Hand Powered Rotary Tool

The present invention is concerned generally with a hand powered rotary tool, more particularly with a trigger actuated pistol grip type hand powered rotary tool and specifically with a tool of the character described adaptable for selectively driving a tool bit received therein in either sense of rotation.

Various types of hand powered devices have appeared in the prior art, for example, electric hand lamps or rotary type tooth brushes, wherein manual exertion actuates a motion and force converting mechanism within the device to produce a rotary motion required for attainment of the functional result of the device. Thus pistol shaped electric hand lamps have been proposed where a trigger element is manually moved for the ultimate driving of a generator therein; while other devices include a hand squeezed element other than a trigger as the energy input for a mechanism having one or more rotary output spindles carrying a working element.

It is an object of the present invention to provide a conveniently gripped and hand actuated tool for driving rotary tool implements connected thereto such as screw driver bits, drill bits, or other rotary implements. Another object of the present invention is to provide a device of the character described which is conveniently hand held and operated. Another object of the invention is to provide a device of the character described where a rotary output is selectively available in either sense of rotation. A still further object of the invention is to provide a device of the character described which is simple, compact, rugged and of low cost in construction.

Other objects and advantages of the invention will appear from the following description and the drawings wherein:

FIG. 1 is a generally vertical, longitudinal section of the device, with certain parts being shown in exploded relationship;

FIG. 2 is a plan view with certain portions broken away;

FIG. 3 is a fragmentary sectional view taken as indicated by the line 3—3 in FIG. 1; and

FIG. 4 is an enlarged fragmentary top view of a ratchet means.

The device of the present invention in the form shown in the drawings comprises a hollow casing C, generally of pistol-shaped form having a trigger 11 projecting downwardly from an opening in the upper part of the casing forward of the pistol grip portion 18, and a mechanism indicated as a whole by the reference character M for converting trigger motion into rotary motion of a tool bit B, here shown as a screw driver, the back end of which is inserted into a nose assembly N for an internal connection with an output spindle 13.

The casing C is conveniently formed of two halves, each a mirror image of the other and secured together by a plurality of transverse screws 14 passing through one and threaded into the other. Preferably the casing halves are formed of molded insulating plastic and the external portion of the trigger element 11 has a plastic insulating coating, as a safety measure against electrical shock to the user. However, the two halves of the casing could be produced by die casting or other like means adapted to low cost fabrication. The nose assembly includes a somewhat wedge-shaped element or plate 16 disposed in a space formed by opposed recesses at the front wall 16a of the composite casing as hereinafter described; the spindle plate having a pair of aligned tubular portions 17 and 18 projecting from its forward and rear faces respectively to provide a journal or supporting cylindrical surface for the output spindle 13 extending therethrough. Since the forward projection 17 is counterbored for the head 13a of the spindle, with a thrust or wear washer 20 interposed between the counter-bore shoulder and the under side of the head 13a, the spindle is retained in the assembly by the output bevel gear 15 pinned on its inner end and bearing against the end of the tubular portion 18. The end of 17 projecting beyond the casing is threaded to receive thereon the bit retaining nose nut 21. The forward wall of nut 21 has a co-axial bore rotatably supporting the back end of tool bit B, which is retained therein for driving engagement of the bit end tongue 23 in a spindle head transverse slot by means of a spring urged ball 25 in a radial bore of the nut engaging a circumferential bit groove 26.

It will be noted in FIG. 3 that the lower end or apex of the plate 16 is rounded to serve as a pivot surface seated in a rounded bottom of a transverse wedge shaped plate receiving compartment formed by opposed recesses in the front wall portion 16a of the two halves of the casing C, and that an angle of the sides of the compartment is broader or wider than the angle between the converging sides of plate 16, to permit the plate to be swung to the left or right of the tool in selecting the driving direction of the output as hereinafter explained, while the top of the compartment is accuratley conformed with the top edge of the plate as a portion of a cylindrical surface having as its axis the effective pivot axis of the plate. The thickness of the plate and its height are selected relative to the corresponding thickness and depth of the compartment forming recesses for a close sliding fit of the plate allowing swinging of the nose assembly from one side to the other while keeping the axis of the spindle from twisting, i.e. maintained substantially parallel at all times to the longitudinal center plane of the tool. At front and back of said compartment, the wall 16a is also provided with arcuate slots such as 106, resulting from corresponding opposed notch formations in the two casing halves, for receiving therein the tubular portions 17, 18 respectively of the nose assembly with close sliding clearance, which slots further support and steady the entire assembly. The arcuate center of these slots is coincident with the intended axis of pivoting for the plate.

Near the top of the plate three apertures 31, at the plate center line and 31a and 31b equi-spaced at opposite sides thereof, cooperate with a pointed locking plunger rod 34 in retaining the nose assembly at a selected position. Rod 34 is slidable seated fore and aft in apertures formed by correspondingly sized semi-cylindrical recesses in the abutting edges of two halves of the casing, and is biased forwardly to engaged position by a helical spring 35 interposed between a fixed collar 36 and the back interior wall of the casing. The external end of plunger rod 34 is headed or knobbled as a convenient finger grip for disengaging the plunger to allow shifting of the plate. The nose assembly thus may be held at a neutral position at the center of the device by engagement of the plunger in aperture 31, or at either side by engagement with 31a or 31b; and accordingly provides means rotatably mounting the spindle and adapted for shifting the spindle for the hereinafter described selective engagement of gear 15 with either 44 or 45.

The mechanism M includes as an input element the trigger member 11 supported by a pivot 40, preferably integral therewith, having opposite ends received and journaled in corresponding recesses in the opposed abut-
ting faces or edges of the casing members. A segmental gear 11a, formed on the end of the trigger within the casing and having pivot 40 as its arcuate center, is engaged or meshed with an input spur gear element 41 rotatable and axially shiftable with respect to the casing. Opposite ends of shaft 42 are journaled in aligned opposite casing side wall apertures, preferably formed in metal inserts 43 as shaft bearings molded into the casing members. The ends of the shaft may be redressed to provide shoulders cooperating with the inner faces of respective inserts for locating the shaft axially.

A pair of bevel gear members 44—45 are pinned or otherwise secured to the shaft 41 in axial spaced relation with their bevel gear faces disposed toward each other. Where the shaft is not positioned by end shoulders as above described each bevel gear immediately inside its respective casing wall has its outer face bearing against an inward edge of the journal insert.

As a uni-directional or one-way clutch for converting oscillating motion of the gear formation 14a and the consequent rotationally oscillating motion of gear 41 into uni-directional rotational motion in the shaft bevel gears and the shaft, the bevel gear 45, on its inner face has a ratchet tooth formation 45a engageable with a corresponding ratchet 41a formation (see FIG. 4) on the adjacent face of gear 41, a helical compression spring 47 disposed about shaft 42 being interposed between gear 44 and spur gear 41 to urge the ratchet formation of the latter axially into engagement with that of the bevel gear 45. The output bevel gear 15 on the inner end of the output spindle 13 is smaller than 44 and 45 for moment multiplication; the spacing between the two bevel gears 44—45 being such that with the output spindle at neutral position, the output gear meshes with neither, while at either of the two selectable left and right positions of the nose assembly, the output spindle gear is in mesh with one or the other of the gears 44—45.

A helical pretensioned return spring 50 has its forward end hooked into an aperture at 51 in the back of the fan or segmental gear formation and its back end anchored by a pin 52 with its ends received in respective sides of a notch formed at the back wall of the casing between the opposed casing members as shown in FIG. 2.

As the trigger is drawn back against the force of spring 50 by finger pressure, the gear 41 is rotated clockwise as viewed in FIG. 1 and so also the shaft bevel gears 44, 45 by virtue of ratcheting clutching or engagement. The spindle rotation is determined however by the nose assembly. For right hand rotation of a tool bit as in driving a normal right hand screw or drill, the nose assembly is set to the right as viewed in FIG. 3 (or downwardly as viewed in FIG. 2) for meshing engagement of the output spindle gear with the gear 45. The reverse rotational drive sense is of course obtained by setting the assembly to mesh 15 with 44. Upon release of the triggered same is returned by the stretched spring 50, rotating the gear 41 now counter-clockwise; but with the tool bit held stationary as by engagement with the work, the gears 44—45 cannot rotate, and the gear 41 is shifted axially against the bias of spring 47 for declutching or escape of the ratchet 41a from and over that on 45. Hence in normal use the trigger with segmental gear, spur gear and cooperating ratchet formations provide hand powered means for driving the shaft and bevel gear pair in one direction only. Repeated squeezing and release of the trigger in oscillating the gear formation 11a then gives intermittent rotation of the output spindle and bit.

Fabrications of the casing by plastic molding or die casting methods has the obvious advantage that the several notches, recess or openings above described supporting or receiving the various elements may be integrally formed in the very casing members or in metal inserts incorporated therein in the molding process, with a minimum of or none of the machining operations otherwise required.

We claim:

1. A hand operated tool adapted to single-handed operation for rotationally driving a drill, screw driver bit or the like comprising: a hollow casing having a pistol grip end adapted to be held in one hand, a shaft rotatably supported within and transversely of the casing, a pair of shaft bevel gears secured to said shaft for rotation therewith and in spaced relation, said bevel gears having like tooth sets disposed toward each other, a trigger-like element pivoted in and projecting from said casing forward of the grip, a trigger return spring within the casing for restoring the trigger to a normal position away from said grip after an application and then release of a manual trigger squeezing force, means for converting oscillating, pivoting motion of the trigger into uni-directional rotation of said shaft, a rotatable output spindle extending through said casing having an outer end adapted to receive and drivingly engage a tool bit and having an inner end, an output bevel gear secured on said inner end of the spindle and located between said pair of bevel gears, means for mounting said spindle for rotation and adapted for shifting the spindle in a direction transversely of its axis for bringing the output bevel gear selectively into meshing engagement with one or the other of said pair of bevel gears whereby the output spindle may be driven selectively in either rotational sense, and means for locking the spindle mounting means in either selectable position with the output bevel gear meshed with a selected one of said pair of bevel gears.

2. A tool as described in claim 1 wherein said casing is a longitudinally split casing comprised of two mirror image halves secured together, and having a front wall portion through which said spindle extends.

3. A tool as described in claim 2 wherein said journaling means includes a plate having said spindle extending at right angles therethrough and rotatably supported therein, said plate being pivotally mounted in a supporting and guiding compartment formed in said front wall for pivoting in a plane transverse to the tool, whereby the spindle output gear may be meshed selectively with said shaft gears.

4. A tool as described in claim 3 wherein said locking means is provided in the form of locking means for said plate, comprising a series of apertures in said plate, and an on end say retractable plunger rod spring biased toward said plate for engagement selectively with said apertures.

5. A tool as described in claim 1, wherein said means for converting motion of the trigger comprises: a spur gear rotatably and axially shiftable on said shaft between said shaft bevel gears, uni-directional clutch means between said spur gear and shaft, and a segmental gear formation secured to the trigger within the casing and meshed with the said spur gear.

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