and finger and releasing the same from the cavity **76** against the action of ball detent **83**.

It should now be apparent that there has been provided a four-way ratchet handle tool which can be driven directly or through ratchet mechanism, in assembly with extension and angle drive pieces and in so doing meets the conditions of practical use.

While various changes may be made in the detail construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A hand operated rotary tool comprising a handle part, a spindle journalled in said handle part, a ratchet pawl selectively angularly adjustable in said handle part and extending slidably from one end thereof, a ratchet wheel fixed to the spindle and having ratchet teeth on the underside thereof engageable with the ratchet pawl, a cup-shaped clutch part drivingly connected to the spindle and axially displaceable between extended and retracted positions, drive pins projecting axially forward from the handle part, the clutch part having openings for receiving the drive pins of the handle part to lock the handle and the cup-shaped clutch parts together with the cup-shaped clutch part in its retracted position, whereby direct drive as well as ratchet drive may be selectively effected between the handle and spindle parts.

2. A hand operated rotary tool as defined in claim 1, and detent means on the clutch part and engageable with the spindle to retain the clutch part in either its extended or retracted positions, set collar means for retaining the clutch part against axial displacement from the spindle and limiting the outward movement of the clutch part to the extended position.

3. A hand operated rotary tool as defined in claim 1, and said handle part having a cut-away opening intermediate its length, said pawl extending axially through the cut away opening and having a laterally-extending finger knob for turning the pawl and said handle part having cradle formations in the cut-away opening for receiving the finger knob and holding the pawl in selected right, left or neutral positions, biasing means in the handle part and acting against the pawl to retain it against a selected one of the cradle formations.

4. A hand operated rotary tool as defined in claim 1, and said spindle having a coupling extension of square section and a rounded surface portion adjacent thereto, the diameter of the square coupling portion diagonally between its corners being the same as the diameter of the adjacent rounded surface portion, whereby a skirted coupling part receiving the squared coupling extension of substantially the same dimensions will be tight fitted when telescoped over the rounded surface portion.

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