G. D. ALEXANDER.

POWER DRIVEN TOOL DRIVER.

APPLICATION FILED OCT. 9, 1919.

1,341,701.

Patented June 1, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

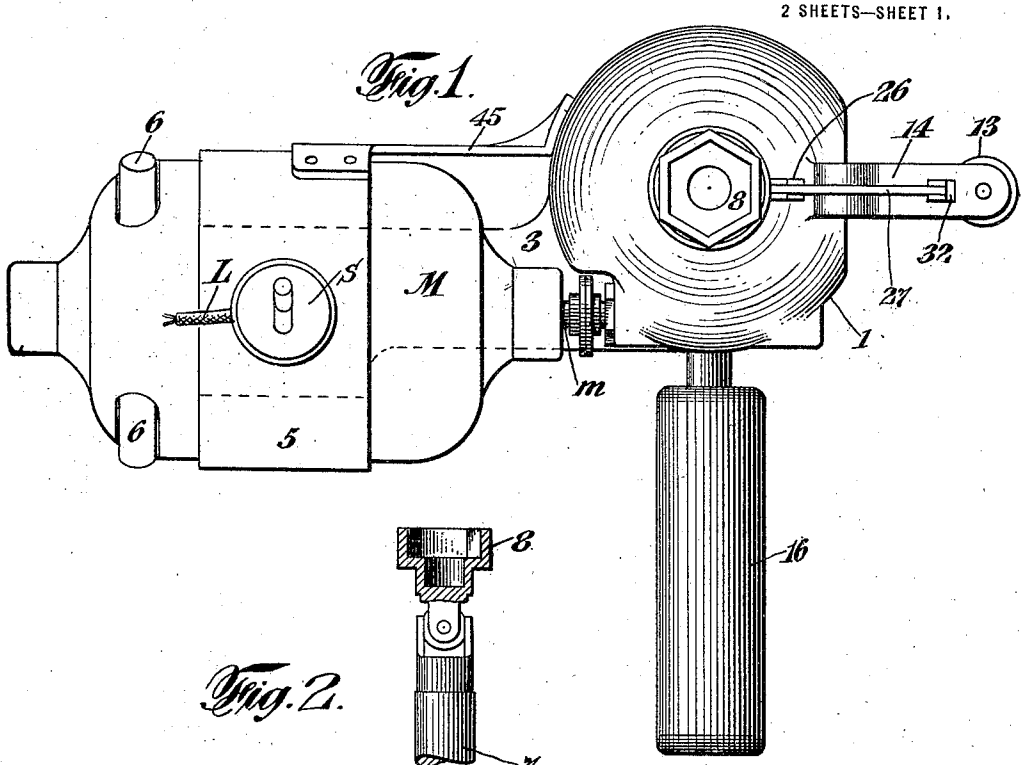
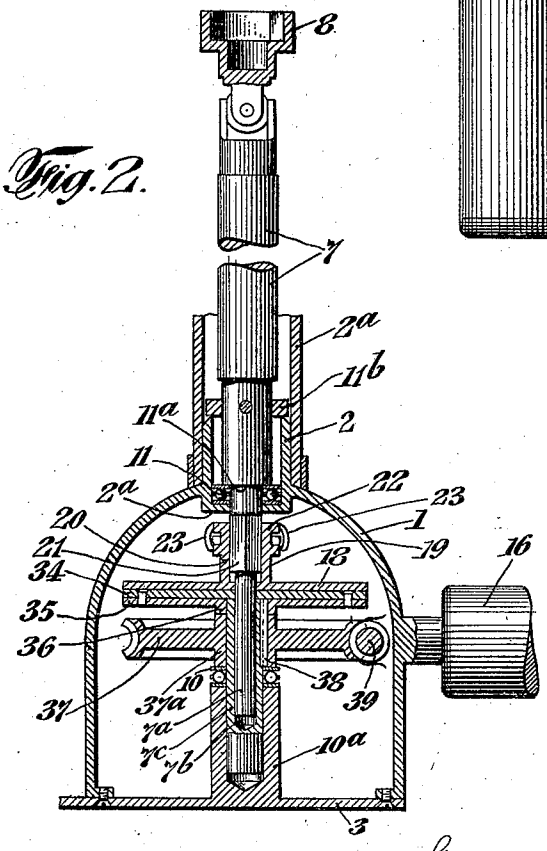


Fig. 2.



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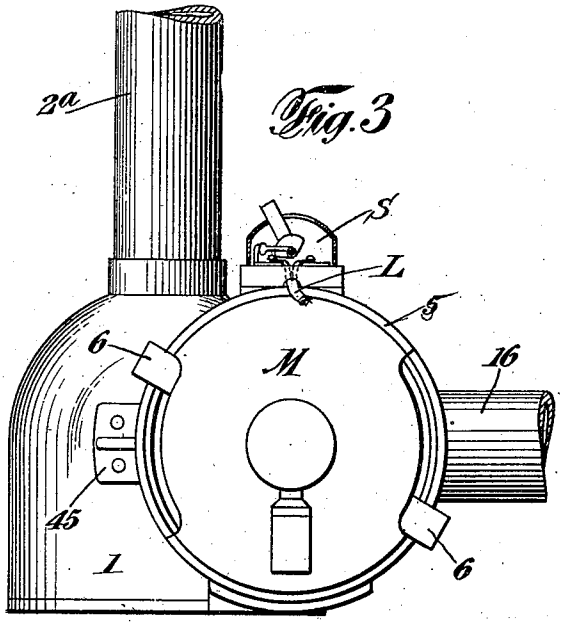


Fig. 3

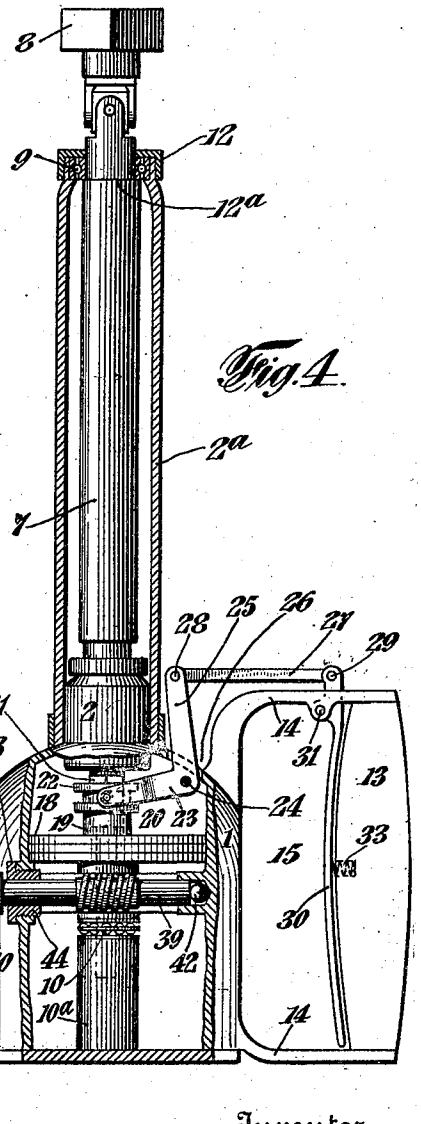
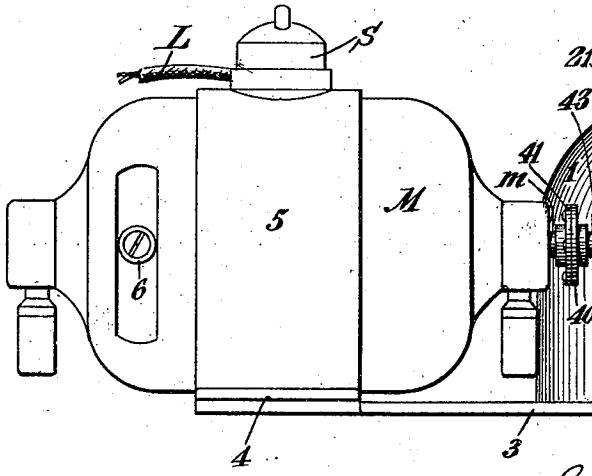


Fig. 4



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UNITED STATES PATENT OFFICE.

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POWER-DRIVEN TOOL-DRIVER.

1,341,701. Specification of Letters Patent. Patented June 1, 1920.

Application filed October 9, 1919. Serial No. 329,599.

To all whom it may concern:

Be it known that I, GEORGE DEWEY ALEXANDER, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Power-Driven Tool-Drivers, of which the following is a specification.

This invention relates to power-driven tool-drivers, especially power-driven hand wrenches or other tools, and is in the nature of an improvement on the power-driven hand wrenches set forth in my co-pending applications Serial No. 284,416, filed March 22, 1919, and allowed May 14, 1919, and Serial No. 301,487, filed June 3, 1919. In practical operation, a power-driven wrench like that shown in my said application Serial No. 301,487 has been found to heat up to an objectionable degree; and the objects of this invention are in part to overcome that objection and also to improve the mechanism in practical respects by provision of means for reducing the speed of the tool-carrying spindle relatively to the speed of an electric motor forming a member of the tool itself and from which the spindle is driven, and in such a manner that a minimum number of requisite parts will be required to the end that the weight of the tool may be kept low, and low enough to make it manually supportable for manual manipulation. But nothing herein contained is intended to limit embodiments of this invention to a hand or portable mechanism as distinguished from other or stationary mechanisms except in so far as may be herein stated, because features of this invention may be embodied in heavy or in stationary mechanisms that are not to be considered as portable hand-tools although my more specific objects are to produce relatively light-weight portable hand-wrenches or other tools and especially power-driven hand-wrenches for use in working under and in and about motor cars.

In the accompanying drawings forming a part hereof,

Figure 1 is a top plan view of my invention embodied in a portable manually-operable wrench which comprises in its construction an attached electric motor.

Fig. 2 is a broken vertical section at line 2—2 of Fig. 1, and shows the revoluble upstanding tool or nut-socket-carrying spindle, a clutch mechanism, and also a worm gear and worm shaft drive for the spindle.

Fig. 3 is a partial end elevation of what is shown in Fig. 1, the view being partially in section at line 3—3 of Fig. 1; and illustrates details of a motor starting and stopping switch.

Fig. 4 is in part an elevational view and in part a vertical sectional view at line 4—4 of Fig. 1, showing particularly the worm shaft connected to and alined with the motor shaft and the manually-operated clutch mechanism.

In that form of the invention now shown in the drawings, the tool casing as distinguished from the motor casing, comprises a chambered bulbous base 1 and a short upstanding tubular extension 2, the bottom of the chambered base being provided with a detachable cover or base plate 3 which has an edge extension that is fixed preferably by welding at 4 to the rigid center ring 5 of the casing of a reversible electric motor M of known construction in which the reverse movements result from manual adjustment of the movable fingerpieces 6 and which in the tool embodying my invention are conveniently located for operation at will by the user of the tool. The upstanding tool-carrying spindle 7 is revolubly mounted within the tubular extension 2. A rigid tubular hand-grip 2^a has its lower end fixed to the tubular extension 2. The upper end of the spindle projects outwardly of the tubular hand-grip 2^a and is at its projecting outer end provided with a detachable tool or implement which is here shown as a nut socket 8. At its upper end the tubular hand-grip 2^a is provided with a bearing 9 for the spindle which extends downwardly into the chamber of the base wherein its lower end or foot portion 7^a is reduced in diameter and socketed with a running fit in a center bore 7^b formed in the upper end of an upstanding worm gear and under-clutch-disk-carrying shaft 7^c, the under end of which is provided preferably with a ball-bearing 10, the extreme lower end of the shaft running loose in an upstanding socket bearing 10^a formed on the inward face of the cover plate 3, the spindle 7 and the shaft 7^c being axially alined. In order to give steadiness to the revoluble spindle 7 the upstanding integral tubular extension 2 has a bottom wall 2^a centrally apertured for

passage of a diametrically-reduced portion of the spindle 7, and a ball bearing 11 is located in the chamber of the tubular extension 2, one member of the ball bearing resting on the bottom wall 2^a and the other member being engaged by a shoulder 11^a on the spindle 7; and preferably the spindle 7 is provided with a fixed collar 11^b which works on the upper beveled edge of the mouth of the extension 2. The top bearing 9 carried by the tubular hand grip 2^a is secured in place by a screw cap 12 with the annular shoulder 12^a of the spindle bearing against a member of the bearing 9, which is shown as a ball bearing, whereby the revoluble tool-carrying spindle 7 is maintained in proper endwise position. The chambered casing member 1 carries a vertical hand-grip 13 the ends of which are fixed to the horizontally-projecting upper and under bracket arms 14 of the casing member 1 which is preferably integral with these bracket members. The hand-grip 13 is spaced apart from the opposed portion of the casing member to form a finger-and-palm space 15. The casing member 1 is also preferably provided with a laterally projecting hand-grip 16 spaced apart from the hand grip 13. The tool as described is provided with three portions, 2^a, 13 and 16, to any one or two of which either one or both hands of the user may be applied for positioning the tool to work to be done. Within the upper portion of the chamber of base member 1 the thereinto-projecting under end portion 17 of the spindle 7 is provided with a horizontal upper clutch disk 18 the hub 19 of which is formed in its upper portion with a cross-sectionally polygonal recess 20 for reception of a cross-sectionally polygonal portion 21 of the spindle, said hub also being provided with an exterior annular groove 22 for reception, as usual, of fork end rolls on the under forked arm 23 of a bell-crank clutch-lever which is pivoted at 24 within the chambered base 1; the other arm 25 of the bell crank extending upwardly through a slot 26 in the wall of the base member. A link 27 has one end pivoted at 28 to the end of the upstanding arm 25 of the bell-crank clutch-lever and its other end pivoted at 29 to the upwardly-projecting end of the bell-crank or clutch actuating lever 30 which is pivoted at 31 to the upper bracket arm 14, the greater length of this lever 30 lying within the finger-and-palm space 15 approximately parallel to the inner side of the vertical hand-grip 13 and adjacent thereto. The upper bracket arm 14 is slotted at 32 for upward extension of the upper end of the bell-crank-actuating or clutch-actuating lever 30 which when not compressed toward the hand-grip 13 by the user is held in the direction of the base member 1 by a coiled spring 33 compressibly mounted in a socket of the hand-grip 13 with its inward end abutting against the lever 30, and its outward end abutting against the bottom of the socket indicated by x. In this position the upper clutch-member is in negligible or ineffective clutching contact with the under clutch disk member to be described; but when the lever 30 is compressed by the grip of the operator toward the hand grip, the link 27 will be moved in the direction of the spindle 7 with the result that the forked arm of the bell-crank clutch-lever 25 will be pressed downwardly, forcing the clutch disk 18 against the complementary clutch-disk member carried by the upstanding worm-gear shaft 7^c. The under clutch disk member is shown provided as usual with a facing disk 34 which is carried by the under clutch-disk member 35 the hub 36 of which together with the worm gear 37 are fixed by a spline 38 to the upstanding shaft 7^c.

The worm gear 37 is in constant mesh with the worm shaft 39 which is axially alined with the motor shaft m and clamped thereto by bolting the flange disk 40 of the worm shaft to the flange disk 41 of the motor shaft. The worm shaft is journaled at its inward end in an interior horizontal bearing 42 of the chamber of base 1, and at its outward portion in a bore through a nut 43 which is screwed at 44 into a threaded hole through a wall of the chambered casing opposite the bearing 42. The purpose of this nut bearing construction is to provide an aperture at 44 sufficiently large for introduction of the worm shaft 39 into said chamber and into assemblage with the worm gear during assemblage of the parts.

As appears from Fig. 1, the vertical axis of the tool-carrying spindle 7 on the one hand and the alined axes of the worm shaft and motor shaft on the other hand are perpendicular one to the other and in vertical parallel planes spaced apart one from another; that is, the alined motor shaft and worm gear are offset relatively to the tool-carrying spindle 7 by a distance equal to the radius of the worm gear 37; and it results by this arrangement that I am able to give a straight-line motor-drive to the worm shaft 39; and also, according to the number of teeth on the worm gear 37 to reduce greatly the working speed of rotation of the tool-carrying spindle relatively to the R. P. M. of the motor, and this is of very great importance because it is necessary to have a fairly high R. P. M. in order that the implement may perform the work practically; and at the same time it is desirable, relatively to the R. P. M., greatly to reduce the rotational speed of the spindle both to prevent undue heating of the parts by friction and also to bring the rotation of the tool carried by the spindle 7 down low enough

for conveniently engaging the nut-engaging socket 8 with nuts and disengaging it from nuts, when and if the implement is to be used as a nut wrench. For some uses, however, the speed reduction referred to is not so essential, or perhaps not essential at all. I have shown the motor equipped with the usual starting and stopping switch S which is also carried by the center band 5 of the motor, the leads being indicated at L. I have also shown, to increase the rigidity of connection between the motor and the casing 1, a brace 45 one end of which is preferably welded to the casing 1 and the other end of which is similarly welded to the center ring 5 of the motor, back of and above the cover plate extension 3. By socketing the foot of spindle 7 in the upper end recess of the worm-gear shaft 7^c, the spindle and the shaft are kept in alinement and lateral support is afforded the upstanding worm-gear shaft 7^c which is given further lateral support by locating the bearing 10 against the under end of the hub 37^a of the worm gear. The cross-sectional, round, foot portion 7^a of the spindle, which foot portion is immediately below the polygonal portion 21 of the spindle, passes freely through a round center hole in the members of the 3 under clutch disk.

Various changes in details of construction may be made without departure from this invention.

The worm gear and worm shaft, the latter constituting the power shaft of the tool-driver, form a light-weight and simple speed-reduction mechanism. The spindle 7 is reversible and may be rotated in one direction for screwing on a nut or for boring if a bit is mounted on the spindle in lieu of the nut socket, and in the opposite direction for taking off a nut or for withdrawing the bit if the latter be used in lieu of the nut socket. It is obvious that the tool-driver may be made without an attached motor, and that any form of power-shaft-actuating mechanism or device, such as a hand crank, may be secured to an end of the power shaft, that is the worm shaft.

The worm gear 37 is located in radial horizontal projection from the axis of the spindle 7 and is of considerably larger diameter than the spindle 7 in order that it may be provided with a considerable number of teeth whereby the spindle may be turned slowly by the rotation of the worm shaft 39 the axis of which is at right-angles to and at one side of the axis of the spindle 7. It results from this construction that when and if a motor shaft is alined with and connected to the worm shaft, the latter and the motor shaft are laterally removed from the vertical axis of the spindle to a considerable extent, depending on the radius of the radially-projecting worm gear. The clutch disk members 18, 34 and 35 also project radially from the axis of the spindle and are of diameters approximately that of the worm gear; thus giving a large contacting surface between the two main members of the clutch mechanism.

Having described the principle of the present invention and shown the best form of embodying it now known to me,

What I claim is:

1. The combination of a revoluble tool-carrying spindle constructed at one end for connection with the tool, and provided at its other end with a radially-projecting worm gear of a diameter in excess of the diameter of said spindle; a worm shaft and a therewith-alined and mechanically-connected shaft of an electric motor; such motor; a framework for holding together and for fixing the intermeshing worm gear and worm shaft and the motor shaft in fixed operative positions with the worm shaft and motor shaft in alinement and at right-angles to and spaced laterally apart from the axis of the spindle; and a clutch mechanism between the spindle and worm gear for clutching the spindle to and unclutching it from the worm gear; and a clutch-actuating mechanism carried by said framework.

2. In the combination set forth in claim 1, the framework therein referred to comprising a hand-grip frame having a finger-and-palm space, and a clutch mechanism comprising a clutch-actuating lever adjacent the hand-grip.

3. In the combination set forth in claim 1, the framework therein referred to comprising a hand-grip frame having a finger-and-palm space, and a clutch-actuating lever adjacent the hand-grip; the motor having motor-reversing means, and a manually-operable accessible reversing device.

4. The combination of a tool-carrying spindle having a cross-sectionally polygonal section and adjacent thereto a cross-sectionally round section with a clutch member slidably movable on said polygonal section; a worm gear revoluble with the spindles and a supplementary clutch member shaft in alinement with the spindle, said cross-sectionally round section being loosely socketed in a recess in the adjacent end of said shaft; a supplementary clutch member and worm gear fixed on said shaft; a worm shaft in mesh with the worm gear for rotating the latter; and actuating means accessible to the operator for said movable clutch member.

5. The combination of a chambered casing open at its bottom end and having at its upper end an upstanding tubular extension; a revoluble tool-carrying spindle loosely mounted in the tubular extension and provided within the chamber of the casing with a cross-sectionally polygonal portion and a cross-sectionally round portion therebelow;

a vertically movable upper clutch disk member having an upstanding hub slidable on the cross-sectionally polygonal section of the spindle; a detachable cover plate for the under side of the casing; an upstanding worm-gear-and-under-clutch-disk - carrying shaft having a center bore open at its upper end; the cross-sectionally round section of the spindle being revolubly mounted in said center bore; a worm gear fixed to and revoluble with said shaft; an under clutch disk member fixed to and revoluble with said shaft; the cross-sectionally round section of the spindle passing centrally through the under and upper clutch disk members; a worm shaft in mesh with said worm gear and mounted at right-angles to the axis of the spindle; and accessible mechanism for actuating the movable clutch member.

6. The combination of a detachable cover and base plate; a reversible electric motor having a shaft, the motor being fixed to one portion of said plate; a chambered casing spaced apart from the motor and fixed to another portion of said plate; a worm shaft having within the chamber of the casing a worm-threaded portion, the motor shaft and the worm shaft being alined and fixedly connected whereby both shafts rotate together; the casing having an upstanding tubular extension; within said extension, an upstanding tool-carrying spindle revoluble in either direction and which projects into said chamber in a path laterally removed from the worm-threaded portion of the worm shaft; within said chamber, fixed on the spindle, a worm gear of larger diameter than said spindle and in constant mesh with said worm-threaded portion of the worm shaft; a clutch mechanism for the tool-carrying spindle, located between the worm gear and the spindle bearing above the worm gear; an accessible clutch-mechanism-actuating means comprising a manually operable member exterior of the casing; and an accessible means carried by the motor for reversing the motor and thereby reversing the rotation of the motor shaft, worm shaft, worm gear, and tool-carrying spindle; the motor being provided with an accessible switch for turning the current on and off.

In testimony whereof I have hereunto set my hand this 7th day of October, 1919.

GEORGE DEWEY ALEXANDER.