Feb. 19, 1935. M. N. MATVEYEFF 1,991,766

SCREW DRIVER

Filed Aug. 22, 1934

Fig. 1

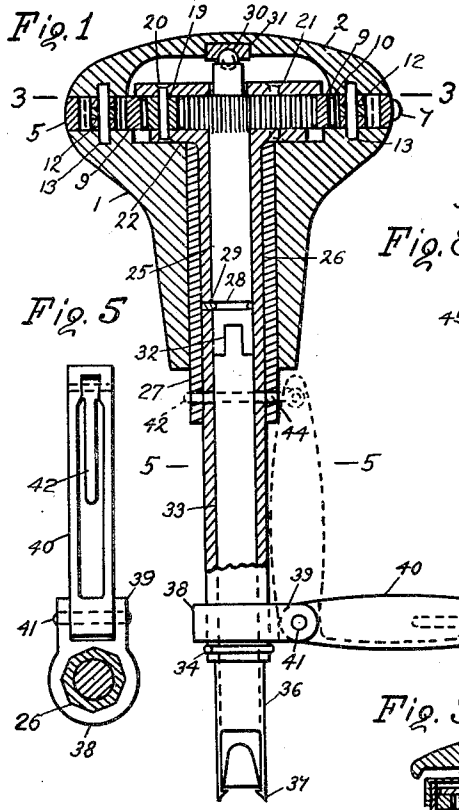


Fig. 8

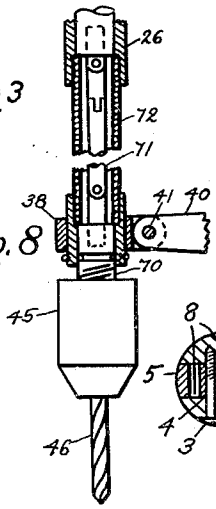


Fig. 2

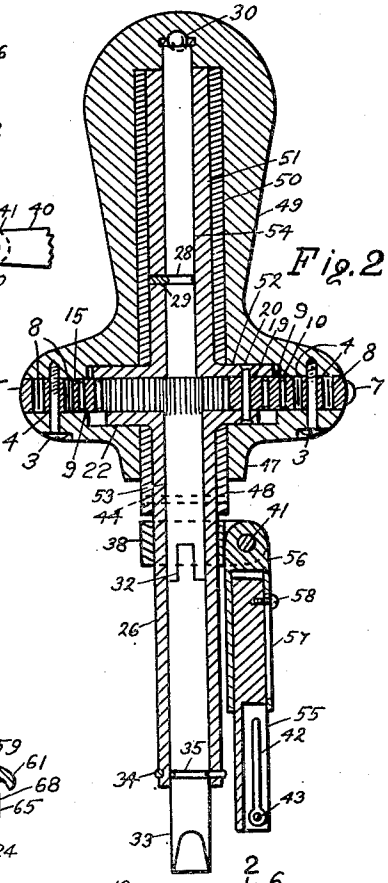


Fig. 5

Fig. 9

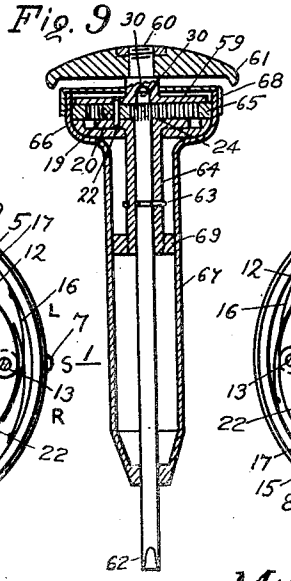


Fig. 3

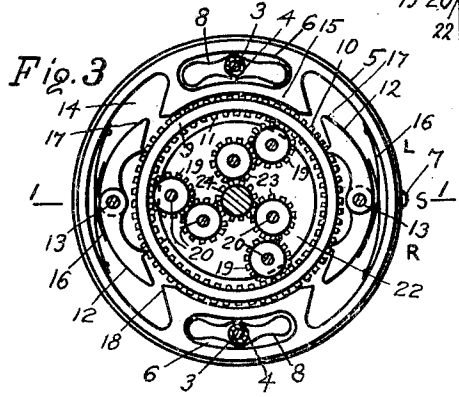


Fig. 4

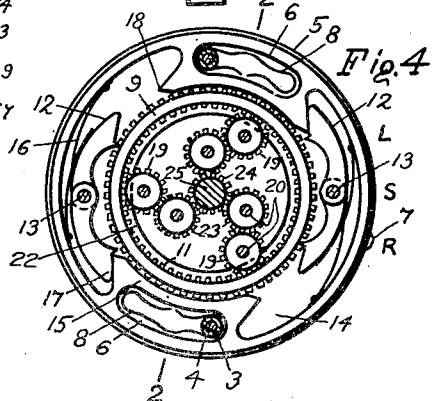


Fig. 6

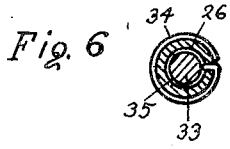
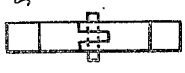


Fig. 7



MICHAEL N. MATVEYEFF

INVENTOR

BY John P. Wilkinson

ATTORNEY

Patented Feb. 19, 1935 1,991,766

UNITED STATES PATENT OFFICE

1,991,766

SCREW DRIVER

Michael N. Matveyeff, New York, N. Y.

Application August 22, 1934, Serial No. 740,868

6 Claims. (Cl. 145—75)

My invention relates to screw drivers and has particular reference to screw drivers employing geared transmission inside.

The operation of ordinary screw drivers is very slow, as each turn of the operator's wrist can impart only a little more than half of a turn to the screw. The blade of the screw driver must be then removed from the head of the screw while the wrist is being turned back, and the blade again replaced for the next turn; or the grip on the handle is changed if the blade is held against the screw. The slowness of this operation becomes especially noticeable when the screw driver is used for machine screws which require a large number of turns, offering comparatively little resistance to their turning.

In order to overcome this difficulty with ordinary screw drivers, I provide a geared screw driver in which the blade turns much faster than the handle, so that for each half turn of the handle the blade will make several complete revolutions.

I also provide my screw driver with a ratchet mechanism so that the handle can be turned backward while the blade remains stationary.

In order to render my screw driver operative for screws with right and left hand threads, I provide means for changing quickly the direction of the operative rotation of the blade, the ratchet mechanism being automatically reversed when the operative rotation is reversed.

I provide my screw driver with an easily removable blade, so that a variety of blades and other tools can be used, one blade being easily replaced by another.

I also provide means for locking the gears so as to render my device operative as an ordinary screw driver, for instance when using it for screws with large resistance to turning.

My invention is more fully described in the accompanying specification and drawing in which—

Fig. 1 is a sectional side view of my screw driver, the section being taken on the line 1—1 of Fig. 3, Fig. 2 is a similar view of a modified device, Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1 and showing the handle set in a neutral position, Fig. 4 is a similar view showing the handle set for the use with right hand screws, Fig. 5 is a detail view of the lower or locking handle, Fig. 6 is a detail view of the blade retaining spring, Fig. 7 is a side view of the ratchet pawls, Fig. 8 is a view of a modified tool used with my screw driver, and Fig. 9 is a sectional view of a modified screw driver.

My screw driver consists of a handle 1 to which a cover 2 is attached by screws 3. Spacing bushings 4 are placed on the screws so as to provide a clearance between the top of the handle and the cover. A ring 5 is placed in this clearance closing the latter from the outside. The ring is shaped on the outside so as to conform to the curvature of the handle. Slots 6 are provided in the ring for the bushings 4 permitting the ring to be turned by a knob 7 between the middle or neutral position marked "S" and the two end positions marked "L" and "R" respectively. Curved springs 8 are placed in the slots 6. These springs are provided with enlarged portions for holding the bushings 4 in one of the three operative positions, the sides of the springs being drawn together between these positions, a certain effort being required to push the bushings through these narrow portions of the springs.

The portions of the ring with the slots 6 are curved on the inside forming arcs of a circle enclosing a gear ring 9. The latter has teeth 10 on the outside and internal teeth 11. The external teeth 10 are engaged by pawls 12 pivotally mounted on pins 13 and placed in recesses 14 between the lugs 15. Springs 16 are attached to the inside of the ring 5 and press with their free ends against the pawls thereby pressing the latter against the gear ring. There are two pawls on each pin, facing in the opposite directions. The ends of the pawls have tapering lugs 17 adapted to engage the tapering ends 18 of the lugs 15, the pawls being lifted from the engagement with the gear teeth when so engaged by the points 18.

The gear ring 9 is in mesh with pinions 19 rotatively mounted on pins 20. The ends of these pins are fastened in plates 21 and 22. The pinions 19 are in mesh with a second set of pinions 23, the latter being in mesh with a central pinion 24 on a shaft 25. The second set of pinions is provided in order to obtain the same direction of rotation for the shaft and for the handle. The shaft 25 is journaled in a tube 26 the upper end of which is attached to the plate 22. The tube 26 is rotatively mounted in a tubular bearing 27 pressed into the handle 1. A circular groove 28 is formed in the shaft 25 for a key 29 set in a slot in the tube 26. This key prevents the axial movement of the shaft. The upper end of the shaft has a seat for a ball 30 resting against a bearing plate 31 set in the cover 2. This ball forms a thrust bearing for the shaft. The lower end of the shaft has a slot 32 for the upper end of a screw driver blade 33, or

other similar tool. The shank of the blade is cylindrical so that it can rotate together with the shaft 25 in the tube 26.

The blade of the screw driver is held in its place by a spring ring 34 placed in a groove in the tube 26. One end of the ring is bent-in and passes through a hole in the wall of the tube engaging a corresponding groove 35 in the shank of the blade. The point of the spring is rounded off so that the blade can be slipped in and out, but it will not fall out by itself. This arrangement of the locking spring ring is shown in Fig. 6, also in Figs. 1 and 2.

A tubular screw holder 36 may be placed on the end of the blade for holding the screw with resilient lugs 37.

The end of the tube 26 outside of the tube 27 is made of a polygonal section on the outside, as shown in Fig. 5, and a bushing 38 is slidably fitted over this portion of the tube 26. A clevis 39 is formed at one side of the bushing for the end of a handle 40 which is held on a pin 41. The other end of the handle is hollowed out and has a pin 42 pivotally mounted on a pin 43. The latter is made so that it can be fitted into a hole 44 in the tube 27 when this hole is brought into register with the corresponding holes in the tube 26 and in the shank of the blade (or in the shaft 25). In this position, as shown with dotted lines in Fig. 1, the gears are locked together through the rotative parts 26 and 33 (or 25).

The operation of my screw driver is as follows.

If it is desired to use the geared reduction of the screw driver for rapid turning of the screws with right hand threads, then the control ring 5 is turned to the right until the bushings 4 snap into the enlarged end portions of the springs 8, in which position the knob or button 7 will point to the letter "R" on the handle.

In this position, as shown in Fig. 4, the left hand pawls 12 will be rendered inoperative by the tapered lugs 18 passing under the lugs 17 and raising thereby the pawls out of engagement with the teeth 10. The handle 40 is turned to one side as shown in Fig. 1 and is held in the palm of the operator's left hand. The end of the tube 27 being close to the point of the blade, this arrangement permits the operator to use the fingers of his left hand for holding the screw and guiding the blade point. With the blade thus held in engagement with the head of the screw, the handle 1 is turned by the operator's right hand. The right hand pawls 12 under combined action of both springs 16 press against the teeth 10 of the gear ring and turn the latter to the right. The control ring 5 cannot slip from its position as the ends of the slots 6 press against the bushings 4. The internal or satellite pinions 19 rotate on their shafts or pins 20 but their axes do not move, the supporting plates 21 and 22 remaining stationary while the tube 26 is prevented from rotation by the handle 40. The result is that the rotation of the gear 9 is transmitted to the shaft pinion 24 at an increased ratio. It is easy to make a ratio of five to one or more, so that the blade will make several revolutions while the handle 1 is given but a half turn. Upon completion of the operative turn of the handle 1, it can be turned back again to bring the operator's wrist into its original or starting position. This return rotation is not transmitted to the blade so that the latter can be kept in engagement with the head of the screw. The right hand pawls during the reverse rotation will merely slide over the teeth 10 without moving the gear 9. The axial pressure is taken up by the ball bearing 30 with very little loss on friction.

The rotation of the blade is therefore unidirectional although intermittent. For this reason my screw driver can be also used for drilling holes. Fig. 8 shows a shank 70 fitted with a chuck 45 for a drill 46. The shank in this case may have a flexible shaft 71 in the middle enclosed in a flexible extension 72 of the tube 26. The handle bushing 38 is attached to the end of the flexible tube.

For turning screws to the left the control ring 5 is turned to the left until the bushings 4 become lodged in the opposite ends of the springs 8, resting against the corresponding end walls of the slots 6. The button 7 will then point to the mark "L" on the handle. In this position the right hand pawls will be raised into inoperative position, and the left hand pawls will be pressed against the gear ring. The blade will rotate to the left when the handle is turned to the left, and will remain stationary when the handle is turned to the right.

The control ring 5 may be placed in the middle or neutral position with the button 7 against the mark "S" as shown in Fig. 3. In this position both, left and right pawls, become operative. The screw driver then can be used for turning screws to the right or to the left at an increased speed, but there will be no free handle movement in either direction.

If it is desired to use my device as an ordinary screw driver without the gear reduction, then the handle 40 is turned up and the pin 42 moved out and pushed into the hole 44 in the tube 26. The handle is then turned until the corresponding holes in the tube 26 and shank 33 come into alignment, permitting the pin 42 to be pushed all way through, as shown in Fig. 1 with dotted lines.

A modified construction is shown in Fig. 2. Here the handle 47 is comparatively short with a correspondingly shortened tube 48. The cover 49 is shaped like a handle, however, and has a tubular bearing 50 for a tubular extension 51 on the upper plate 52. The pinion shaft 53 has an extension 54 above the pinion 24 resting against the ball 30 in the upper portion of the cover-handle 49.

The handle 55 is made telescoping, having an outer shell 56 with a slot 57 for a screw 58 on the inner end of the handle.

Another modification is shown in Fig. 9, representing a simplified construction for small screw drivers, such as are used by watch makers and jewelers. Here the upper plate 59 has a cylindrical extension 60 to which a flat, mushroom-shaped handle 61 is attached. The extension 60 has a recess inside for the bearing ball 30 against which the upper end of a shaft 62 rests. The lower end of the shaft can extend outside of the device, being shaped as a screw driver blade. It is retained by a spring 63 placed in a groove in a tube 64 connected with the lower plate 20. The gear ring 65 has no external teeth and is securely fastened to the inside of the bell shaped enlargement 66 on a tubular handle 67. A cover 68 is fitted to the enlargement 66 over the plate 59. The tube 64 has a bushing 69 forming a guide for the handle 67. The pinions 19 on pins 20 transmit the rotation from the gear ring to the inner pinion 24. This screw driver can be used in either direction but it has no free movement of the handle. It is used like similar

small screw drivers by holding the handle 61 stationary and turning the tubular handle 67 between the fingers.

My screw driver can be conveniently used for any purposes where manual turning of screws or bolts is required, also for drilling holes. It may operate screw driver blades of various sizes, socket wrenches, drills, also similar tools mounted on flexible shafts.

Important advantages of my screw driver are that it provides an increased speed of rotation for the blade, thereby considerably shortening the time required for assembling various apparatus having a large number of screws, such as typewriters, computing machines, electric motors, various meters, etc.; also that with a very simple adjustment my screw driver can be used for either screwing in or screwing out various screws and bolts; the operation is considerably simplified and accelerated by having a free return rotation for the handle. With all these advantages my screw driver retains substantially the conventional form of an ordinary screw driver, being compact and adapted to be operated in the same conventional manner. The additional handle 40 does not interfere with the use of the left hand for guiding the blade and holding the screw head.

It is understood that the construction of my screw driver can deviate from the practical embodiments shown and described, without departing from the spirit or idea of my invention.

I claim as my invention:

1. A screw driver, in combination a handle, a tube rotatively supported in said handle, a plate on the end of said tube, satellite pinions rotatively mounted on said plate, an internal gear in mesh with said pinions, a shaft rotatively supported in said tube, a blade on the end of said shaft, means to manually prevent the rotation of said tube with said plate, a control ring rotatively supported in said handle around said gear, said ring being adapted to be manually turned, means to limit the rotation of said control ring, right and left hand pawls for said gear supported in said handle, said control ring being adapted to render inoperative the right hand pawls when turned in one position, and being adapted to render inoperative the left hand pawls when turned into another position, said gear and said pinions being adapted to multiply the speed of rotation of said gear as transmitted to said shaft.

2. A screw driver, in combination a handle, a tube rotatively supported in said handle, a plate on the end of said tube, satellite pinions rotatively supported on said plate, an internal gear in mesh with said pinions, a shaft rotatively supported in said tube, a screw driver blade detachably connected with said shaft, means to manually prevent the rotation of said tube with said plate, ratchet teeth on the outside of said gear, right and left hand pawls adapted to engage said teeth, a control ring rotatively supported in said handle around said gear and said pawls, said ring being adapted to be manually turned, means to limit the degree of rotation of said ring, lugs on said ring adapted to alternately lift said right or left hand pawls when said ring is turned into one of its extreme positions; both sets of said pawls being free when said ring is placed in its middle position, resilient means to retain said ring in its three positions, said gear and said pinions being adapted to multiply the speed of rotation of said gear when turned by said handle through said pawls, as transmitted to said shaft through said pinions.

3. A screw driver, in combination a handle, a tube rotatively supported in said handle, a plate on the end of said tube in said handle, satellite pinions rotatively supported on said plate, a gear in mesh with said pinions, a shaft with a screw driver blade rotatively supported in said tube, a pinion on said shaft in mesh with said satellite pinions, means to turn said gear by said handle thereby rotating said shaft through said pinions at an increased rate of speed, a bushing on the end of said tube outside of said handle, means to prevent the rotation of said bushing on said tube, and a handle pivotally connected with said bushing and adapted to be held by the operator when in open position, said handle being adapted to be folded along said tube, said tube being provided with an aperture, a portion of said handle being adapted to enter said aperture when said handle is folded and to engage said shaft thereby preventing its rotation in relation to said tube.

4. A screw driver, in combination a handle, a plate rotatively supported in said handle, satellite pinions rotatively supported on said plate, a gear in mesh with said pinions, a shaft rotatively supported in said handle, a pinion on said shaft in mesh with said satellite pinions, a selective means for operatively connecting said handle with said gear for either direction of rotation, said means being adapted to be inoperative when said handle is turned in direction opposite to its selected operative rotation, a member rotatively supported in said handle and operatively connected with said selective means, said member being adapted to be manually turned in relation to said handle, means to limit the movements of said member, said member in its limiting positions being adapted to render said selective means operative in one direction of rotation of said handle, a screw driver blade connected with said shaft, said satellite pinions being adapted to transmit the rotation to said shaft at an increased ratio of speed, and means to manually prevent the rotation of said plate when said handle is being turned.

5. A screw driver, in combination a handle, a plate rotatively supported in said handle, satellite pinions rotatively supported on said plate, a gear in mesh with said pinions, a shaft rotatively supported in said handle, a pinion on said shaft in mesh with said satellite pinions, selective means to operatively connect said handle with said gear for either direction of rotation, said means being adapted to be inoperative when said handle is turned in direction opposite to its selected operative rotation, a member rotatively supported in said handle and operatively connected with said selective means, said member being adapted to be manually turned in said handle, means to limit the movements of said member, resilient means to yieldingly retain said member in its limiting positions, said member being adapted in its limiting positions to render said selective means operative in one direction of rotation of said handle, a screw driver blade connected with said shaft, said satellite pinions being adapted to transmit the rotation to said shaft at an increased rate of speed, and means to manually prevent the rotation of said plate when said handle is being turned.

6. A screw driver, in combination a handle, a tube rotatively supported in said handle, a plate on the end of said tube, satellite pinions rota-

tively mounted on said plate, a gear in mesh with said satellite pinions, a shaft rotatively supported in said tube, a pinion on said shaft in mesh with said satellite pinions, a screw driver blade on the end of said shaft, right and left hand ratchets for said gear in said handle, a member rotatively supported in said handle and operatively connected with said ratchets, said member being adapted to be manually turned in said handle, means to limit the rotation of said member, said member in its extreme positions being adapted to render respectively operative either right or left hand set of said ratchets for right or left hand operative rotation of said blade, and means to manually prevent the rotation of said tube with said plate when said gear is being turned by said handle, said gear and said pinions being adapted to increase the speed of rotation as transmitted to said shaft.

MICHAEL N. MATVEYEFF.