

March 20, 1945.

J. R. HAWKINS
SCREW-DRIVING TOOL

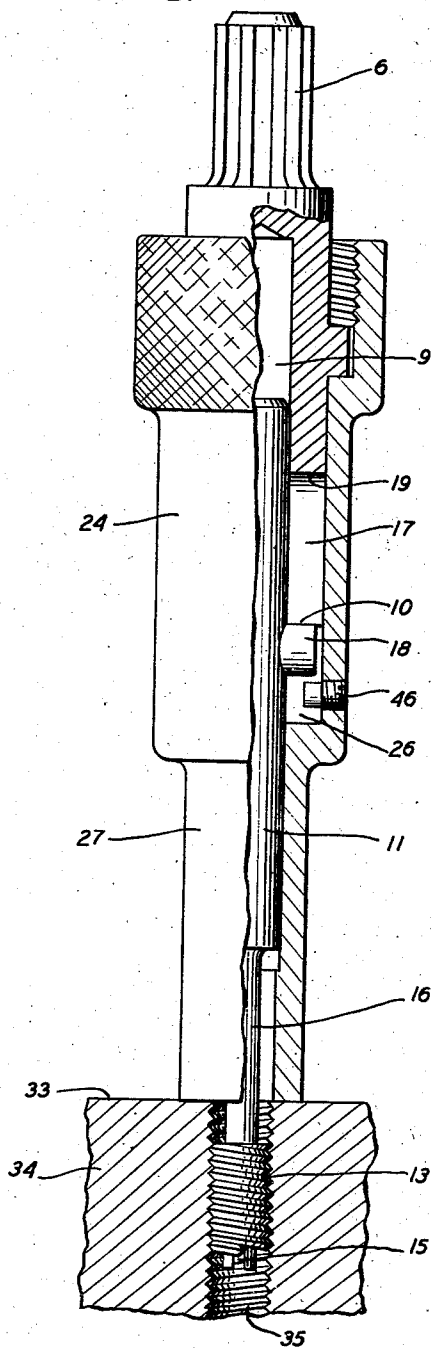
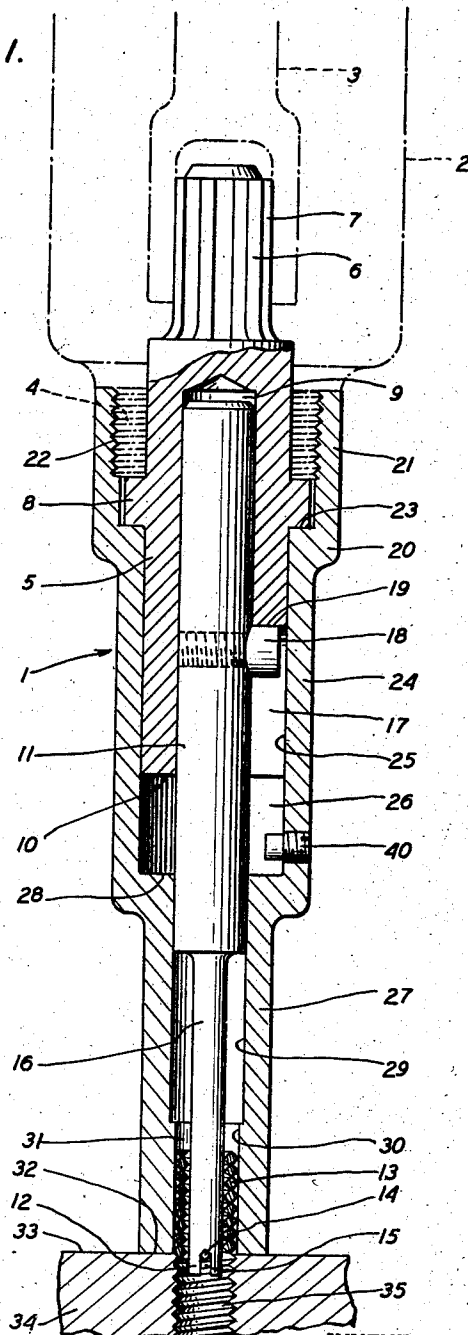
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Filed Nov. 3, 1943

3 Sheets-Sheet 1

FIG. 1.

FIG. 2.



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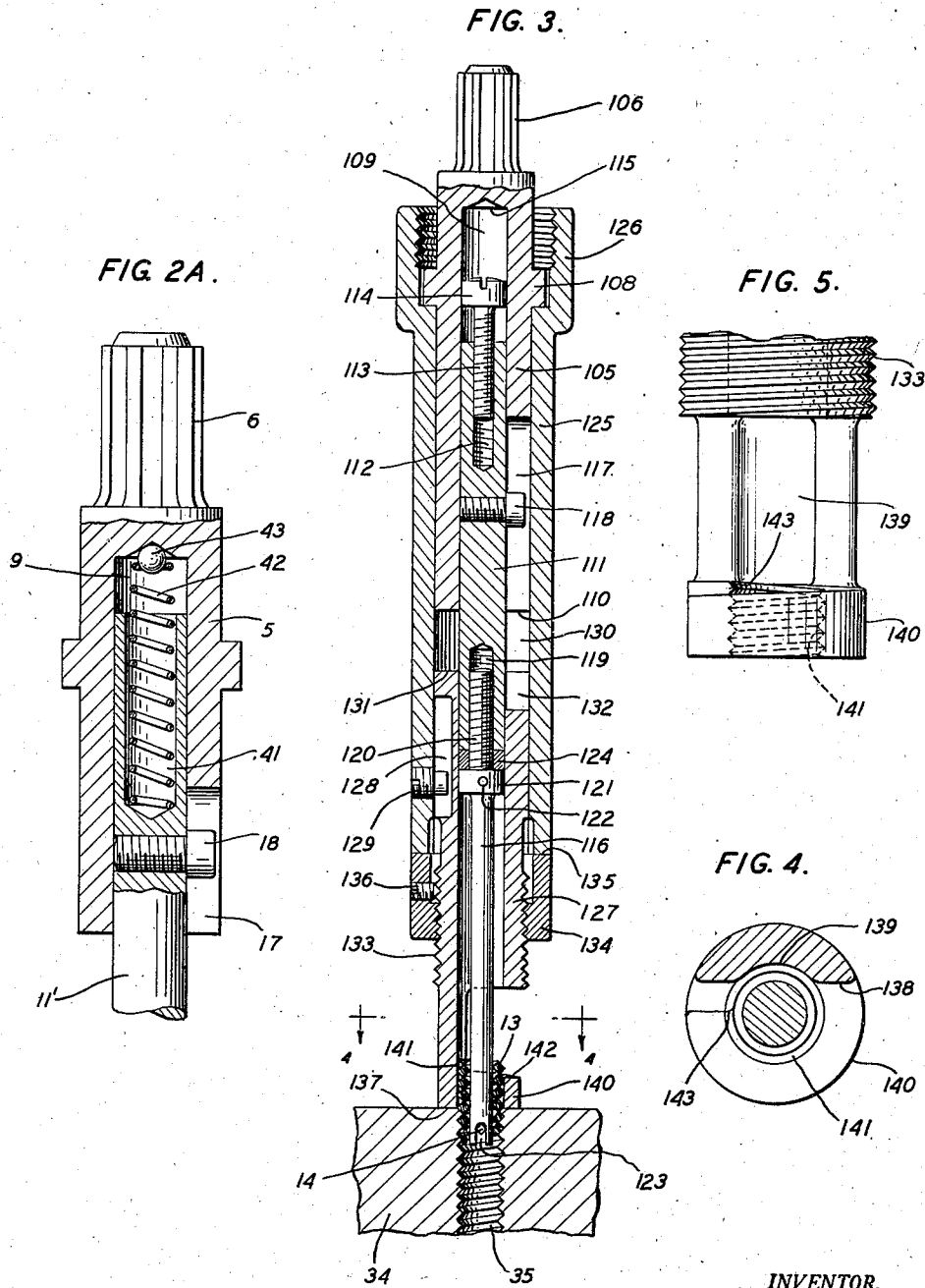
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2,371,622

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

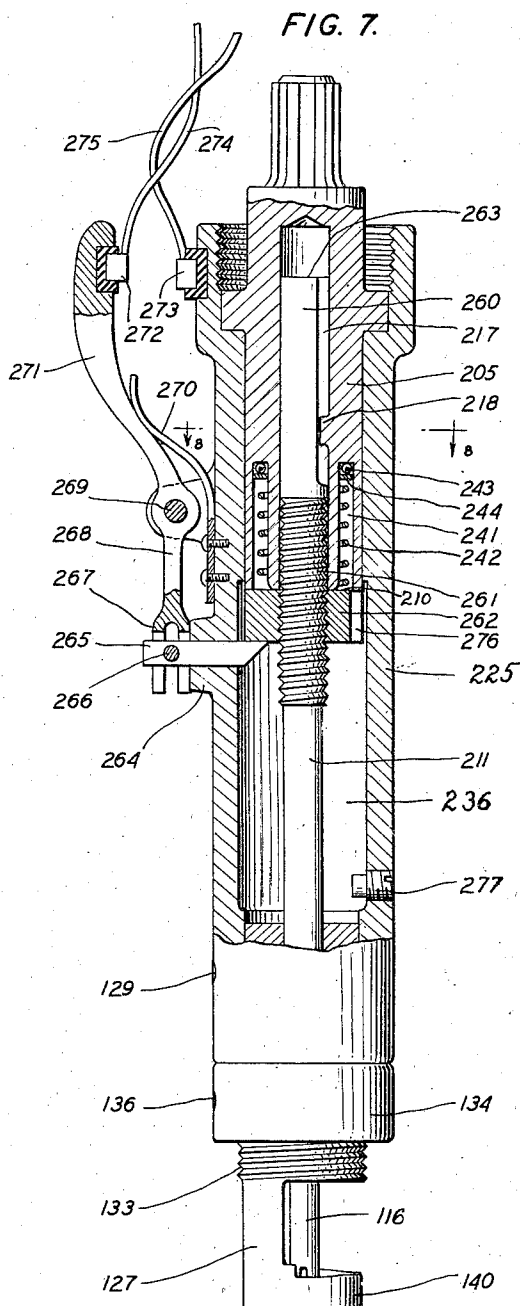
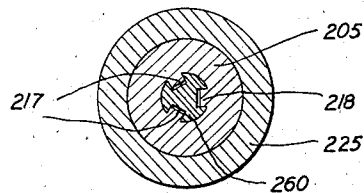
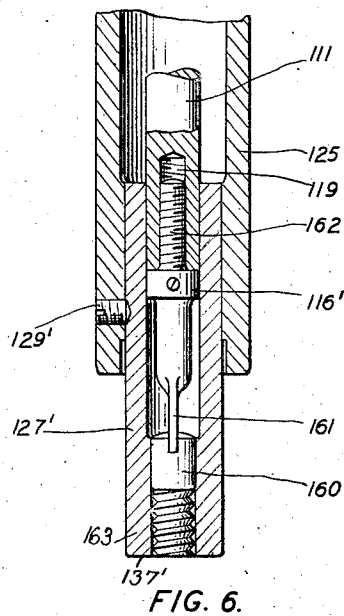


FIG. 8.



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2,371,622

SCREW-DRIVING TOOL

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Application November 3, 1943, Serial No. 508,770

19 Claims. (Cl. 10—1)

The present invention relates to a tool for driving a screw-threaded element into a boss member. It is an object of the invention to provide a tool suitable for power drive whereby the screw-threaded element can be screwed a predetermined length into the boss and wherein the driving torque is automatically stopped when the element has reached a predetermined depth in the boss. Another object of the invention is the provision of a tool of the mentioned type wherein the depth to which an element can be driven is adjustable within limits. The tool is in particular intended for inserting wire coil threadings of the type described, e. g. in U. S. Patent No. 2,150,876, and for this purpose, it is furthermore contemplated to provide for a combination of the tool with rewinding means as e. g. disclosed in U. S. Patent No. 2,316,231. However, it is also the intention to render the tool useful for other kinds of screw-threaded elements. The invention, therefore, additionally contemplates exchangeability of certain parts fitted for the engagement of screw-threaded elements of different sizes and different shapes.

The invention mainly consists in the combination of a shaft, a driver in telescopic relationship to said shaft and provided with an end for engagement of the element to be driven, and connecting means between the shaft and the driver which means are operative only in positions of the driver between an inner retracted position and another position in which the driver is spaced a predetermined distance from said end position.

Further details and objects of the invention will be apparent from the description given hereinafter and the accompanying drawings illustrating several embodiments of the invention by way of example. In the drawings,

Fig. 1 is a longitudinal section of a tool according to the invention;

Fig. 2 is a side elevation of the same tool in another position of the driver, the right-hand half of the figure being in section;

Fig. 2a is a longitudinal cross-section of a modified part of the tool of Figs. 1 and 2;

Fig. 3 is a longitudinal section of another embodiment;

Fig. 4 is a section along line 4—4 of Fig. 3;

Fig. 5 is a side elevation of a detail of the tool of Fig. 3;

Fig. 6 is a longitudinal section of a modified driver end and front end parts of the tool;

Fig. 7 is a longitudinal section of a third embodiment of the invention; and

Fig. 8 is a cross-section along line 8—8 of Fig. 7.

Referring now to the drawings, Figs. 1 and 2 illustrate a tool according to the invention for driving a wire coil screw thread a predetermined distance into the internal threading of a boss member. The tool in general denoted by 1 is shown as an attachment to a prime mover 2 which is not a part of the invention and, therefore, diagrammatically illustrated in dash lines, but it is, of course, immaterial whether the design provides for a permanent or a releasable connection of the tool and the prime mover. The prime mover may be of any suitable or conventional type, as for instance an electric motor of the kind used in electric drills. There is indicated, furthermore, a rotary part such as a shaft 3 and an externally screw-threaded, stationary part 4 of the prime mover 2. The tool 1 in the embodiment of Figs. 1 and 2 comprises a shaft 5 having a rearward end 6 so shaped that it may be coupled to the rotary part 3, e. g. by means of splines 7, and a flange-like projection 8 serving to hold the shaft in a fixed axial position as it will be described hereinafter. Shaft 5 is provided with an axial bore 9 extending from its front face 10 close to the rear end 6. Interiorly of shaft 5, a rod or driver 11 is axially movable. Its front end 12 is so shaped that it can properly engage a screw-threaded element for which the tool is destined, i. e. in the illustrated embodiment a wire coil 13 with a tang 14. Accordingly the driver end is slotted at 15 to receive therein the tang 14 and is formed of a cylindrical portion 16 of a diameter similar to the inner diameter of the coil 13.

Means are provided to couple shaft 5 and driver rod 11 for common rotation in any position of the driver between an innermost position and a position at a predetermined distance therefrom. In the illustrated embodiment such means consist in a spline-and-groove connection in that shaft 5 is provided with a groove 17 extending from the front face 10 a suitably selected distance to the rear, and a pin 18 is secured in driver rod 11 so as to project radially therefrom and to be capable of engaging said groove 17 in the manner of a spline. It is, of course, possible in this connection to provide a plurality of splines and grooves rather than only one pin 18 and groove 17. The innermost position of the driver can be predetermined in various manners, for instance by pin 18 abutting against the end wall 19 of groove 17, or by the driver end reaching the bottom of the bore 9 if the groove 17 is made longer than shown in Fig. 1. The driver can be shifted only to its

end position when the pin is in engagement with the groove 17. As long as pin 18 engages groove 17 shaft 5 and driver 11 are coupled for common rotation. On the other hand, no torque will be transmitted from the shaft 5 to driver rod 11 when the latter is shifted far enough forward for pin 18 to clear the end face 10 of shaft 5.

An abutment being a portion of a stationary part of the tool is provided near its lower or front end in order to place the tool in correct position in relation to a boss into which a screw-threaded element is to be driven. In the illustrated form of Figs. 1 and 2 this abutment is constituted by the front face of a sleeve-like casing of the shaft and the driver. The casing or sleeve 20 comprises three tubular portions of different diameter. The rear portion 21 forms a socket interiorly threaded at 22 so that the sleeve 20 can be screwed on the portion 4 of the stationary structure of the prime mover 2, to hold, between an inner shoulder 23 and portion 4, the aforementioned flange 8 of shaft 5, thereby preventing the latter from shifting in an axial direction. However, the connection should be such that the flange 8 can freely rotate between said shoulder and said prime mover. A second portion 24 of sleeve 20 forward of the socket 21 has an inner surface 25 serving as a bearing for shaft 5. This surface extends a distance forward of the shaft 5 so as to form an annular space 26 in which pin 18 can freely move if rod 11 is shifted sufficiently far forward. The front portion 27 of sleeve 20 has an inner diameter smaller than surface 25. The so formed shoulder 28 when contacted by pin 18 prevents the driver rod 11 from dropping out of the assembly when its axis is in a vertical position. For a purpose to be explained later on, it is advisable to make the annular space 26 longer than the dimension of pin 18 in axial direction and to provide near the shoulder 28 an inner projection which the pin 18 may engage when it has left groove 17. In the embodiment of Fig. 1 such projection is constituted by a pin 40 secured to the wall of sleeve portion 24. The upper part of the portion 27 may have an inner surface 29 serving to guide the driver in coaxial alignment with shaft 5, whereas the inner surface 30 of the lower part of portion 27 is spaced from the driver end 16 sufficiently to receive the wire coil element 13 in the annular space 31 therebetween. Portion 27 has an end face 32 to serve as the mentioned abutment when the tool is placed on the top surface 33 of a boss or work member 34 with a threaded hole 35 to be lined with an insert with the aid of the tool. The face 32 is so spaced from the abutment of the driver 11 in its retracted end position, i. e. in the present case, from the groove wall 19 against which pin 18 abuts in Fig. 1, that the end 12 of the driver slightly projects into and the forward end of the wire coil 13 may just contact the top convolution of the threading of the hole 35.

In order to use the tool for driving a wire coil insert into a threaded hole of a boss, the coil 13 is slipped from the front over the driver portion 16 so that the tang 14 engages the slot 15 and the coil body is located in the annular space 31. Then, while the driver is in its rearmost position in which pin 18 abuts against the end wall 10 of the shaft groove 17, the front end of the driver may be inserted in the threaded hole 35 of the boss 34 and the face 32 held downward against the boss surface 33; face 32 being at right angles to the tool axis facilitates co-axial alignment of the wire coil 13 with the hole 35. Then, the

prime mover may be started, whereupon the driver will rotate the wire coil 13 owing to the pin 18 engaging groove 17. In consequence, the coil will enter the threading of the hole 35, and the driver will follow the axial component of the advancing coil owing to its weight while pin 18 travels along groove 17. As soon as the pin 18 has arrived in front of face 10 of shaft 5, the connection between shaft and driver will be interrupted so that the driver comes to a standstill whereas the shaft 5 may continue to rotate. (This is the position shown in Fig. 2.) The tool may now be withdrawn, leaving the coil 13 in the desired position in hole 35, the depth to which the coil is inserted being predetermined by the active length of the groove 17.

In certain instances it is desired to remove the tang 14 of the wire coil after the latter has been inserted. For this purpose, the projection or pin 40 has been provided and may be used in the following manner: The tool will be withdrawn from the work 34 only so far that pin 18 bears on shoulder 28 while slot 15 of the driver end still engages the tang 14. If, now, the whole tool is turned in a direction opposite to that in which the coil is screwed into the hole 35, projection 40 will take along pin 18 and, thus, the driver. This torque acting on the tang 14 will tend to expand the coil so that the latter is firmly forced into the threading of the hole 35 without being turned out, and the edges of the slot 15 will break or shear off the tang in the manner more fully described in U. S. Patent No. 2,210,061.

It will be apparent that the tool according to the invention is extremely simple since it mainly consists of only three parts, viz. the shaft, the driver and the stationary member embodying the bearings and guiding elements for shaft and driver, and the abutment for engagement with the boss into which the screw-threaded element is to be driven.

It has been stated hereinbefore, that the driver during operation will advance in axial direction owing to its weight. This is true, if the tool is applied to the work downward with the driver axis vertical or approximately vertical. However, it has been found that even if the tool is used with the driver axis in a horizontal position, no additional means are required to advance the driver in axial direction. Apparently, the friction set up between the coil tang 14 and the flanks of the end slot 15 is sufficient in most instances to cause the driver to follow the wire coil when the latter enters the threading of hole 35 owing to the rotation. The fact that the tool may be used and is useful in directions where the advancement of the driver is due to the mentioned friction rather than to gravity renders it advisable to provide for a predetermined inner end position of the driver as defined by the abutment of pin 18 against groove wall 19. Where gravity tends to advance the driver, the correct inner end position is insured without additional means by the screw element 13 resting on the top convolution of the threading of hole 35 when face 32 bears on face 33 prior to the starting of the drive. Where, however, no force prevails to shift the driver forward prior to the starting, the driver must be so held by means such as the mentioned abutment that the front end of the screw element projects sufficiently from face 32 to engage the threading of the hole 35 immediately when the driver is started to rotate. If it is intended to use the tool in positions where the driver will not readily follow the screw element

advancing owing to its being screwed into a threaded hole, it may be advisable to add a soft spring of sufficient strength to counterbalance the weight of the driver. An example of such structure is shown in Fig. 2a where the driver 11' has a longitudinal bore 41 to receive therein a spring 42. The spring end projecting from bore 41 rests on a ball 43 which in turn bears against the bottom of the bore 9 of hollow shaft 5 to allow for rotation of the shaft 5 relatively to driver 11' and spring 42. In other respects the parts are similar to those shown in Figs. 1 and 2.

The tool of the form of Figs. 1 and 2 cannot be applied for the insertion of many differently shaped screw elements. In fact, this embodiment of the invention is intended for the use with mainly one type of screw elements, namely, with tang-provided wire coils within the limits of a certain maximum outer and a certain maximum inner diameter. With any such wire coil, regardless of its length, the depth to which it will be inserted by the tool is predetermined by the length of the groove 17; or, in other words, by the distance the driver can shift in axial direction from its position when the screw element bears on the top convolution of the threading of the hole into which it is to be inserted, to that position in which the driver is disengaged from its connection with the hollow shaft. Now, in many instances, it is desirable that a tool according to the invention is applicable to a greater variety of screw elements. For this purpose, parts of the tool may be rendered adjustable and/or exchangeable to adapt the tool to particular requirements. Such a tool is illustrated in Fig. 3.

In this embodiment, the hollow shaft 105 is very similar in structure to the shaft 5 of Fig. 1. It is provided with a splined end 106 for connection to a shaft of a prime mover (not shown), a flange 108, an axial bore 109, an end face 110 and a longitudinal groove 117. Interiorly of the shaft but projecting therefrom the driver rod 111 is arranged with a spline or pin 118 adapted to engage the groove 117. The upper end of driver 111 is provided with an axial threaded bore 112 into which a bolt 113 is screwed so that the head 114 constitutes an axially adjustable abutment of the driver against the bottom 115 of the shaft bore 109. The lower end portion of the driver is formed as a separate piece 116 releasably attached to the driver rod 111 so that it may be exchanged for another piece according to the nature and shape of the screw element to be inserted in each particular case. For this purpose, the lower end of the driver rod 111 is also provided with an axial threaded bore 119, and the piece 116 comprises an upper threaded extension 120 fitting the threading of bore 119, and a collar-like portion 121 with a radial bore 122 for the application of a tool for turning the piece 116 in relation to the driver rod 111. The lower end of piece 116 is slotted at 123 similarly to and for the same purpose as the slotted end 12 of the driver of Figs. 1 and 2. It will be clear that the described structure does not only permit the piece 116 to be exchanged but also to be adjusted within limits so that the slot 123 may be spaced desired distances from the head 114 and from the pin 118. A gap occurring between the collar 121 and the end face of driver rod 111 may be filled by spacers or washers as indicated at 124.

Shaft 105 with driver rod 111 is encased in sleeve 125 the rearward end of which is formed, as a socket 126 similar to the socket 21 in Figs.

1 and 2, for attachment to a stationary structure of the mentioned prime mover. Contrary, however, to the sleeve 20 of the first embodiment, sleeve 125 does not directly embody an end face to bear on the work during the operation of the tool. A separate shoe piece 127 is provided for this purpose. For this reason, the sleeve 125 except for its socket portion may have a straight bore throughout its length according to the diameter of the shaft 105. The mentioned shoe piece is a means to provide for adjustability of the end face or abutment of the tool and also to receive therein the screw element which is intended to be driven by the tool. The shoe piece will have to be shaped according to the screw element for which it is destined, and, therefore, must be exchangeable in order to make the tool applicable for a variety of differently shaped screw elements. In the event it is desired to use the tool for inserting a wire coil in a threaded hole as described in connection with the embodiment of Figs. 1 and 2, it has been found desirable to prewind the wire coil, i. e. to contract it before it is screwed into the threading of the work. An efficacious device for that purpose has been disclosed in U. S. Patent No. 2,316,221, and may be readily combined with the tool according to the present invention by shaping the lower end portion of the sleeve in Fig. 1 or of a separate shoe piece of the kind just mentioned so as to cooperate with the driver in the manner of the cited patent.

Such a structure has been shown in Fig. 3 as it will be apparent from the following description of the shoe piece 127. This shoe piece is a substantially tubular member telescopically inserted in the lower portion of the sleeve 125. It is provided with a longitudinal groove 128 engaged by a pin 129 which is secured to the wall of sleeve 125 and projects inwardly therefrom. This pin prevents the shoe piece from dropping out of sleeve 125; the groove on the other hand is sufficiently long to permit shifting of the shoe piece a required distance in an axial direction. The lower end of the groove 128 is so located that in the topmost position of the shoe piece a sufficiently long annular space 130 remains free between the rear face 131 of the shoe piece and the front face 110 of the shaft 105 for the spline or pin 118 to move freely therein when it is disengaged from the groove 117 of shaft 105. The shoe piece is further provided with a recess 132 in its rear end to receive therein the pin 118 when the driver is sufficiently far projected. Since the shoe piece is prevented by pin 129 engaging groove 128 from turning relatively to the sleeve 125, it will be clear that the flanks of the recess 132 serve the same purpose with respect to the pin 118 as the pin or projection 40 with respect to the pin 18 in Fig. 1. In other words, this recess serves the purpose of coupling the driver to the sleeve 125 when the tang of an inserted wire coil shall be broken off after insertion as it has been described hereinbefore. A portion of the shoe piece 127 which projects from sleeve 125 is provided with an external threading 133 engaged by a nut 134 which may abut against the front face 135 of the sleeve 125. A set screw 136 may be provided to secure the nut 134 in an adjusted position. Nut 134 serves to adjust the spacing of the end face 137 of the shoe piece from the front face 110 of shaft 105 so that the face 137 can constitute an adjustable abutment for the same purpose as that described with respect to the front face of the tool of Figs. 1 and

2. The lower part of the shoe piece 127 is laterally recessed at 138 and the recess is so dimensioned that a screw element 13 to be inserted with the aid of the tool may be placed inside of the shoe piece to bear against the remaining wall portion 139 (Fig. 4), and on the top of the annular end portion 140 of the shoe piece. In order to place screw element 13 into the recess it is, of course, necessary first to project the piece 127 sufficiently far so that the end 116 of the driver has cleared the recess. The annular portion 140 is interiorly threaded at 141 according to the shape and pitch of the screw element 13 and according to the diameter the screw element 13 is intended to have immediately prior to its insertion into the hole for which it is destined. This threaded annular portion in combination with the driver end constitutes the aforementioned prewinder. The application of such prewinder is desirable because in many instances the wire coils here under consideration are originally wound with a diameter slightly larger than that of the tapped hole for which they are destined. Now, in connection with such prewinders I have found that it is extremely difficult to cause the first convolution of a wire coil to enter the threading 141 if the top face 142 of the annular portion 140 is at right angles to the axis of the tool. This difficulty can be avoided if the face on which the wire coil comes to bear before it is caused to enter the threading 141 is more or less parallel to the helical line of the first coil convolution. If this is done, as it has been shown in Fig. 5, the top convolution of the threading 141 ends with a more or less complete cross-section 143 of a convolution rather than with a taper which would be formed if the top face intersects the helical end convolution at right angles to the axis of the threading. If the top face 142 is shaped in the stated manner, a wire coil bearing thereon will be coaxially aligned with the threading 141 and the front end of the coil will easily drop behind the convolution end 143 of the threading to engage the first groove thereof.

The tool according to the invention may be used in the following manner. Screws 113, 126 and nut 134 are adjusted according to the depth to which the wire coil 13 is intended to be inserted in a boss or nut member with the aid of the tool. For adjusting the tool it is recommended first to set screw 113 so that the driver rod can shift from the position where the screw head 114 abuts the bottom 115 of the shaft 105 to the position where the pin 118 is clear of the groove 117, a distance equal to the desired depth to which the wire coil is to be inserted plus the thickness of the portion 140. Then the shoe piece is pushed backward, i. e. towards shaft 105, until pin 129 is close to the forward end of groove 128. Now, nut 134 is screwed on until it abuts against face 135. If in this position of the parts, the tip of the driver end piece 116 is in the rear of the face 142, the piece 116 is to be screwed out and the gap between its collar 122 and the end of the driver is to be filled with spacers until the tip of the end 116 slightly projects into the hole of the prewinder threading 141. If, however, the tip of the piece 116 projects too far into the threading 141 while the shoe piece 127 is in its backward end position, nut 134 abutting against face 135 is to be turned to shift the piece 127 forward until the desired relative position of the tip of the piece 116 and face 142 is reached. When this has been done, the shoe piece is to be pulled

forward in order to be sure that in its forward end position in which the pin 129 contacts the backward end of the groove 128, the recess 138 is free of the end piece 116. Otherwise the total length of the driver assembly must be shortened by screwing the end piece 116 backward into driver rod 111 after sufficient spacers 124 have been removed, and the inner end position of the shoe piece 127 must be readjusted with the aid of nut 134.

When correct adjustment is accomplished the shoe piece 127 is to be pulled forward to clear the recess 138 so that wire coil 13 may be inserted in the recess 138 with its front convolution bearing on the face 142. Then the shoe piece is shifted back until the nut 134 abuts against face 135. Thereby the driver end passes axially through the wire coil so as to engage with its slot 123 the tang 14 of the coil. The tool may now be brought into position in relation to a tapped hole into which the wire coil is to be inserted and the prime mover may be started. Rotation of the prime mover causes shaft 105 to take the driver along which thus will rotate the wire coil thereby screwing the coil first through the prewinder and then into the hole of the work. As heretofore described, the driver will follow the axial movement of the advancing wire coil until the pin 118 is free of face 110 and comes to a standstill within the annular space 130. In order to remove the tang of the coil the tool may be so far withdrawn from the work that the pin 118 can drop into the recess 132 whereupon the tang can be broken off by turning the tool in the direction opposite to that in which the coil had been screwed home. When the tool is then removed from the work and the driver shifted back into its innermost position the tool is ready to receive another wire coil for insertion.

It has been stated hereinbefore, that the tool according to the invention is useful for screw elements of a character also other than wire coils. This has been exemplified in Fig. 6 showing the lower portion of the tool of Fig. 3 adapted for application to a screw stud 160. In this event a driver end piece 116' embodying a screw driver blade 161 is substituted for the end piece 116 of Fig. 3 and screwed with a threaded upper end 162 into the threaded bore 119 of the driver rod 111. Similarly, another tubular shoe piece 127' is substituted for the piece 127 and inserted in sleeve 125. By shifting the shoe piece in an axial direction, its end face 137' can be adjusted in relation to the other parts of the tool and the set screw 126' in place of the pin 129 can be used to secure the shoe piece 127' in its adjusted position. The lower portion 163 of the shoe piece is interiorly so formed that it serves to hold and guide the screw stud 160 during its being inserted in a boss to a predetermined depth. All other parts of the tool may be according to those shown in Fig. 3 so that no further explanation of the operation of the modification of Fig. 6 is required.

Whereas in the preceding embodiments of the invention, the relative location of the end face (10 in Fig. 1 and 110 in Fig. 3) of the hollow shaft is determinative for the depth to which a screw element will be inserted with the aid of the tool, it is similarly possible to render an end face of the driver capable of accomplishing that function. An example of such a structure is illustrated in Fig. 7 in which also a modification of the adjustment means and a certain different arrangement has been shown. In Fig. 7, the

sleeve member 225 forms the bearing for the hollow shaft 205 into which the driver rod 211 engages with its rear end portion 260 substantially in the manner of Fig. 3. However, in this case, portion 260 is provided with a groove 217 and shaft 205 with inner spline projection 218 capable of engaging the groove. A portion 261 forward of the portion 260 of rod 211 is externally screw-threaded and a nut 262, preferably of self-locking quality, is adjustable on that threading. Thus, the nut when bearing against the front face 210 of shaft 205 defines the innermost end position of the driver in a manner similar to that of the screw head 114 abutting against the bottom 115 of the hollow shaft 105 in Fig. 3.

On the other hand, the driver rod 211 may be shifted forward with the nut 262 moving in the annular space 236 until the rear face 263 of the rod is forward of pin 218 so that the shaft and driver become disconnected. Forward movement of the rod 211 may be assisted or caused by a spring 242 in a cylindrical recess 241 of the shaft 205. The one end of the spring bears against the nut 262 on driver rod 211 and the other end bears on a race 244 for balls 243 which may roll on the bottom of the recess 241. Spring 242 functions in substantially the same manner as spring 42 of Fig. 2a. The lower or front portions of the sleeve 225 and of the driver are similar to the corresponding parts of Fig. 3 so that a shoe piece 127 with nut 134 on its threaded portion may be used and a driver end piece 116 may cooperate with a prewinder part 140 of the shoe piece 127. Thus, the function of the tool of Fig. 7 is the same as described with respect to the tools of Figs. 1 and 3.

In certain instances it may be found inconvenient that the driver can freely move in axial direction while the tool is not in use. For this reason a releasable detent may be applied to hold the driver in retracted position. An example of such structure is shown in Fig. 7, where the sleeve 225 is provided with a wart 264 through which a detent 265 projects into the space 236 in front of the nut 262 when the latter bears against the front face 210 of the shaft 205. A pin 266 is secured to the outwardly projecting end of the detent and is engaged by the forked end 267 of the one arm 268 of a lever pivoted at 269 on the outside of the sleeve 225. A spring 270 engaging the other lever arm 271 tends to hold the end 267 against the face of the wart 264 with the detent in operative position. By pressing lever arm 271 towards sleeve 225 the detent will be removed so that the driver may become free to shift in axial direction. It is, of course, possible and may be desirable that withdrawal of the detent occurs simultaneously or in timed relation to the starting of the prime mover. Means for this purpose may be provided in connection with the lever arrangement 268 to 271 and an example of such means is diagrammatically indicated by two contacts 272 and 273 insulatedly secured to lever arm 271 and sleeve 225 respectively, and connected to electric leads 274 and 275 which in turn may be connected to a starting device (not shown). Thus, if lever 271 is actuated a current may be closed through the contacts 272 and 273 at the same time when the detent 265 is withdrawn.

Where frequent changes of the adjustment of the tool are necessary, it may be desirable that the adjustment of the distance which the driver is axially shiftable while connected to the hollow

shaft, may be accomplished without requiring the tool to be partly disassembled as is the case in the tool of Fig. 3. Means may be provided to avoid this inconveniency. In the embodiment of Fig. 7, such means consist of a groove or plurality of grooves 276 in the periphery of nut 262, in conjunction with an inner projection such as pin 277 near the lower end of the space 236. Now it will be clear that in order to accomplish an adjustment it is only necessary after the detent 265 has been withdrawn, to drop the driver and to bring pin 277 into engagement with a groove 276 whereupon the front end of the driver may be grasped and turned to alter the position of the nut 262 thereon. When, then, the driver is returned to its retracted position the tool will be ready for operation.

It will be understood that various changes and modifications in the specific form of the tool may be made without departing from the spirit and essence of my invention which is not limited by the particular disclosure of the embodiments thereof illustrated and described but by the scope of the appended claims.

I claim:

1. In a tool of the type described, the combination of a shaft hollow through at least a portion of its length, a driver member having a front end shaped for engagement of a screw-threaded element to be driven by said tool and having a rear end portion adapted to move axially within said shaft, said shaft and said driver member including means for a disengageable spline and groove connection of said shaft and driver, the effective length of said means in axial direction being approximately equal to the desired depth to which said screw-threaded element is to be driven in a job, and stationary sleeve-like means constituting a bearing for said shaft and a guide for the driver in axial direction, the front face of said sleeve-like means constituting an abutment to engage said job during the driving operation, and said driver member being of such length that disengagement of said spline and groove connection will occur while the driver front end is still in engagement with the screw-threaded element driven to the desired depth.

2. A tool as claimed in claim 1, said sleeve-like member and said shaft including abutment means to prevent said shaft from axial movement in the direction of the front end of the tool.

3. A tool as claimed in claim 1 further comprising means to connect said shaft to a prime mover, a detent to retain said driver in its retracted position, operative means in engagement with said detent and pivoted on said stationary member for withdrawing said detent from retaining position and switching means in connection with said operative means and adapted to be connected to said prime mover to start the latter.

4. A tool as claimed in claim 1, wherein the front end portion of said sleeve is so shaped as to receive therein said screw-threaded element and to hold it in a position for engagement by said driver member prior to the start of the driving operation.

5. In a tool of the type described the combination of a shaft hollow through at least a portion of its length, said shaft being provided with an interior groove extending lengthwise from its front face, a driver member having a front end shaped for engagement of a screw-threaded element to be driven by said tool and having a rear end portion axially movable within said shaft, a

spline-like projection extending radially from said driver member and adapted to engage said groove of said shaft, and a stationary sleeve-like member constituting a bearing for said shaft, the front face of said sleeve-like member constituting an abutment to engage a job into which said screw-threaded element is intended to be driven, and said driver member being of such length that its front end projects from said front face of said sleeve-like member the distance required to drive said screw-threaded element to the desired depth in said job before said spline-like projection is disengaged from said groove of said shaft.

6. In a tool of the type described the combination of a shaft hollow through at least a portion of its length, said shaft having an interior spline-like projection short in the longitudinal direction, a driver member having a front end shaped for engagement of a screw-threaded element to be driven by said tool and having a rear end portion axially movable within said shaft, the rear end portion of said driver being provided with a longitudinal groove adapted for engagement with said projection of said shaft, and a stationary sleeve-like member constituting a bearing for said shaft, the front face of said sleeve-like member constituting an abutment to engage a job into which said screw-threaded element is intended to be driven, and said driver member being of such length that its front end projects from said front face of said sleeve-like member the distance required to drive said screw-threaded element to the desired depth in said job before said spline-like projection is disengaged from said groove of said driver member.

7. In a tool of the type described the combination of a rotatable hollow shaft member, a driver member in telescopic relationship to said shaft and having its front end projecting from said shaft and shaped for engagement of an extraneous screw-threaded element to be driven by said tool, a spline-and-groove connection of said shaft and said driver, said spline and groove being of such extensions in the axial direction as to be operative in positions of the driver between its retracted end position and a position in which said driver is projected a predetermined distance from said retracted position and in which said spline and groove are disengaged, and a stationary sleeve member constituting a bearing for said shaft, said sleeve member forming a chamber forward of the front face of said shaft and having a shoulder constituting the forward end of said chamber as a means to prevent the driver from being shifted forward beyond a predetermined end position.

8. In a tool of the type described, a stationary sleeve, a hollow shaft rotatable in the rear portion of said sleeve, a driver having a rear end portion telescopically arranged within said shaft and a front end portion projectable from the front end of said sleeve and shaped for engagement of an extraneous screw-threaded element, said driver being axially movable between a rear end position and a front end position and having a critical intermediate position, interengageable means of said driver and said shaft to couple them for common rotation in all positions of the driver between said rear end position and said critical position, and means in connection with said sleeve to prevent the driver when in its front end position from rotating relatively to said sleeve.

9. In a tool of the type described the combination of a rotatable hollow shaft member, a driver

member in telescopic relationship to said shaft and having its front end projecting from said shaft and shaped for engagement of an extraneous screw-threaded element to be driven by said tool, interengageable means of said shaft and said driver to insure common rotation of said members, said means being of such an extension in axial direction as to be operative in positions of the driver between an inner retracted position thereof and a position in which said driver is projected a predetermined distance from said retracted position and in which said means are disengaged, and a two-part member stationary in relation to said shaft and said driver during their rotation, one part of said two-part member embodying a bearing for said shaft, the other part having a front end face at right angles to the axis of said bearing and being adjustable in relation to the other part in the direction of said axis.

10. In a tool of the type described the combination of a rotatable hollow shaft member, a driver member in telescopic relationship to said shaft and having its front end projecting from said shaft and shaped for engagement of an extraneous screw-threaded element to be driven by said tool, interengageable means of said shaft and said driver to insure common rotation of said members between two axially spaced positions of said driver member, a stationary sleeve embodying a bearing for said shaft, and a substantially tubular shoe piece in telescopic relation to the front end portion of said sleeve and exchangeably attached thereto, said shoe piece having a front end face at right angles to its axis and being interiorly shaped so as to receive therein said screw-threaded element prior to its being driven by said tool.

11. In a tool of the type described a hollow rotatable shaft, a driver including a rear rod-like part in telescopic relationship to said shaft, and a front part coaxially and exchangeably connected to said rear part and adjustable to vary the total driver length, the front end of said front part being shaped for engagement of an extraneous screw-threaded element to be driven by said tool, interengageable means of said shaft and said rear driver part to insure common rotation of said shaft and said driver between two axially spaced positions of said driver, and a member embodying a bearing for said shaft and including a front face at right angles to the bearing axis as an abutment to engage the job into which said screw-threaded element is intended to be driven.

12. In a tool of the type described the combination of a rotatable hollow shaft member, a driver member in telescopic relationship to said shaft and having its front end projecting from said shaft and shaped for engagement of an extraneous screw-threaded element to be driven by said tool, interengageable means of said shaft and said driver to insure common rotation of said members between two axially spaced positions of said driver member, a portion of said driver being screw-threaded, a screw-threaded member in engagement with the threading of said driver portion, said screw-threaded member constituting an adjustable abutment of said driver against a face of said shaft for adjustment of the spacing of said two driver positions, and a stationary member embodying a bearing for said shaft and including a front face at right angles to the bearing axis as an abutment to engage the job into which

said screw-threaded element is intended to be driven.

13. A tool as claimed in claim 12 wherein the rear end portion of said driver member is interiorly screw-threaded, said screw-threaded member being a headed screw bolt in engagement with said inner threading, and said hollow shaft has a bottom against which the head of said bolt can abut.

14. A tool as claimed in claim 12 wherein said threading of said driver is an outer threading, said screw-threaded member being a nut on said threading and having a rear face to abut against the front face of said shaft.

15. A tool as claimed in claim 12 further comprising second interengageable means in connection with said screw-threaded member and said stationary member to prevent the former from turning relatively to the latter, said second means being so located and arranged that they may be caused to interengage when said driver member is protracted beyond a position in which the first mentioned interengageable means are disengaged.

16. In a tool of the type described the combination of a rotatable hollow shaft member, a driver member in telescopic relationship to said shaft and having its front end projecting from said shaft and shaped for engagement of the tang of an extraneous tang-provided wire coil to be inserted by said tool in a tapped hole of a job, interengageable means of said shaft and said driver to insure common rotation of said members, said means being of such an extension in axial direction as to be operative in positions of the driver between a first retracted position and a second position in which said driver is projected a predetermined distance from said retracted position and in which said means are disengaged, and a two-part member stationary in relation to said shaft and said driver during their operation, the first part of said stationary member embodying a bearing for said shaft, and said second part embodying in cooperation with said driver a pre-winder to contract said wire coil prior to its insertion in said hole.

17. In a tool of the type described a stationary sleeve, a hollow shaft rotatable in the rear portion of said sleeve, a driver having a rear end portion telescopically arranged within said shaft and a front end portion shaped for engagement of the tang of an extraneous tang-provided wire

coil to be inserted by the tool into a tapped hole, said driver being axially movable between a rear end position and a front end position and having a critical intermediate position, interengageable means of said driver and said shaft to couple them for common rotation in all positions of the driver between said rear end position and said critical position, a substantially tubular shoe piece axially shiftable with its rear portion between two end positions in telescopic relationship to the front end portion of said sleeve and being secured thereto against rotation, a portion of said shoe piece projecting from said sleeve being laterally recessed, to receive therein said wire coil, and the shoe piece portion in front of said recess being interiorly screw-threaded with a diameter to which it is desired to contract said wire coil prior to its insertion in said tapped hole, the dimensions of said driver and said shoe piece being such that with both in their respective end positions the front end portion of the driver projects through the recessed portion of said shoe piece, and that with the driver in its rear and the shoe piece in its front end position, the recessed portion is free from the front driver end.

18. A tool as claimed in claim 17 further comprising a lengthwise adjustable projection of said shoe piece, said projection being adapted to abut against the front face of said sleeve, for adjustment of the rear end position of the latter.

19. In a tool of the type described and including a prewinder for the contraction prior to the insertion of a tang-provided wire coil intended to be screwed into a tapped hole, consisting of a slotted driver and a substantially tubular shoe piece in which said driver is rotatable and axially shiftable and wherein said tubular member is provided with a lateral recess in the rear of an interiorly threaded front portion, said recess being so dimensioned as to receive therein said wire coil, and said interior threading being substantially according to the desired pitch and diameter of the prewound coil, that invention which consists in that the rear face of said interiorly threaded portion is substantially helicoidal according to the helical line of the front convolution of said coil, whereby said coil when bearing on said face will be substantially coaxially aligned with said driver and said interior threading.

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