Dec. 29, 1953 H. F. TRAVIS 2,664,121

POWER SCREW DRIVER

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Fig. 1.

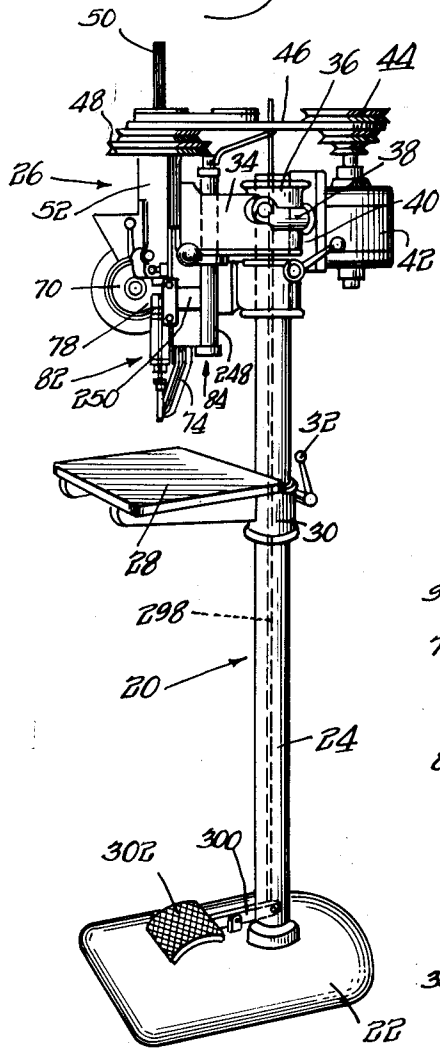


Fig. 2.

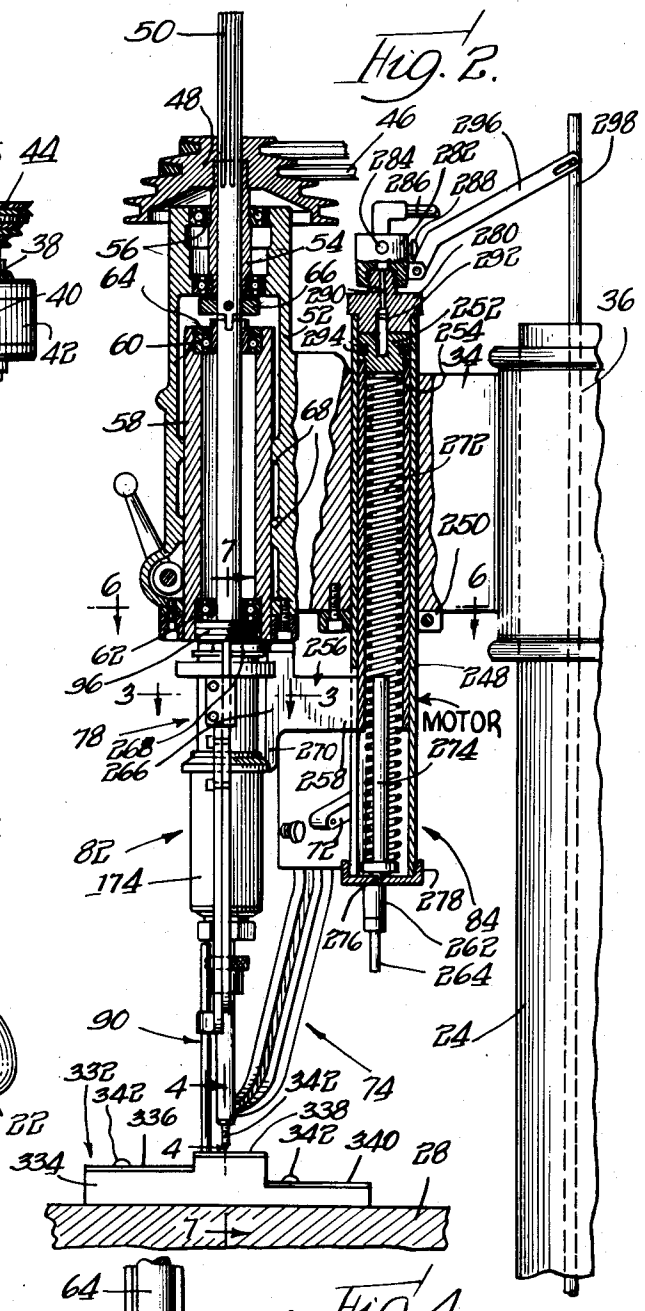


Fig. 3.

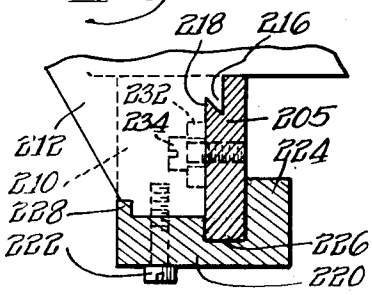
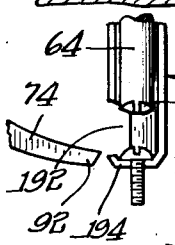


Fig. 4.



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POWER SCREW DRIVER

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Fig. 5.

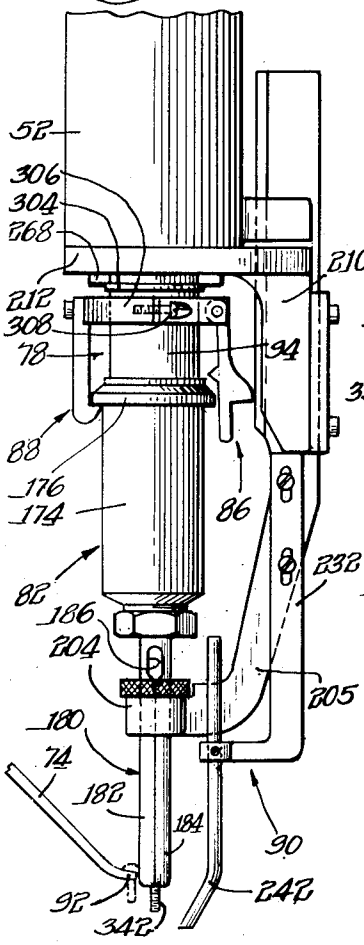


Fig. 7.

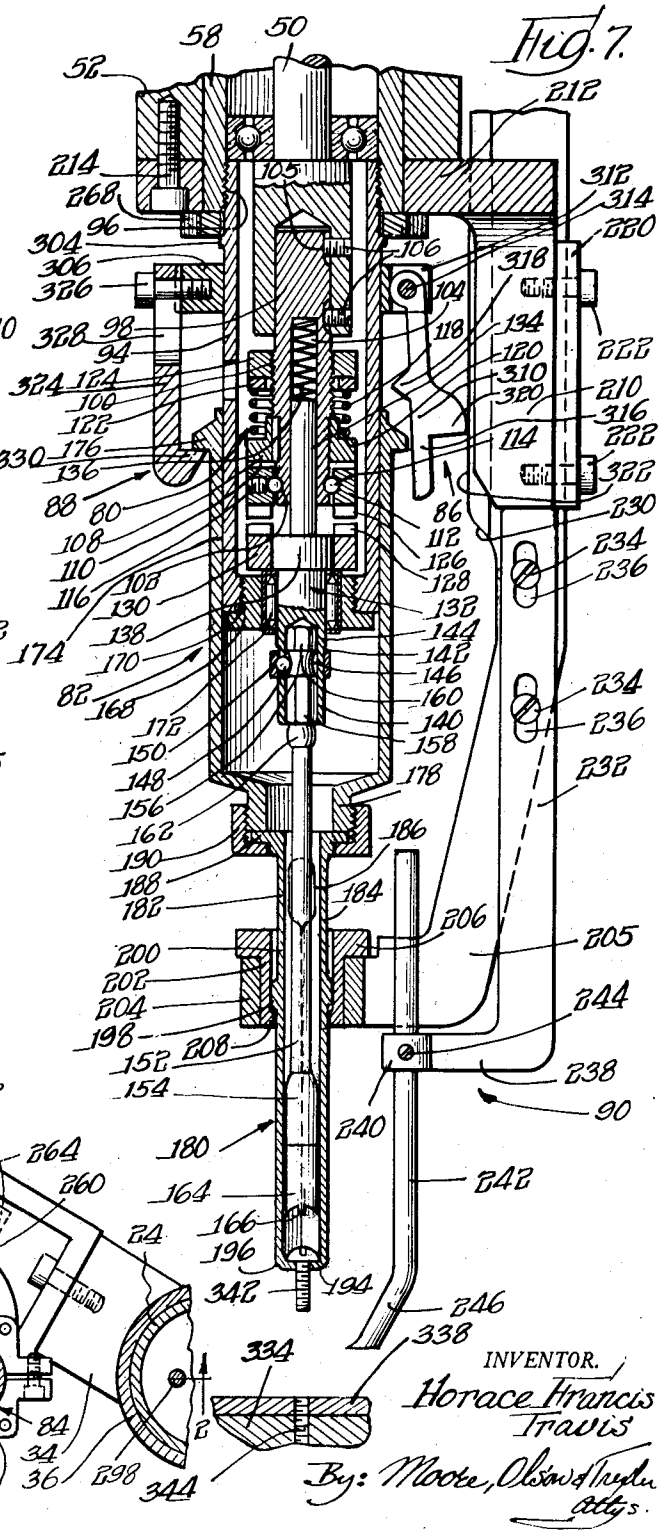
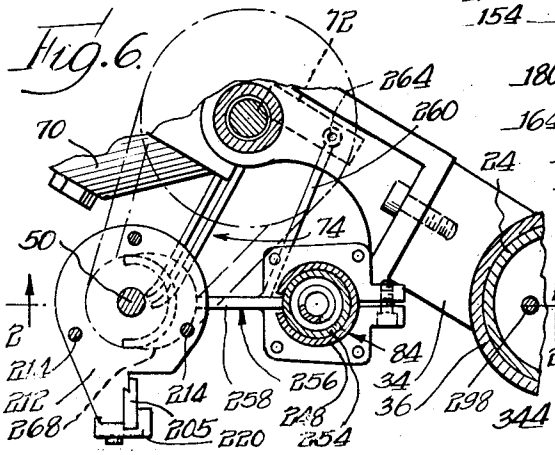


Fig. 6.



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POWER SCREW DRIVER

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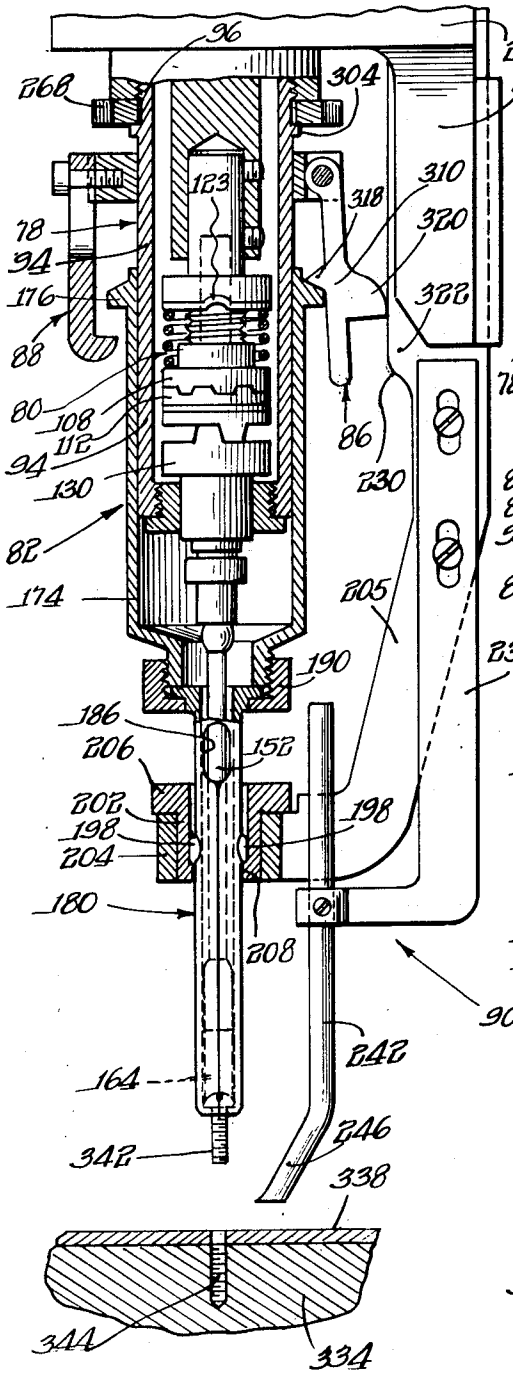

Fig. 8.

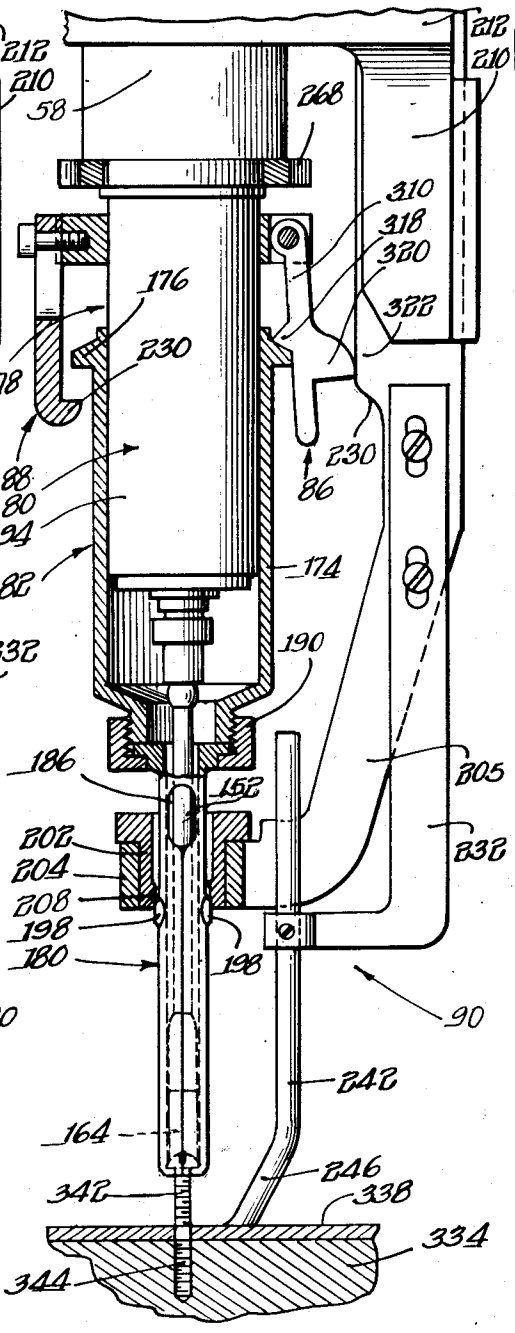

Fig. 9.

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POWER SCREW DRIVER

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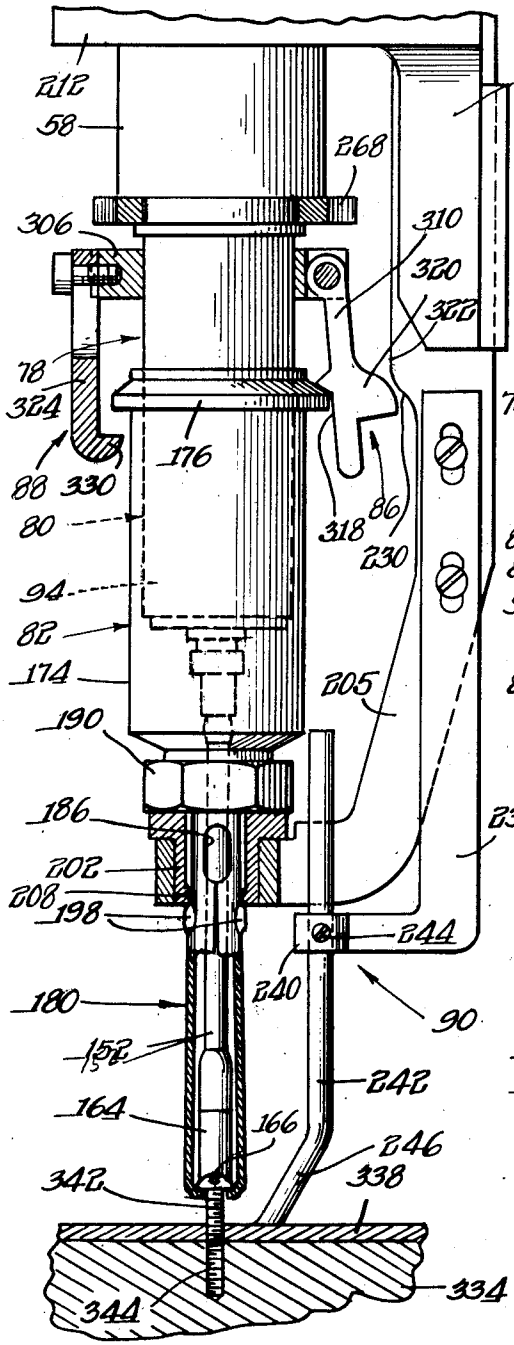

Fig. 10.

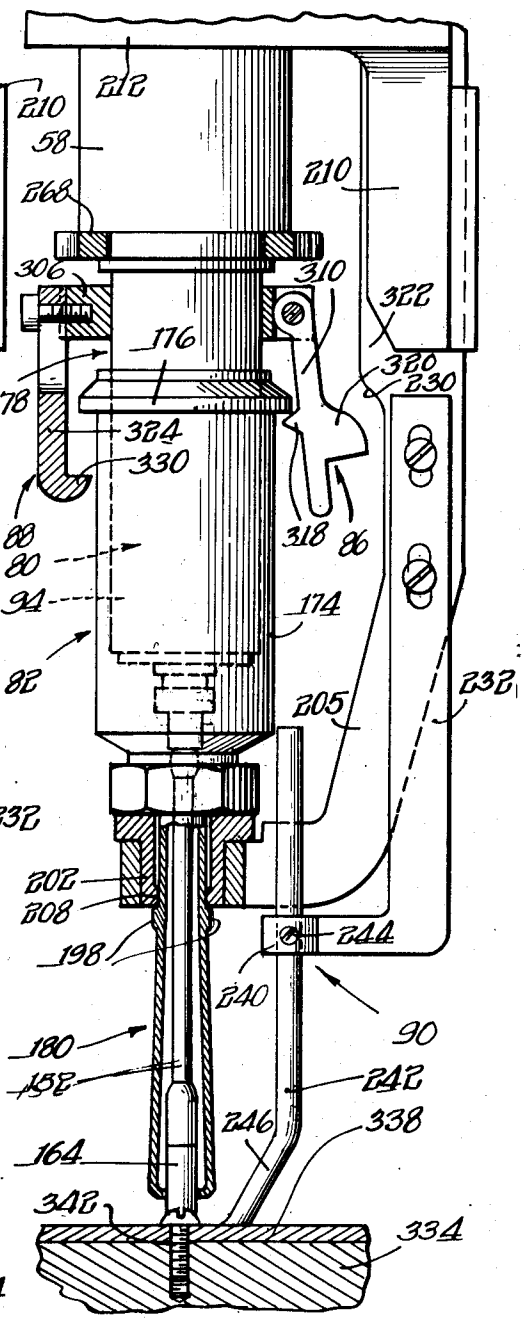

Fig. 11.

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UNITED STATES PATENT OFFICE

2,664,121

POWER SCREW DRIVER

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Application February 17, 1951, Serial No. 211,505

20 Claims. (Cl. 144—32)

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This invention in concerned generally with the driving of fasteners and particularly with a power screw driver.

Power drivers and particularly power screw drivers as heretofore constructed have been operable to drive screws or other fasteners into fastening position on or in a work piece at a fixed height above the supporting table of the driver. Supporting tables are vertically adjustable to accommodate articles of different heights, but frequent adjustment is not feasible due to the time required therefor. Work pieces frequently have fastener receiving portions or surfaces of different heights and it has been necessary heretofore to operate on each such work piece by a plurality of fastener drivers, each driver driving a fastener into fastening position on or in a position or surface of a different height. Operation on a single work piece by a plurality of drivers is time consuming and it often has been found difficult to maintain parts in proper registration while shifting from one driver to another.

An object of this invention is to provide a power driver operable without adjustment to drive screws or other fasteners into fastening relation with work surfaces positioned a variety of distances above a supporting table.

A further object of this invention is to provide an attachment for use with a reciprocable power driver to adapt the driver to drive screws or other fasteners into fastening relation with work surfaces positioned a variety of distances above a supporting table.

An object of this invention is to provide, in a screw driver having screw positioning means, means for opening the positioning means to release a screw at a predetermined height above a work surface and means for closing the positioning means at a greater height to clear the top of the screw just released.

Yet another object of this invention is to provide a power screw driver having a simple adjustment for driving screws of diverse lengths.

A further object of this invention is to provide, in a power screw driver, means facilitating alignment of screws and screw receiving apertures.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings wherein:

Fig. 1 is a view in perspective of a power screw driver embodying the invention;

Fig. 2 is an enlarged fragmentary view substantially in vertical section and taken along the line 2—2 of Fig. 6;

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 2;

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Fig. 4 is an enlarged fragmentary view showing the screw positioning means and taken along the line 4—4 of Fig. 2;

Fig. 5 is a further enlarged side view of a portion of the apparatus shown in Fig. 2;

Fig. 6 is an enlarged view in horizontal section taken substantially along the line 6—6 of Fig. 2;

Fig. 7 is a fragmentary enlarged view taken substantially along the line 7—7 of Fig. 2; and

Figs. 8, 9, 10 and 11 are views similar to Fig. 7, but showing the parts in different positions of operation.

As shown in the drawings, a power screw driver embodying the principles of my invention comprises a standard drill press 20 to which is attached a plurality of additional and substitute or auxiliary mechanisms. The standard drill press 20 comprises a main base or stand 22 (Fig. 1) on which is mounted a hollow supporting column or positioned means 24 carrying at its upper end a vertically adjustable head unit 26 and intermediately of its length a vertically adjustable work table 28. The work table 28 is secured to the column 24 by a conventional slidable collar 30 clamped in adjustable position by the usual clamping means operated by a hand lever 32. The head unit 26 includes the usual mounting frame 34 formed with a vertically slidable collar 36 clamped in adjusted position by the usual lever operating means (not shown).

The mounting frame 34 is also formed on opposite sides of the collar with bosses 38, only one of which is shown in the drawing, receiving adjustable mounting rods (not shown) for the motor mounting plate 40 to which is bolted on its rear face the usual drive motor 42. The motor shaft extends upwardly and carries at its upper end a four-step pulley 44 driving a belt 46 which passes over a four-step pulley 48 driving a multi-splined spindle 50 in the usual manner.

The spindle 50 is journaled in the usual manner in tubular front section 52 of the mounting frame 34, as by a sleeve 54 fitted in roller bearings 56 at the upper end of the tubular frame section 52. The spindle is also journaled in a vertically reciprocable tube or quill 58 as by roller bearings 60 and 62 at the upper and lower ends of the quill. The bearing 60 is held in place by a ring nut 64 and a collar 66 pinned to the spindle above the bearing 60 prevents relative axial movement between the spindle and the quill in a downward direction.

The quill or tube 58 is slidably mounted in the tubular frame section 52 by suitable means such as axially spaced annular shoulders 68 formed on the inner surface of the tubular frame section 52.

The additional and substitute or auxiliary mechanism or means includes a screw feeding hopper **70**; an escapement or screw feeding control device including an operating lever **72** (Figs. 2 and 6); a screw feeding chute **74** (Figs. 1, 2 and 4–6); a vertically reciprocable and rotatable screw driving means or unit **78**; a rotary drive unit **80** (Figs. 7–11) connecting the spindle of the drill press to the screw driving means or unit **78**; vertically reciprocable screw receiving or carrying means **82**; manually or pedally operated or controlled actuating means **84** (Figs. 1, 2 and 6) causing vertical reciprocation of the screw driving means or unit; automatically operable means **86** and **88** for connecting the screw driving means or unit to, and for disconnecting it from, the vertically reciprocable screw receiving or carrying means to cause reciprocation of the screw receiving or carrying means during a portion of the reciprocation of the screw driving means or unit; and automatically positioned means **90** for effecting release of a driven screw at a predetermined distance above a work surface of variable height above the work table **28**.

The screw hopper **70** may be of any desired known type delivering screws in horizontal position to the top of the screw feeding chute **74**. The screws are released one by one by escapement mechanism, which may be conventional, when actuated by the operating arm or lever **72**, this arm or lever being engaged by a member once for each reciprocation of the screw driving means or unit as will be apparent hereinafter. The screw feeding chute **74** comprises a pair of spaced apart rails which are vertical at their upper ends, inclined throughout their intermediate portion, and are curved to a horizontal position at their lower ends **92** (Fig. 5).

The screw driving means and drive unit

The vertically reciprocable and rotatable screw driving means or unit **78** comprises a tube or sleeve or mounting member **94** externally threaded at its upper end as at **96** (Figs. 2, 7 and 8) and threaded into the lower end of the quill **58** in place of the usual ring nut for holding the lower roller bearing **62** in position. The tube or sleeve **94** forms a housing for the drive unit **80**. The drive unit **80** comprises a spindle or stub shaft **98**, the shaft having an enlarged threaded portion **100** intermediate the ends thereof, an annular groove **102** adjacent the lower end thereof, and an axial bore **104** opening at the lower end of the shaft. The shaft **98** is formed at its upper end with flat surface sections **105** for engagement by set screws **106**, which fix the shaft to the drill press spindle **50** for rotation therewith when the stub shaft is introduced into the socket at the lower end of the spindle.

A clutch member or collar **108** is splined on the stub shaft **98** just below the threaded section **100** for rotation with the stub shaft, but axially shiftable along the shaft. The clutch member **108** is formed at its lower face with teeth or projections **110** adapted to engage in complementary notches formed by similar teeth on the top surface of a second clutch member or collar **112**. The clutch member or collar **112** is rotatably mounted on the stub shaft **98** but held against movement axially of the shaft by ball bearings **114** received in the groove **102** at the lower end of the shaft and a like groove in the inner surface of the collar **112**, the ball bearings being inserted through a radial opening in the collar **112** and that opening thereafter being

closed by a set screw **116** threaded into the opening and preferably locked into position by a wire ring received in an annular slot in the collar and in a driving slot in the set screw **116** (not shown).

The clutch member **108** is urged into driving engagement with the clutch member **112** by a coil spring **118** interposed between a shoulder **120** of the clutch member **108** and a ring or washer **122**. The ring or washer **122** is formed with an inwardly directed radial key or lug (not shown) received in a key slot in the threaded section **100** of the stub shaft **98**. The ring **122** is adjusted in position and secured against axial movement by a ring nut **124** threaded on the threaded section **100** of the stub shaft. The retaining ring **122** is formed with spaced upwardly extending projections **123** (Fig. 8) received in complementary notches in the under surface of the ring nut **124**. It will be evident that the retaining ring, being keyed to the stub shaft and interlocked with the tension adjusting ring nut **124**, insures rotation of the clutch spring with the clutch member **108** so that the spring exerts no drag on the rotation of the stub shaft and further acts to hold the adjusting nut in adjusted position. The clutch member **112**, in addition to the clutch teeth on its upper surface, is provided on its opposite or lower surface with a pair of diametrically opposite V-shaped clutch teeth **126** adapted to cooperate with similar, diametrically opposite clutch teeth **128** formed on the upper surface of a third clutch member or collar **130**.

The third clutch member or collar **130** is mounted on a tool receiving chuck or collet **132** which consists of a stub shaft having a reduced upper portion **134** received in the axial bore **104** of the stub shaft **98** and of a diameter such as to form a close frictional fit therein. A coil spring **136** is inserted in the bore **104** of the stub shaft **98** between the closed end of the bore and the upper end of the shaft **134**. The tool receiving chuck or collet **132** is formed with an annular flange or ring portion **138** on which the third clutch member **130** is press fitted, the clutch member **130** being keyed to the tool receiver **132** by any suitable means.

It is to be understood that any standard or known double-clutch functioning in a manner similar to that described above may be substituted for the double-clutch between the spindle and tool receiving collet as described above.

The lower end of the tool receiver or collet **132** is reduced in diameter as at **140**, forming a small annular shoulder **142** between the reduced portion and the intermediate lower portion **144**. The tool receiver is also formed at its lower portion with a hexagonal or other non-circular bore **146** opening at the lower end of the reduced portion **140**, the portion **140** also having a radial opening to receive a ball, pin or key **148** resiliently urged into the bore **146** by a spring retaining ring **150** so as detachably to retain a driver bit **152**. The driver **152** preferably comprises a rod having an enlarged portion **154** at its lower end, and hexagonal portions **156** and **158** at its opposite end spaced axially by an annular groove **160**. The rod is also provided with an enlarged portion **162** adjacent but below the hexagonal portion **156** and larger than the bore **136** in the tool receiving collet so that by engaging the lower end of the collet it positions the annular groove **160** in the plane of the retaining ball, pin or key **148**.

The enlarged portion **154** of the driver bit is formed at its lower end with a threaded bore

(not shown) detachably to receive a driver blade 164 having a reduced threaded upper end portion for insertion in the threaded bore of the portion 154. The screw engaging and driving end of the driver blade may take a number of different forms depending upon the head shape of the screws to be driven. For handling the ordinary round head screws, as shown for illustrative purposes in this application, the driving end of the blade is concave complementary to the shape of the screw head with a flat sided projection or blade 166 extending therefrom to enter the cross slot of a screw head.

It will be evident that the driver bit blades 164 are readily detachable from and insertable in the shanks of the driver bits so that a single shank may be used with any of a large variety of bit blades differing in size and in the shape of their screw receiving ends to handle a large variety of types and sizes of screws without requiring any change other than in the bit blade. In order to handle a still larger variety of types and sizes of screws, the driver bit shanks are readily replaceable.

The sleeve or tube 94 is closed at its lower end by a sleeve nut 168 having external left hand threads 170 so that it will not be loosened by the rotation of the tool receiving chuck or collar. The sleeve nut 168 is formed internally to receive a needle bearing 172 which forms a bearing for and receives the portion 144 of the tool receiving chuck or collar. The sleeve nut also serves as an abutment limiting the axial movement of the clutch member 130 in a direction away from the clutch member 112. The coil spring 136 in the bore 104 of the stub shaft 98 and the close fit of the portion 134 of the tool receiver in the bore serve as a means for frictionally starting the driving of the tool receiving chuck or collet as the clutch members 112 and 130 move toward engagement with each other.

The screw carrying means

The vertically reciprocable screw receiving or carrying means 82 preferably comprises a cylinder 174 having an annular flange 176 adjacent its upper end, and a reduced annular threaded lower end 178. A screw receiver and carrier or catcher 180 (best seen in Figs. 4 and 7) comprises a sleeve having resilient catcher arms 182 and 184 integrally united at the top of the sleeve, the arms normally being spaced by diametrically opposite slots extending from the bottom end of the sleeve to cross openings 186 in the wall of the sleeve adjacent the upper end thereof. The sleeve is formed at its upper end with an annular flange 188 received in a cup-like nut 190 threaded on the portion 178 of the tube 174 in order detachably to mount the screw carrier or catcher on the tube. The catcher arms are formed at their lower ends with confronting slots 192 facing the bottom end 92 of the chute 74 so as to permit the head of a screw moving down the chute to pass from the chute into the space between the catcher arms, the shank of the screw passing between the open catcher arms below the confronting slots 192. The catcher arms are formed at their lower ends with inturned generally semicircular shelves or lips 194 forming a seat for the heads of the screws.

The inner surfaces of the arms adjacent these shelves or lips 194 are semicircular in form and preferably tapered axially for a short distance above the shelves or lips and exert a centralizing action on a screw when the catcher arms are brought to closed position thereby aligning the shank of the screw with the axis of rotation of the drive bit. The external surfaces of the catcher arm are semicircular in shape and are preferably tapered or beveled at their lower ends as at 196.

The catcher arms are formed with enlarged cam portions or surfaces 198 which are joined to the surfaces of the arms above and below the cam portion by tapered cam surfaces, the sections 200 of the catcher arms above the cam portions 198 being of less external diameter than the cam portions 198 and the sections of the catcher arms below these cam portions, for purposes shortly to be described.

The catcher arm control mechanism

The opening and closing of the screw carrier or catcher 180 is governed by the mechanism 90 which comprises a control sleeve or bushing 202 best seen in Figs. 7–11, detachably mounted in a boss 204 formed at the lower end of a bar 205 and positioned in coaxial alignment with the drill press spindle 50 and concentric to the path of movement of the screw carrier. The bushing 202 is provided at its upper edge with an external annular flange 206 overlying and abutting against the boss 204 and is provided at its lower edge with an inturned annular flange 208. The bushing is detachably secured within the boss by means such as screw threads, a bayonet connection, or any other readily releasable means.

The bar 205 is slidably mounted for vertical shifting or reciprocation on a depending bar or arm portion 210 (Figs. 3 and 6–11) of a bracket 212 secured to the under side of the tubular frame section 52 by means such as screws or bolts 214. The depending bar or arm portion 210 is provided with a longitudinal angular or dovetail flange portion 216 cooperating with a similar portion 218 on the bar 205. A plate 220 is secured to the edge of the depending bracket arm or bar 210 by bolts or screws 222 and is provided with a laterally extending flange 224 overlying the edge of the slidable or reciprocable bar 205, the edge of the bar 205 opposite the dovetail flange portion being received in an elongated groove or slot 226 in the plate 220. A narrow flange 228 extending parallel to the flange 224 from the other edge of the plate 220 is received in a cooperating notch in the depending bar or arm portion 210 for utmost stability and rigidity.

The vertically shiftable or reciprocable bar 205 is provided near the lower end of the depending bracket arm or bar 210 with a camming surface 230 facing the vertically reciprocable screw receiving or carrying means 82. A stop arm 232 is secured to the arm 205 by screws 234, the screws fitting through vertically elongated slots 236 for adjustably positioning the stop arm 232 relative to the arm 205. The arm 232 is provided at its lower end with an extension 238 substantially confronting the screw catcher 180 and having a boss 240 at the outer end. A positioning finger or striker 242 fits through a vertical aperture in the boss 240 and is held in any desired vertically adjustable position by means of a set screw 244. The positioning finger or striker 242 is provided at its lower end with an inturned or diagonal foot 246 extending nearly into alignment with the catcher 180 and driver bit 152.

The quill actuator and reciprocating drive connections

The quill actuator 84 and reciprocating drive connections 86 and 88 comprise a fluid actuator or pneumatic motor including a cylinder 248 (Figs. 1 and 2) received in a vertical hole drilled through the drill press frame 34 and mounted on the frame by a split mounting bracket 250 clamped to the cylinder and bolted to the lower end of the frame 34.

A piston 252 is press fitted or otherwise secured in any convenient manner to a long tube 254 open at its bottom end, the upper end of the tube being closed by the piston 252. The tube 254 at its lower end is secured to or formed integrally with a bracket 256 (Figs. 1, 2 and 6) the bracket having an arm 258 which extends from the cylinder 248 through a slot therein. The arm 258 is formed integrally with a diagonally depending arm 260 (Fig. 6) formed at its lower end with a boss 262 (Fig. 2) in which is adjustably mounted an escapement control rod 264. The escapement control rod engages the escapement lever 72 to actuate the same to deliver a screw to the feeding chute 74. The control rod 264 preferably is adjustable vertically in the boss 262 to provide for adjustment of the extent of motion imparted to the lever 72. The rod may be adjusted by any well known means, which are not shown.

The bracket 256 further is provided with an arm 266 (Fig. 2) having a semicircular yoke 268 at its outer upper end and a depending guide bar or lug 270 at its outer lower edge to guide the screw carrier sleeve 174 as presently will appear.

The fluid motor also includes a return actuating coil spring 272 housed in the tube 254 and positioned at its lower end by a rod 274 which projects thereinto, the rod 274 having a tapered fitting projection 276 fitted in a tapered hole in a cap member 278 which is secured in any convenient manner, as by screw threads, to the lower end of the cylinder 248 and closes the lower end thereof.

Upward movement of the piston 252 under the action of the return actuating spring 272 is determined by a cylinder head nut 280 threaded into the upper end of the cylinder and carrying a conventional air admitting and exhausting control valve structure 282, the valve structure having an air exhaust opening 284 and an air pressure supply pipe 286. The control valve 288 normally is urged to air exhausting position in which the air exhausting passage 284 is connected to the air passage 290 in the cylinder head nut 280. The piston 252 is provided with a cushion piston 292 in the form of a rod projecting above the main piston and received in a complementary small opening in the cylinder head nut 280, the small piston 292 serving to cushion the final upward movement of the main piston so that in its upper position it abuts the cylinder head. Leakage of air past the piston 252 may be prevented by a single packing ring 294 set into a groove in the piston.

The control valve 288 may be operated to air admitting position connecting the air pressure supply pipe 286 to the air passage 290 by a lever 296 pivoted to the valve unit 282 at one end and at its upper end to a control rod 298 extending through the hollow column 20 of the drill press. At its lower end the control rod 298 is connected to a lever 300 (Fig. 1) pivoted to the base 22 intermediate its ends, the lever passing into the column through an appropriate slot at the lower end of the column and carrying at its forward end a foot pedal or treadle 302 by means of which

the lever may be swung in a counterclockwise direction to raise the control rod 298 and thereby swing the valve control lever 296 in a counterclockwise direction and shift the control valve 288 to air admitting position. On release of the pedal 302, the weight of the control rod 298 causes return of the foot pedal to its upper position and moves the valve control lever 296 in a clockwise direction, thereby permitting the control valve 288 to move to air exhausting position. The spring 272 thereupon moves the piston 252 and the tube or cylinder 254 and consequently the bracket 256 to their upper positions.

The yoke 268 of the bracket 256 encircles the sleeve 94 of the screw driver unit 78 and fits above an annular seating flange 304 (Figs. 5 and 7–11) formed integral with the sleeve 94 and spaced axially from the threaded portion 96 thereon and clamping the yoke against the bottom of the quill 58. On return movement of the fluid motor, the escapement actuating rod 264 engages the escapement actuating lever 72 to operate the escapement to allow a screw element to advance through the chute 74.

The tube or sleeve 94 of the screw driving unit, the quill and the spindle are connected directly to the fluid motor as set forth heretofore, but the screw receiving or carrying means is operatively connected to the actuator only during a portion of the reciprocation of the screw driving unit, the quill and the spindle. The reciprocating and drive connections 86 and 88 by means of which the screw carrying means is caused to reciprocate with the screw driving unit only during a portion of the reciprocation thereof includes a split clamping ring 306 clamped in adjusted position on the housing tube 94 of the screw driving unit by means such as a clamping bolt 308 (Fig. 5). A clutch member or latch 310 is received in a slot 312 (Fig. 7) in the clamping ring and is pivoted therein by means of a pin 314.

The latch member 310 is formed at its lower end with a depending finger 316. Intermediate its length, the latch member is formed with a V-shaped cam member or tooth 318 having upper and lower camming surfaces. The latch member 310 is provided on the side opposite the tooth 318 and intermediate the tooth and finger 316 with a control cam lug 320 adapted to ride along a control track 322 formed integrally with the slidable or reciprocable bar or arm 205. The control track 322 is terminated at its lower end by the camming portion or shoulder 230 set forth heretofore, this shoulder by engagement with the camming edge of the camming lug 320 causing inward movement of the latch member on upward movement of the screw driving unit and allowing outward movement of the latch member during a downward movement of the screw driving unit.

A second latch member or catch 324 is mounted on the clamping ring 306 by means of a bolt 326 fitting through a vertically elongated slot 328 and threaded into the ring. An inwardly directed tooth 330 on the lower end of the catch 324 fits beneath the annular flange 176 on the screw receiving or carrying means 82 for raising the same. The use of the latch members 310 and 324 allows the lowering of the screw receiving or carrying means to be adjusted independently of the raising means.

It should be noted that the under side of the annular flange 176 is substantially normal to the surface of the screw carrier tube 174 so as to form a sharp shoulder for cooperative engage-

ment with the tooth 330 of the latching member or catch 324. The upper edge of the annular flange 176 is beveled for cooperative engagement with the tooth 318 of the first latch member 310.

Operation

The primary advantage of the current invention resides in the ease with which screws can be driven into work surfaces spaced at varying heights above the work table 28. A work piece 332 having surfaces of different heights is shown in Fig. 2 and portions thereof are shown in Figs. 5 and 7–11. The work piece includes a base or block 334 to which plates 336, 338 and 340 are secured at diverse heights above the work table 28 by means of screws 342 in any suitable order, the plates forming the work surfaces heretofore alluded to.

Assuming the parts to have just completed an upward movement under the impetus of spring 272, the parts will be in the relative portions shown in Figs. 5 and 7 and a screw 42 will have been released by engagement of the escapement rod 264 with the escapement lever 72. The screw 342 slides down the feeding chute 74 and into the catcher arms 180, moving from the dashed line position of Fig. 5 to the solid line position through the notch or relieved portion 192.

Upon depression of the foot pedal or treadle 302, the valve 288 is actuated to admit air into the cylinder 248 to depress the piston 252 and tube or sleeve 254 and thereby to lower the bracket 256 and the tube or housing 94 and quill 58. The cam lug 320 of the latch member 310 rides along the cam track 322 until the tooth 318 engages the top surface of the annular flange 176 of the screw receiving or carrying means 82 as shown in Fig. 8. Continued lowering of the parts set forth heretofore causes the latch 310 to lower the screw receiving or carrying means 82, this means being shown in Fig. 8 in partially lowered position above the work piece 334 and plate 338. The catcher arms 180 fit sufficiently tightly within the catcher closer bushing as to pull the slidable or reciprocable bar 205 downwardly in its slidable mount in the depending bracket arm or bar 210. The stop arm 232, being fixed to the bar 205, and the positioning finger or striker 242 descend with the bar 205 until the foot 246 of the striker engages the plate 338. The striker aids in visually aligning the screw 342 with the aperture 344 into which it is to be threaded and limits downward movement of the stop arm 232 and slidable or reciprocable bar 205. After engagement of the foot 246 of the striker against the plate 338 (Fig. 9) and upon continued downward movement of the quill 58, tube 94, and screw receiving or carrying means 82, the catcher arms 180 move frictionally through the catcher closer bushing 204, the enlarged surface portions 198 passing through the restricted lower portion 208 of the bushing as the screw starts to enter the aperture 244 in order best to secure the screw.

It will be noted that the initial downward movement of the quill 58 and tube 94 has brought the clutch parts 114 and 130 into driving engagement and the driver bit 164 into driving engagement with the screw 342 prior to engagement of the latch 318 against the annular flange 176.

Continued downward movement of the quill 58, tube or cylinder 94, and screw receiving or carrying means 82 moves the enlarged portions 198 of the catcher arms below the closer bushing 204 and the arms begin to spring apart as shown in Fig. 10 due to the flexibility imparted to the arms by the notches or relieved portions 186 and the initial presetting of the arms away from one another. At the same time the cam lug 320 of the latch 310 moves off the cam track 322 past the shoulder 230 and the nut 190 strikes the top of the closer bushing 202 to prevent further downward movement of the screw receiving or carrying means 82 as shown in Fig. 10. Downward movement of the quill 58 and tube or cylinder 94 completes the driving of the screw 342 as shown in Fig. 11, the screw and driver blade 164 camming the catcher arms apart to permit passage of the screw therethrough into completely inserted position. When the screw reaches fully inserted position, the clutch parts slip relative to one another as is well known in the art, and the foot pedal or treadle 302 is released to reverse the valve position.

The spring 272 then acts to raise the piston 252, tube 254, the bracket 256, the quill 58, and the tube or cylinder 94. The tooth 330 of the second latch member or catch 324 catches beneath the annular flange 176 and raises the screw receiving or carrying means 82. The catcher arms frictionally engage the closer bushing 202 and additionally the enlarged or raised portions 198 engage beneath the bushing to raise the slidable or reciprocable bar 205 until such time as the upper end of the stop arm 232 engages the lower edge of the depending bracket arm or bar 210. The catcher arms then move frictionally upwardly through the bushing 202 and are closed thereby. The cam lug 320 of the latch member 310 engages the camming shoulder 230 and the lug is shifted inwardly to ride along the cam track 322, the tooth 318 at this time lying above the annular flange 176. It will be seen that the raising of the screw receiving or carrying means prior to closing of the catcher arms positively precludes any possibility of the catcher arms engaging or grasping at the head of a driven screw. The parts come to rest in the position shown in Figs. 5 and 7 and another screw is fed downwardly through the chute 74 in response to engagement of the escapement rod 264 with the actuating lever 72 and the screw driver is ready to perform another driving operation on a surface of any desirable height above the table 28.

It will be seen that the power screw driver as disclosed herein is capable of driving screws in succession into work surfaces positioned a variety of distances above the work table without the necessity of any adjustment whatsoever on the part of the operator. The screw driver readily is adjustable by shifting the striker or positioning finger vertically in its holder to drive screws of diverse shank lengths and particularly is adapted to drive short screws as shown in the illustrative embodiment. The positioning finger, in addition to controlling the height at which the driven screw is released, provides a convenient means for visually aligning the screw and aperture into which it is to be driven.

Although this invention has been illustrated with respect to a power screw driver, it will be apparent that a driving member other than a blade could be used and the power driver could drive rotary fasteners other than screws and also could drive non-rotary stud fasteners of diverse types. The structural modifications necessary to drive fasteners other than screws will be apparent to those skilled in the art, and it is to be understood that such modifications fall within

the scope of this invention and that the invention is to be limited only as set forth in the following claims.

I claim:

1. A power fastener driver comprising supporting means, a rectilineally shiftable fastener driving member carried by said supporting means, a fastener carrier rectilineally shiftable with and relative to said driving member, said fastener carrier including fastener holding means movable between fastener carrying and fastener releasing positions, means for delivering fasteners to said carrier, means for reciprocating said driving member to engage a fastener in said carrier and to drive said fastener into a work surface, means for rectilineally shifting said fastener holding means to a predetermined distance above a work surface of indeterminate distance from said supporting means, and means for effecting movement of said fastener holding means to fastener releasing position at said predetermined distance from a work surface of indeterminate distance from said supporting means.

2. A power fastener driver as set forth in claim 1 wherein the means for rectilineally shifting the fastener holding means to a predetermined distance from the work surface includes means for adjusting said distance.

3. A power fastener driver comprising a rectilineally shiftable fastener driving member, a fastener carrier shiftable with and relative to said driving member, said fastener carrier including fastener holding means movable between fastener carrying and fastener releasing positions, means for delivering fasteners to said carrier, means for reciprocating said driving member to engage a fastener in said carrier, means shiftable with said carrier for moving said fastener holding means between fastener carrying and fastener releasing positions, means extending below said fastener holder for engaging a work surface, and means controlled by said extending means upon engagement with said work surface for effecting movement of said fastener holding means to fastener releasing position at a predetermined distance from said work surface.

4. A power fastener driver comprising a rectilineally shiftable fastener driving member, a fastener carrier shiftable with and relative to said driving member, said fastener carrier including fastener holding means movable between fastener carrying and fastener releasing positions, means for delivering fasteners to said carrier, means for reciprocating said driving member to engage a fastener in said carrier, means shiftable with said carrier for moving said fastener holding means between fastener carrying and fastener releasing positions, means extending below said fastener holding means for engaging a work surface, means effective upon engagement of said extending means with said work surface to render said shiftable means effective to move said fastener holding means to fastener releasing position at a predetermined distance from said work surface, and means for limiting movement of said shiftable means when shifting away from said work surface to render said shiftable means effective to move said fastener holding means to fastener carrying position at a greater distance than said predetermined distance from said work surface to insure clearance of a driven fastener by said holding means.

5. A power fastener driver comprising a support, a rectilineally shiftable fastener driving member carried by said support, a fastener carrier shiftable with and relative to said driving member, said fastener carrier including fastener holding means movable between fastener carrying and fastener releasing positions, means for delivering fasteners to said carrier, means for reciprocating said driving member to engage a fastener in said carrier, a control member shiftably carried by said support and frictionally coupled to said fastener carrier, and means extending below the fastener holding means of said control member to engage a work surface to limit movement of said control member toward said work surface, and means effective upon such engagement to render said control member effective to move said fastener holding means to fastener releasing position.

6. A power screw driver comprising a support, a rotary and rectilineally shiftable screw driving member carried by said support, a screw carrier shiftable with and relative to said drive member, said screw carrier including screw holding means movable between screw carrying and screw releasing positions, means for delivering screws to said carrier, means for rotating said drive member, means for reciprocating said drive member to engage a screw in said carrier, a control member shiftably carried by said support and frictionally coupled to said screw carrier, means extending below said control member to engage a work surface to limit movement of said control member toward said work surface, means effective upon such engagement to render said control member effective to move said screw holding means to screw releasing position, and a stop limiting movement of said control member away from said work surface to render said control member effective to move said screw holding means to screw carrying position.

7. A power screw driver comprising a support, a rotary and rectilineally shiftable screw driving member, a screw carrier shiftable with and relative to said driving member, said screw carrier including a plurality of resilient screw carrying arms biased away from one another, control means shiftably carried by said support and including a retaining ring frictionally coupled to said resilient arms, said retaining ring when in one position on said arms being effective to retain said arms in contiguous, screw holding position and when in another position causing said arms to spring apart to screw releasing position, means for delivering screws to said arms, means for rotating said driving member, means for reciprocating said driving member to engage a screw carried by said arms, and means for limiting shifting of said control means at a predetermined distance from a work piece to move said retaining ring relative to said resilient arms into said second mentioned position to effect release of a screw at a predetermined distance from said work surface.

8. A power screw driver comprising a support, a rotary and rectilineally shiftable screw driving member, a screw carrier shiftable with and relative to said driving member, said screw carrier including a plurality of resilient screw carrying arms biased away from one another, control means shiftably carried by said support and including a retaining ring frictionally coupled to said resilient arms, said retaining ring when in one position on said arms being effective to retain said arms in contiguous, screw holding position and when in another position causing said arms to spring apart to screw releasing position, means for delivering screws to said arms,

means for rotating said driving member, means for reciprocating said driving member to engage a screw carried by said arms, and a member extending from said control means beyond said retaining ring to engage a work surface and limit shifting of said retaining ring toward said work surface and thereby to shift said ring relative to said resilient arms to said second mentioned position to effect release of a screw.

9. A power screw driver comprising a support, a rotary and rectilineally shiftable screw driving member, a screw carrier shiftable with and relative to said driving member, said screw carrier including a plurality of resilient screw carrying arms biased away from one another, control means shiftably carried by said support and including a retaining ring frictionally coupled to said resilient arms, said retaining ring when in one positon on said arms being effective to retain said arms in contiguous, screw holding position and when in another position causing said arms to spring apart to screw releasing position, means for delivering screws to said arms, means for rotating said driving member, means for reciprocating said driving member to engage a screw carried by said arms, a member extending from said control means beyond said retaining ring to engage a work surface and limit shifting of said retaining ring toward said work surface and thereby to shift said ring relative to said resilient arms to said second mentioned position to effect release of a screw, and a stop for limiting shifting of said control means away from said work surface to shift said retaining ring relative to said resilient arms to said first mentioned position to render said arms effective to carry a screw.

10. In a screw driver, a supporting column, drive means mounted on said column, said drive means including a rotary and rectilineally shiftable screw driving member and a rectilineally shiftable mounting member, a screw carrier shiftably mounted on said mounting member for movement therewith and relative thereto, said carrier including jaw members movable to open and closed positions to receive and release a screw, means for delivering screws to the jaw members of the carrier, a screw driver unit secured to said mounting member for movement therewith and connected to said drive member for rotation thereby and positioned to engage a screw in the jaw members of said carrier, actuator means for shifting said mounting member relative to said carrier to move the screw driver unit into engagement with a screw in the carrier, a work surface engaging member, and means controlled by said work surface engaging member for opening the jaw members of the screw carrier to release the screw at a predetermined distance from said work surface for driving by the screw driver unit brought into engagement with said screw by movement of the mounting member relative to the carriage.

11. In a power screw driver a supporting column, drive means mounted on said column, said drive means including a rotary and rectilineally shiftable drive member and a rectilineally shiftable mounting member, a screw carrier shiftably mounted on said mounting member for movement therewith and relative thereto, said carrier including screw retaining means movable between screw holding and screw releasing positions to receive and release a screw, means for delivering screws to the screw retaining means of the carrier, a screw driver unit secured to said mounting member for movement therewith and connected to said drive member for rotation thereby and positioned to engage a screw in the screw retaining means of said carrier, actuator means for shifting said mounting member relative to said carrier to move the screw driver unit into engagement with a screw in said screw retaining means, a work surface engaging member extending below the screw retaining means of said carrier, and means actuated by engagement of said member with said work surface for effecting movement of the retaining means of the screw carrier from screw holding to screw releasing position to release the screw for driving by the screw driver unit brought into engagement with said screw by movement of the mounting member relative to the carrier.

12. In a power screw driver, a first rectilineally shiftable hollow member, a rotary screw driver bit carried by and depending from said member, a rotary drive spindle rotatably mounted in said member and secured to said member for rectilinear movement therewith, rotary drive means connecting said spindle to said screw driver bit, a screw carrier including a second hollow member slidably mounted on the first hollow member and having depending jaw members spaced apart and movable between a closed position receiving a screw therebetween and an open position releasing the screw for driving by said screw driver bit, said driver bit projecting into the space between said jaw members, actuator means for shifting said first hollow member to move the driver bit into engagement with the screw in the jaw members of the carrier and thereby shift the jaw members with the first hollow member and the driver bit, means causing the jaw members to move to a closed position to receive and hold a screw when the hollow members are in a first position of movement, means causing the jaw members to move to open position as the members approach a second limit of movement whereby to release the screw for rotation by the rotary screw driver bit, and means for establishing said second limit of movement at a predetermined distance from a work surface of indeterminate position.

13. In a power screw driver, a first rectilineally shiftable hollow member, a rotary screw driver bit carried by and depending from said member, a rotary drive spindle rotatably mounted in said member and secured to said member for rectilinear movement therewith, rotary drive means connecting said spindle to said screw driver bit, a screw carrier including a second hollow member slidably mounted on the first hollow member and having depending jaw members spaced apart and movable between a closed position receiving a screw therebetween and an open position releasing the screw for driving by said screw driver bit, said jaw members being resiliently urged to open position, said driver bit projecting into the space between said jaw members, actuator means for shifting said first hollow member to move the driver bit into engagement with the screw in the jaw members of the carrier and thereby shift the jaw members with the first hollow member and the driver bit, control means causing the jaw members to move to a closed position to receive and hold a screw when the hollow members are in a first position of movement and causing the jaw members to move to open position as the members approach a second limit of movement whereby to release the screw for rotation by the rotary screw driver bit, and means for establishing said second limit of movement at a predetermined distance from a work surface of

indeterminate position, said control means including a guide for the jaw members maintaining them in closed position positively to hold the screw in said jaw members, said guide and said jaw members being shaped to permit said jaw members to move to open position as the members approach said second limit of movement, said guide being frictionally coupled to said jaw members for movement therewith.

14. An attachment for use with a power screw driver having a support, a rotary and rectilineally shiftable screw driving member carried by said support, and screw carrying means movable between holding and releasing positions, comprising means for moving said screw carrying means between screw holding and releasing positions, means for mounting said moving means for rectilinear movement relative to said support and for movement with and relative to said screw carrying means, and means extending below said moving means for engaging a work surface to limit the extent of movement of said moving means at a predetermined distance from a work surface of indeterminate position relative to said support, and means operative upon engagement of said extending means with a work surface to move said carrying means to screw releasing position at said predetermined distance from said work surface and an indeterminate distance from said support.

15. An attachment as set forth in claim 14 further including means for limiting movement of said moving means to effect movement of said screw holding means to screw holding position at a predetermined distance from said support.

16. An attachment as set forth in claim 15 wherein means is provided for adjusting at least one of said predetermined distances.

17. An attachment for use with a power screw driver having a support, a rotatable and rectilineally shiftable screw driving member and a plurality of resilient screw carrier arms tending

to spring away from one another, comprising control means adapted to be shiftably carried by said support and including a retaining ring frictionally engaging said resilient arms and effective in a first position to cause said arms to hold a screw and effective in a second position to cause said arms to release said screw, and means limiting movement of said retaining ring at a predetermined distance from a work surface, when moving toward said work surface, to shift said retaining ring relative to said resilient arms from said first to said second position to release a screw.

18. An attachment as set forth in claim 17 wherein a stop is provided limiting movement of said retaining ring away from said work surface to shift said ring relative to said arms to said first position to bring said resilient arms together in screw holding position.

19. An attachment as set forth in claim 17 wherein the means for limiting movement of said retaining ring at a predetermined distance from said work surface includes a member extending beyond said ring and engaging said work surface.

20. An attachment as set forth in claim 17, wherein the movement limiting means includes a member projecting beyond said ring and adapted to engage a work surface.

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