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W. POTTERTON  
SCREW HOLDING AND FEEDING MEANS FOR  
POWER-OPERATED SCREW DRIVERS

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2 Sheets-Sheet 1

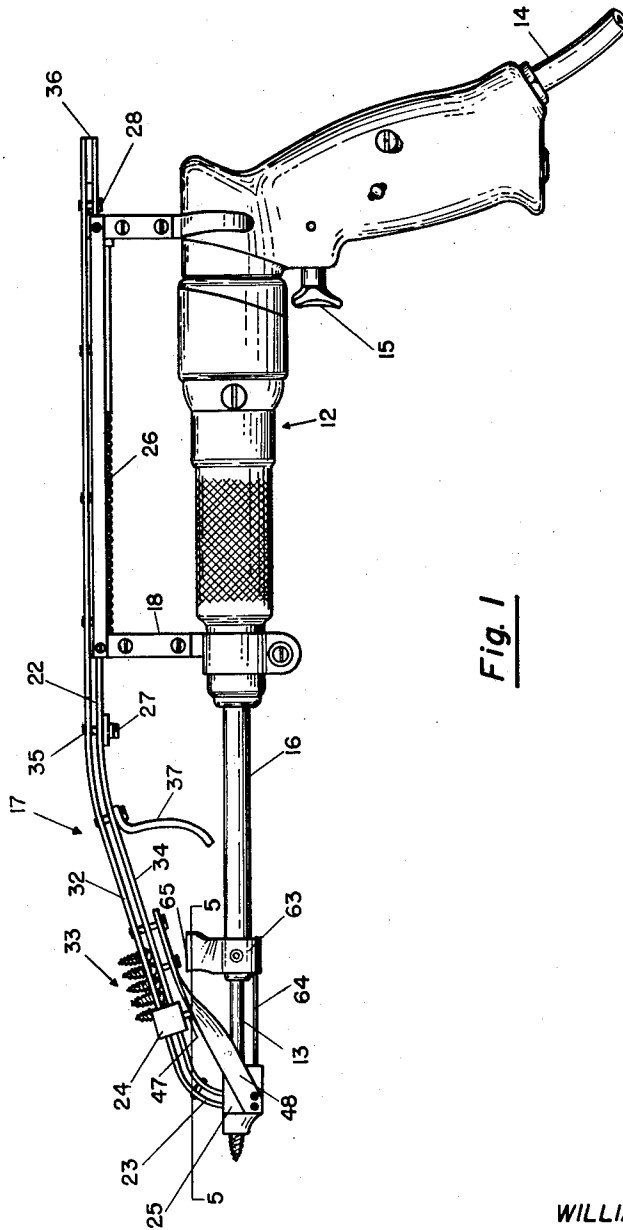


Fig. 1

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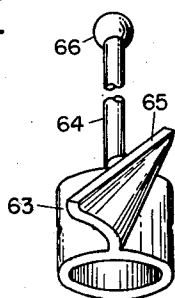
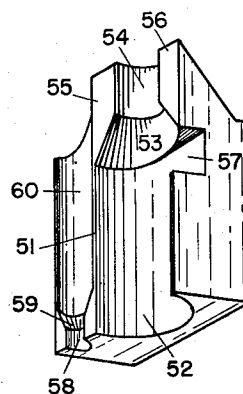
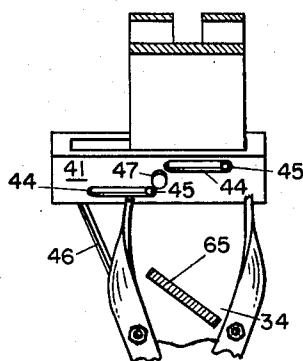
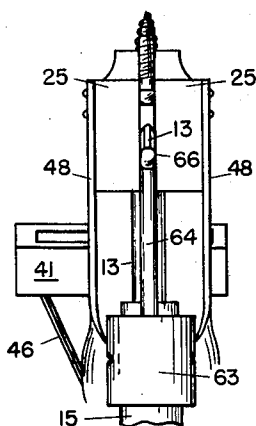
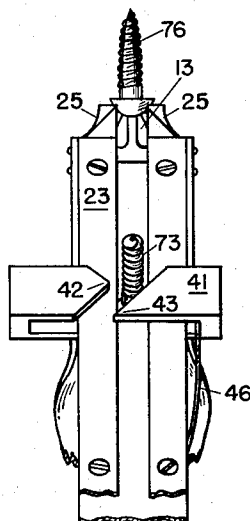
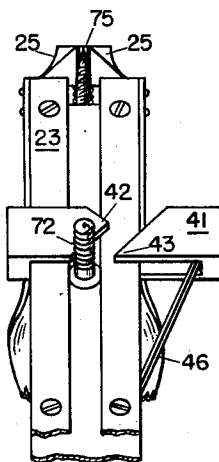
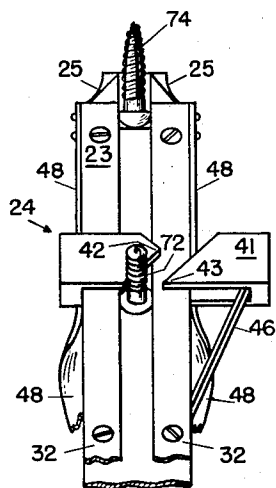
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## UNITED STATES PATENT OFFICE

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SCREW HOLDING AND FEEDING MEANS FOR  
POWER-OPERATED SCREW DRIVERS

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6 Claims. (Cl. 144—32)

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This invention relates to portable power driven tools of the rotary type and more particularly to automatic screw drivers.

The usefulness of screw drivers of this type has been heretofore impaired by the necessity or desirability of providing pilot holes when screws are driven into relatively hard wood such as is used in furniture and cabinets and the like. The necessity for having a pilot hole is obviated if the screw can be held with sufficient rigidity during the first part of the driving operation to prevent the screw from twisting while being driven.

It is accordingly an object of my invention to provide an automatic screw driver which incorporates means for holding the screw rigidly during the first part of the driving operation.

It is another object to provide a screw driver which is fully automatic in action.

It is a further object to provide a screw driver which handles without error all screws having a variable range of dimensions within commercial tolerances.

Another object is to provide a screw driver which is light, portable, easy to operate and to manufacture.

In accordance with my invention, apparatus is provided which causes screws to fall into a cavity formed between a pair of specially shaped holding jaws. Pressure of the screw against an undrilled wall then causes the screw to be rigidly clamped, driven partially by engagement with a revolving tool, and finally released from the clamp while continuing to be driven. A feature is embodied in the apparatus for placing the screw in the jaws, applying rotary force thereto and subsequently disengaging therefrom, which apparatus has the features of construction, combination of elements and arrangement of parts hereinafter to be detailed.

Other objects and advantages of the invention will be readily discerned from the following description in conjunction with the accompanying drawings in which:

Figure 1 is a side view of an automatic screw driver embodying my invention;

Figures 2, 3 and 4 are top views of the screw driver head of Figure 1 showing three positions in the operation thereof;

Figure 5 is a section view through 5—5 of Figure 1 of the same screw driver;

Figure 6 is a view from an angle of one of the specially shaped holding jaws of the screw driver;

Figure 7 is a bottom view of the screw driver;

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Figure 8 is a perspective view of a detail of the head.

In the drawings, a power driven rotary tool comprises a stationary barrel member 12 containing a rotating spindle, rotatable about a longitudinal axis, of which spindle only the tool end 13, formed in the shape of a screw driver is visible, this part of the device being old in the art. Although a Phillips head screw driver end is shown here my invention is equally applicable to the driving of slotted and other type screws, provided the appropriate tool end is attached to the spindle. An air hose 14 provides power to rotate the spindle in the preferred form, the flow of air being controlled by a trigger valve 15 of any optional form. It will be readily apparent that my invention may alternatively incorporate a spindle powered electrically or otherwise. A sleeve 16 forming a part of the barrel member 12 encloses the spindle except for the tool end 13, preventing accidental contact therewith.

A screw track assembly 17 is attached to the barrel 12 and is constricted to longitudinal motion with respect thereto by means of a guide 18. The movable assembly 17 comprises a screw holding magazine 22, a screw feed raceway 23, an escapement mechanism 24 and a pair of screw holding jaws 25.

A main spring 26, stretched between the assembly 17 and the guide 18, urges the assembly 17 in a forward longitudinal direction with respect to the barrel 12. Stops 27 and 28 attached to the movable assembly 17 limit the travel thereof.

The screw holding magazine 22 comprises two upper tracks 32 separated sufficiently to clear the shanks but not the heads of screws 33. A single lower track 34 is affixed to and separated from the upper tracks 32 by means of spacers 35 dimensioned to provide laterally constrictive clearance for the screw heads and for the guide 18. A movable closure member 36 at the rear end of the magazine 22 permits the loading of the magazine 22 from an auxiliary feed hopper and also prevents the screws from accidentally falling out of the rear end of the magazine. A handle 37 attached to the lower track 34 permits manual operation of the escapement mechanism or the rejection of a defective screw.

The screw feed raceway 23 comprises an extension of the tracks 32 and 34 from the release mechanism 24 to the holding jaws 25. It is shaped in a gentle curve which permits the screws to slide under gravitational forces from the release mechanism to the jaws when the longitudi-

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dinal axis of the screw driver is oriented either horizontally or vertically.

The release mechanism 24 shown in different positions of its operation in Figures 2, 3 and 4 comprises an escapement member 41 having fingers 42 and 43 extending laterally across the upper track 32 to engage the shanks of screws and to release them one at a time into the raceway 23. The escapement member 41 is constricted to a lateral transverse motion by means of slots 44 shown in the section view of Figure 5 which engage pins 45 affixed to the lower track 34. An escapement spring 46 tends to maintain the escapement member 41 in the positions shown in Figures 2 and 3. A stud 47 attached to the escapement member 41 and shown in Figure 5 provides a means for operating the escapement mechanism against the tendency of the escapement spring 46 in order to release screws one at a time in accordance with the sequence of operation.

The holding jaws 25 are attached to the movable assembly 17 by means of jaw springs 48 which urge the jaws inwardly. The jaw springs 48 constrict the jaws to a transverse motion with respect to the assembly 17. The jaws themselves include several features which can be seen in Figure 6, wherein that one shown is the further jaw hidden behind the nearer jaw in Figure 1. In Figure 6 the inside surface 51 of the jaw is seen to define a cylindrical cavity 52 shaped to provide clearance for the tool end 13 and for the head of the screw. This cavity 52 extends forward to a tapered portion 53 and thence to a cylindrical portion 54 shaped to grip an appreciable length of the shank of the screws when the jaws are in closed position. The cavity 54 is provided with two walls, a first wall 55 extending to the inside face of the jaws, and a less complete second wall 56 being cut back a distance sufficient so that when the jaws are in their open position, screw shanks fall between the second walls and are caught and positioned by the first walls. A lateral slot 57, cut back in the second wall to the depth of the cavity 52, permits ingress of the screw heads when the jaws 25 are in their open position.

A second longitudinally extending slot has a small diameter rear cylindrical portion 58, a tapered portion 59 and a forward large diameter portion 60. This second slot 58, 59, 60 forms a cam surface controlling the placement of the jaws in an open position in a forward extension of the magazine and in a closed position in a more rearward placement thereof. The nearer jaw 25 of Figure 1 is a mirror image of the jaw shown in Figure 6.

An actuator 63 is shown in the view of Figure 7 attached to the forward end of the sleeve 16 and forming an integral fixed portion of the barrel 12. As seen in the offset view of Figure 8, the actuator 63 comprises a jaw actuator rod 64 and a screw release actuator surface 65. The forward end of the jaw actuator rod 64 extends into the cam shaped cavity formed by the second slots 58, 59, 60 of the jaws 25, and terminates in a spherical cam follower 66 which bears outwardly against the second or cam slots 58, 59, 60 of each of the jaws 25 and determines their lateral positions in accordance with the relative positions of the barrel 12 and the assembly 17. The screw release actuator surface 65 forms an angle of approximately 45° with the longitudinal axis, as shown in the sectional view of Figure 5, and is

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positioned to engage the stud 47 when the assembly 17 is in a rearward position.

In operation, the magazine 22 is filled with screws 33, approximately 50 No. 6 round head screws being a typical load for a magazine of the type herein described. These screws slide down the magazine 22 guided between the tracks 32 and 34 until they engage the finger 42 of the escapement mechanism 41, as shown by the position of the screw 72 in Figure 2.

The escapement mechanism 41 is then actuated by manual pulling backward of the handle 37 or by pressing the jaws 25 against a flat surface. Either method presses the magazine into a rearward position with respect to the barrel 12 against the tension of the main spring 26. As the assembly 17 moves backward the stud 47 engages the screw release actuator surface 65 urging the release mechanism 41 laterally against the pressure of the spring 46 into the position shown in Figure 4. As the release actuator moves into this position, the finger 42 regresses, permitting the screw to move forward. At the same time the second finger 43 moves against the rear portion of the screw, urging it forward to the position shown by the screw 73 of Figure 4. The screw is now free to fall forward and downward against the jaws 25 but it cannot enter the jaws until pressure against the assembly 17 is released, and the magazine is returned to the position shown in Figure 2. If the screw should happen to stick in the position of the screw 73 of Figure 4, due to static frictional forces, the return of the finger 42 when the assembly 17 goes into its forward position impels it on its way down the raceway into the open holding jaws 25, as shown by the position of the screw 74 of Figure 2, where it is caught by the lower wall 55 of the cavity 52.

The screw driver is now ready for the driving operation. The first driving position is that shown in Fig. 2. Here with no longitudinal pressure against the holding jaws, the main spring 26 maintains the magazine in its extreme forward position, the cam follower 66 engaging the rearward surface 58 forcing the jaws outwardly against the action of the springs 48 into their open position here shown, permitting a screw 74 to fall into that position shown in Fig. 2.

The screw driver is then pushed against a surface such as wood into which the screw is to be driven. The wood surface engages the point of the screw, pushing its head backward into the slot 52 wherein it is surrounded circumferentially and supported against lateral motion in any direction. The jaws 25 engage the wood surface forcing the magazine backward into a second driving position shown in Figure 3. In this position the jaws with the rest of the assembly 17 have moved backward until the cam follower 66 disengages the slot 58, allowing the jaws to close firmly around the shank of the screw which now is in the position of the screw 75 of Figure 3 and to support it against lateral motion in any direction.

As the screw driver jaws 25 are further pressed into a third driving position against the wood surface the assembly 17 is further pressed backward with relation to the barrel 12 until the tip of the tool end 13 engages the head of the screw, causing it to revolve and be pressed forward into the wood surface, it meanwhile having its head firmly supported against lateral motion by the groove 52 and its shank firmly supported against lateral motion by the groove 54 of the jaws, preventing twisting. It is this feature which al-

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lows screws to be driven into relatively hard wood without requiring a pilot hole.

Continuing in the operation, after several turns of the screw representing about half the length of the screw shank, the tool end 13 engages the tapered portion 53 of the jaws 25, forcing the jaws apart into a fourth driving position shown in Figure 4, so that the screw may be driven home for the remaining turns of its length as shown by the position of the screw 76. In the latter stages of the driving operation, the next screw is released by the release mechanism 24 as previously described. After the first screw has been driven home, the screw driver is removed from the wood surface and the assembly 17 again moves forward to the first driving position where it receives the next screw and is ready to repeat the driving operation.

In order that screws be held sufficiently tightly, the jaw springs 48 in the preferred form require an inward pressure in the closed position of approximately one pound. To assure opening of the jaws in the first driving position the assembly spring 26 must exert a pressure in position 1 of about 3 pounds. The escapement spring 46, which only is required to hold the weight of the screws against gravity, need only have a tension of about 2 ounces. These tensions have been found to give completely satisfactory service in driving  $\frac{5}{8}$  inch No. 6 round head wood screws.

Although a particular embodiment of my invention has been shown and described, modifications thereof will be readily discernible from the foregoing description, the scope of these modifications being limited in their extent by the following claims.

What is claimed is:

1. In a portable automatic screwdriver having a barrel member containing a power driven screwdriver rotatable about a longitudinal axis, a screw holding device comprising a pair of screw holding jaws separable laterally in accordance with the relative longitudinal motion between said jaws and said barrel, a longitudinally extending cam surface common to one of said jaws, and an actuator member connected to said barrel member to control separation of said jaws.

2. The device in accordance with claim 1 in which said cam surface comprises a variable depth groove extending longitudinally along the inner surface of said jaws, said grooves being tapered in the direction of the barrel.

3. In a portable automatic screwdriver, for screws having a head and a shank, separable holding jaws having a first pair of sidewalls contiguous when said jaws are closed and a second pair of side walls not contiguous when said jaws are closed, the space between said second pair of side walls when said jaws are closed being less than the diameter of said shank to retain said shank, and said space being greater than the diameter of said shank when said jaws are opened to permit gravitational ingress of screws past said second walls in said open position.

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4. In automatic screw-feed apparatus for a screw-driver, a screw-feed raceway having an escapement mechanism attached thereto and having a rest position, said escapement mechanism comprising a pair of fingers movable transversely with respect to said raceway, a first bevel-edge on one of said fingers to urge a screw in one direction along said raceway when said escapement is moved from its rest position, and a second bevel-edge on the remaining said finger to urge said screw in the same said direction when said escapement is returned to its rest position.

5. A portable automatic screwdriver comprising a barrel member containing a power driven spindle rotatable about a longitudinal axis, and an assembly movable longitudinally with respect to said barrel member, said assembly comprising a screw holding magazine, a screw feed raceway having an end thereof joining said magazine, and screw holding jaws at least one of which is movable laterally with respect to said magazine to form an opening at the side thereof, said jaws being positioned immediately adjacent the end of said raceway removed from said magazine, said last-named end of the raceway being adjacent said side of the jaws to permit a screw from the raceway to enter said opening, a beveled surface on said movable jaw, and a cam plunger attached to said barrel member and extending in contact with said beveled surface to hold the jaws open to receive said screw through said opening.

6. A screw holding and feeding assembly for a screwdriver, comprising a plurality of jaws arranged to form an enclosure for a screw, a spring positioned to urge said jaws together, a cam surface on the inner sides of said jaws, and a cam follower positioned between said jaws and in engagement with said cam surface to hold said jaws normally open to receive a screw, said jaws being movable with respect to said cam follower to slide therealong when said assembly is pressed against an object, said cam surface being tapered to allow said jaws to be closed by said spring when said jaws are pressed against said object and caused to slide along said cam follower.

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