Nov. 11, 1924. 1,515,025

J. C. FOY

SCREW DRIVING MACHINE

Filed July 8, 1922 3 Sheets-Sheet 1

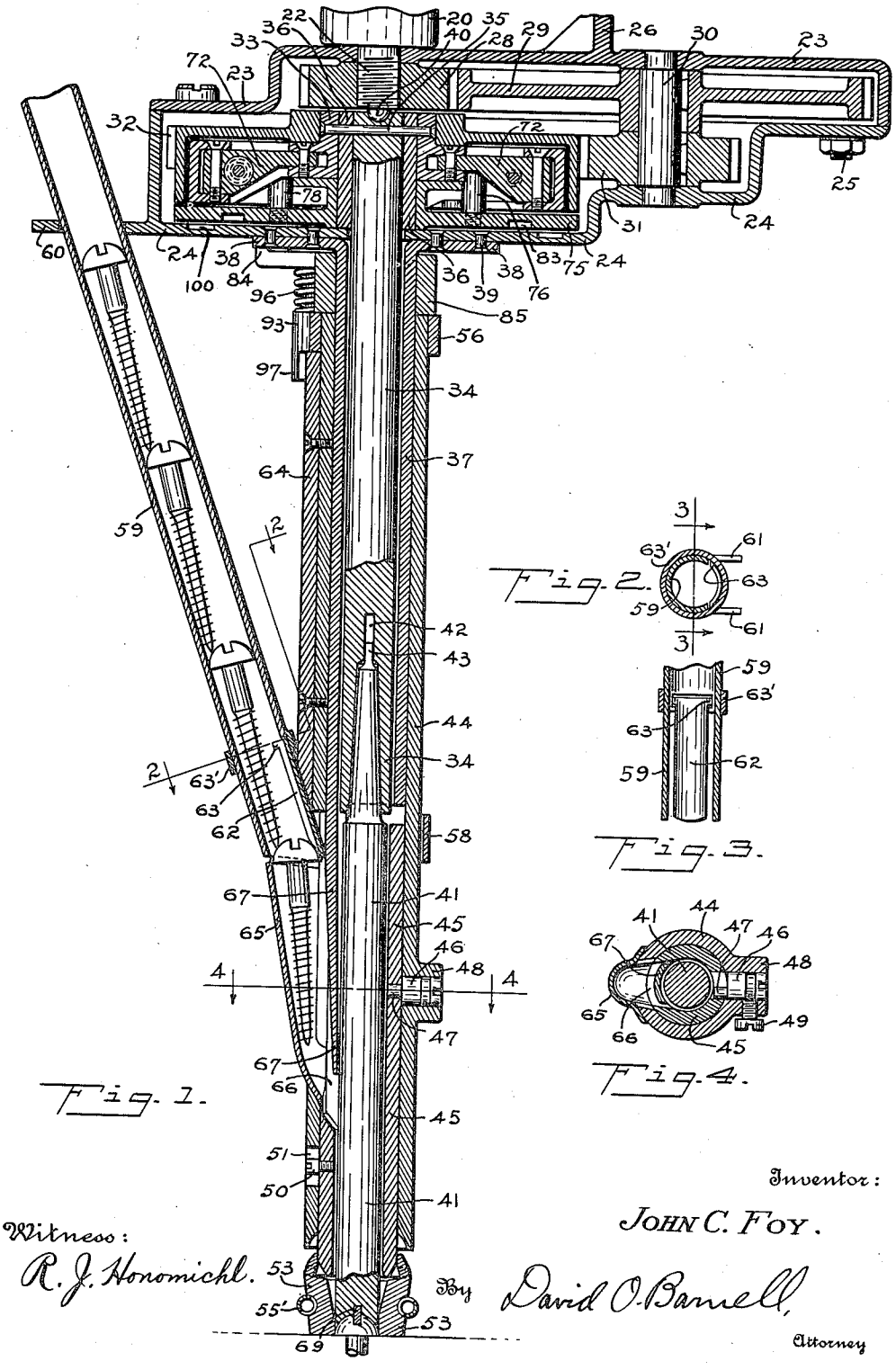


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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SCREW DRIVING MACHINE

Filed July 8, 1922 3 Sheets-Sheet 2

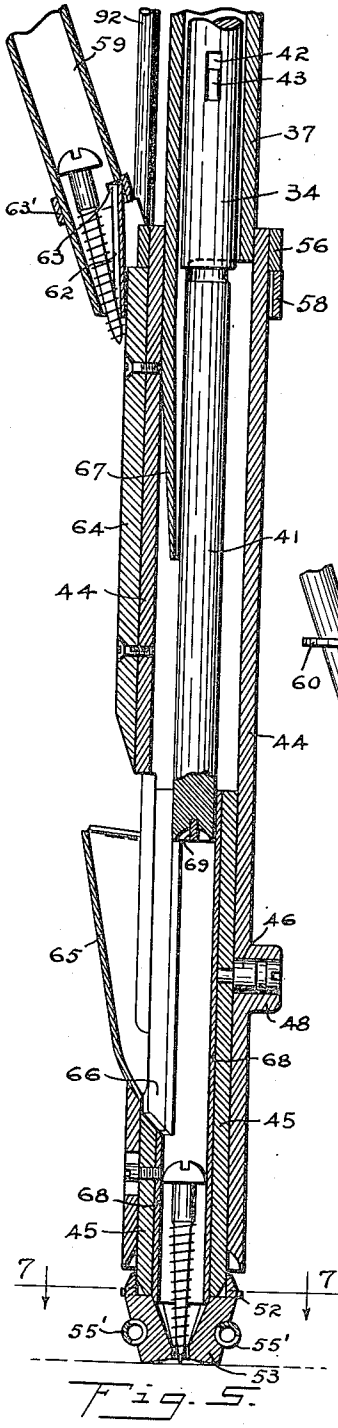


Fig. 5.

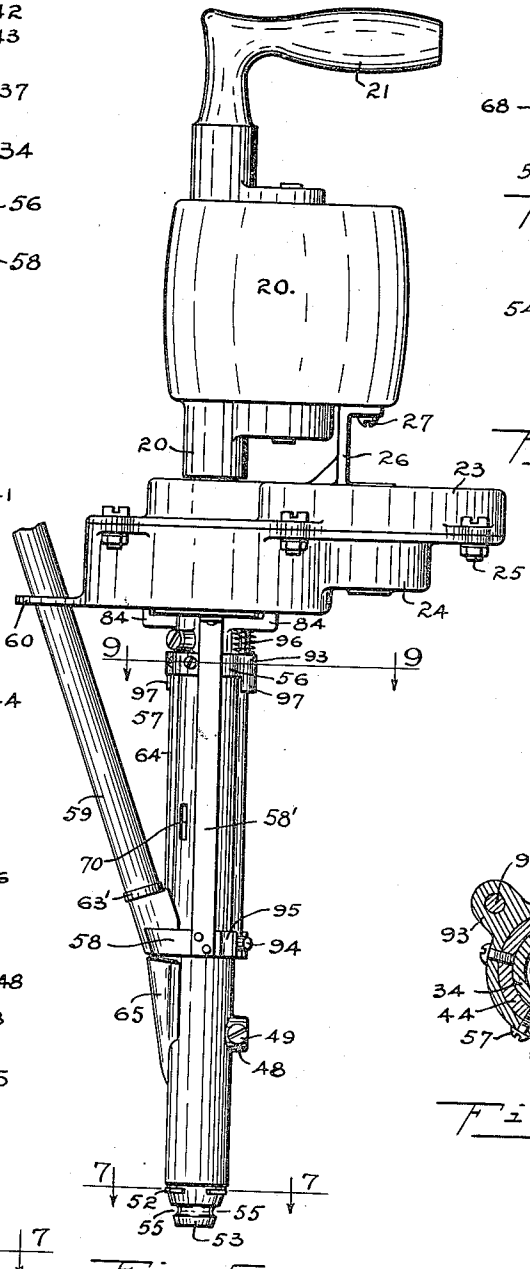


Fig. 6.

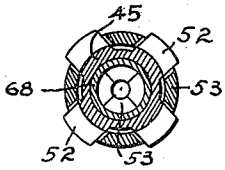


Fig. 7.

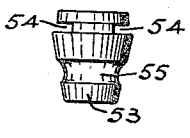


Fig. 8.

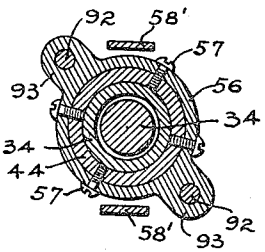


Fig. 9.

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SCREW DRIVING MACHINE

Filed July 8, 1922 3 Sheets-Sheet 3

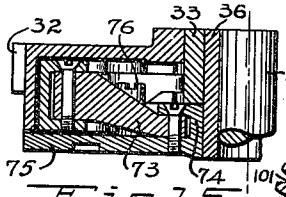


Fig. 15.

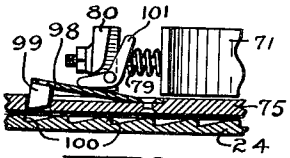


Fig. 16.

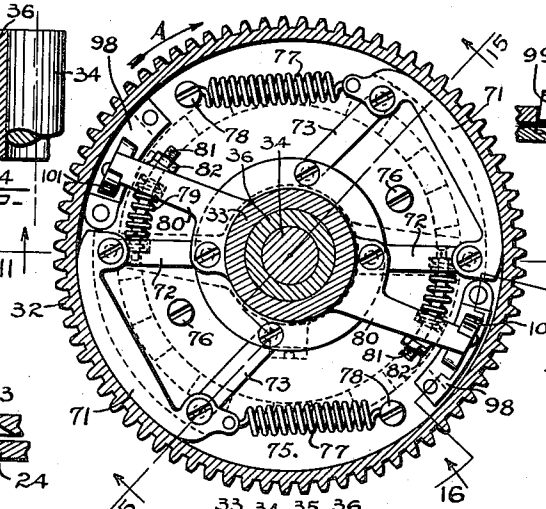


Fig. 10.

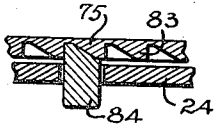


Fig. 12.

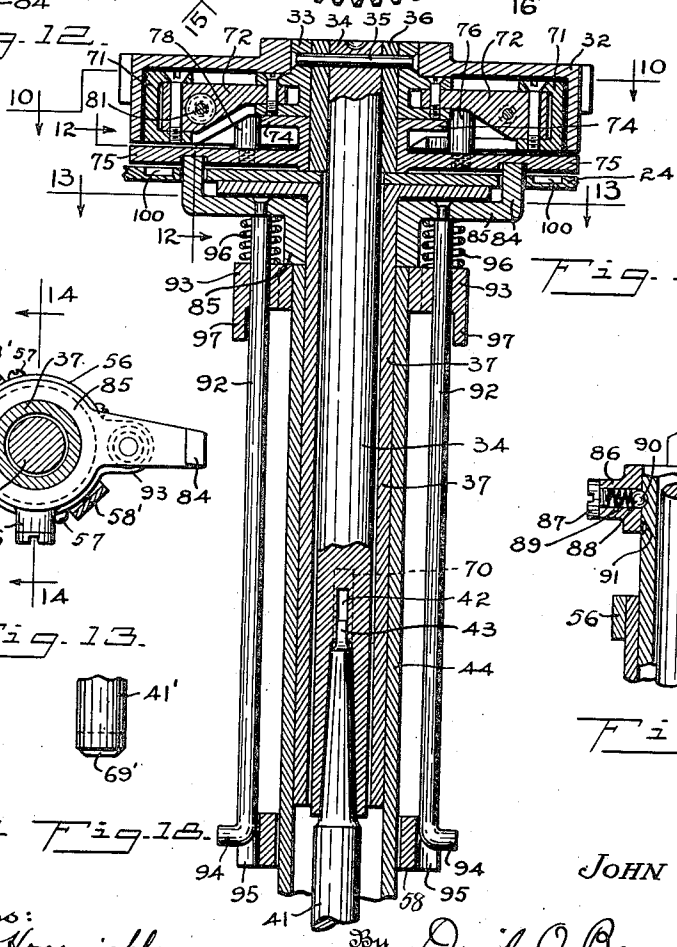


Fig. 11.

Fig. 13.

Fig. 14.

Fig. 17. Fig. 18.

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Patented Nov. 11, 1924. 1,515,025

UNITED STATES PATENT OFFICE.

JOHN C. FOY, OF OMAHA, NEBRASKA.

SCREW-DRIVING MACHINE.

Application filed July 8, 1922. Serial No. 573,654.

To all whom it may concern:

Be it known that I, JOHN C. FOY, a citizen of the United States, and a resident of Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Screw-Driving Machines, of which the following is a specification.

My invention relates to portable power-driven machines for driving screws, and it is the general object of my invention to provide a screw-driving machine adapted for use in factory assembling and similar situations where it is necessary to drive large numbers of screws rapidly and economically. More particular objects of my invention are to provide a machine of this character having a magazine for the screws, and adapted to feed the screws automatically from the magazine as required for use; to provide a screw-driving mechanism which may be actuated by a portable electric or pneumatic motor; to provide means for automatically stopping the action of the driving mechanism either when the screw has entered the work a predetermined distance or when a predetermined resistance is offered to the further entry of the screw into the work; to provide means for guiding and centering the screws as they are started into the work; to provide a special form of bit for engaging the screw-head and whereby to insure a proper engagement between the bit and the slot of the screw-head; to provide means for readily adapting the mechanism for driving screws of any diameter or length within the maximum capacity of the machine, and for driving screws with any standard form of head; and to provide certain other desirable structures and combinations of parts which will be more fully set forth hereinafter.

Structures embodying my invention are illustrated in the accompanying drawings, in which Fig. 1 is a vertical section through the driving and feed mechanism and a part of the magazine, Fig. 2 is a detail section of the magazine-tube on the line 2—2 of Fig. 1, Fig. 3 is a detail section on the line 3—3 of Fig. 2, Fig. 4 is a detail horizontal section on the line 4—4 of Fig. 1, Fig. 5 is a vertical section similar to Fig. 1 but showing the parts in the feeding position, Fig. 6 is a side view of the entire mechanism, including the driving motor, Fig. 7 is a transverse section on the line 7—7 of Fig. 6, Fig. 8 is a detail side view of one of the jaws of the centering-chuck, Fig. 9 is a detail transverse section on the line 9—9 of Fig. 6, Fig. 10 is a detail horizontal section through the clutch-mechanism, the section being on the line 10—10 of Fig. 11, Fig. 11 is a vertical axial section of the clutch and chuck-spindle and connecting parts, Fig. 12 is a detail section on the line 12—12 of Fig. 11, showing the stop-finger engaged with the rotary clutch-control plate, Fig. 13 is a detail transverse section on the line 13—13 of Fig. 11, Fig. 14 is a detail section on the line 14—14 of Fig. 13, Fig. 15 is a partial section on the line 15—15 of Fig. 10, Fig. 16 is a detail vertical section on the arcuate portion of the line 16—16 of Fig. 10, Fig. 17 is a detail side view of the end-portion of a bit for flat-head screws, and Fig. 18 is a similar view showing the flat side of the bit-lip.

Referring first to Fig. 6, my screw-driving and feeding mechanism is shown in connection with a motor of a type commonly used for portable drilling machines, wherein the motor-housing 20 has at one end a handle 21 and at the opposite end a projecting spindle or shaft 22 which is driven by the motor and is suitably threaded to receive a drill-chuck or the like. In the structure shown I provide a gear-housing formed in separable sections 23 and 24 which are secured together by bolts 25 extending through lugs at the adjoining edges of the sections. The upper section 23 has a projecting lug or bracket 26 which is secured by a screw 27 to the motor-housing 20, whereby the gear-housing and motor-housing are held in such relation that the drive-spindle 22 extends into the gear-housing as shown in Fig. 1. On the threaded portion of the drive-spindle 22 is mounted a pinion 28 which meshes operatively with a gear 29 mounted on a shaft 30, the ends of said shaft being journaled in suitable bearings formed in the housing-members 23 and 24. On the lower portion of the shaft 30 is a pinion 31 which meshes operatively with the clutch-gear 32. The clutch-gear is disposed coaxially with the drive-spindle 22, the gear having an annular rim-portion and an offset hub-portion which fits revolubly about a portion of the head-member 33 of the chuck-spindle 34. The chuck-spindle 34 is secured to the head-member 33 by a transverse pin 35, there being an intermediate sleeve or bushing 36 through which the pin passes, so that the same

fixedly connects the three parts 33, 34 and 36. The lower end of the bushing 36 rests upon the bottom of the housing-member 24, and the chuck-spindle extends down through an opening in said member, the lower portion of the spindle being enclosed by a tubular member 37 having at the upper end thereof laterally extending lugs 38 which are secured to the housing by rivets 39. The upper end of the chuck-spindle 34 is spherically recessed to receive the thrust-bearing ball 40, and the end of the drive-spindle 22 is similarly recessed, as shown in Fig. 1. The lower end of the chuck-spindle 34 has a taper socket formed therein for receiving the tapered shank of the bit or driver 41. A transverse slot 42 is provided in the chuck-spindle and housing-tube 37 through which a wedge-bar may be inserted for engaging the flattened terminal portion 43 of the bit-shank, for loosening the shank from the taper socket, the arrangement being substantially the same as is commonly used in drill-press-spindles for taper-shank drills. Upon the lower portion of the housing-tube 37 is slidably fitted the feed-tube 44, the lower portion of said tube 44 extending considerably beyond the lower end of the tube 37 and having slidably disposed therein the center-tube 45. The center-tube is held in adjusted relations to the feed-tube by means of a crank-stud 46 which fits in a tubular boss 48 at one side of the feed-tube, said stud having at the inner end thereof a short crank-pin 47 which extends into a transverse slot in the side of the center-tube, as best shown in Fig. 4. A set-screw 49 in the side of the boss 48 is adapted to engage the side of the crank-stud to hold the latter in adjusted positions, and the outer end of the crank-stud is slotted like a screw-head to enable the same to be rotated for adjusting the center-tube. At the opposite side of the center-tube there is a small screw 50 of which the cylindrical head extends into a longitudinal slot 51 in the side of the feed-tube, as shown in Fig. 1, said screw 50 preventing relative rotation of the members 44 and 45, but permitting relative longitudinal movement of the same to the extent of the slot 51. The center-tube 45 projects slightly beyond the end of the feed-tube, and upon the projecting terminal portion thereof are a plurality of laterally projecting rectangular lugs 52, best shown in Figs. 6 and 7, said lugs serving to support the jaws 53 of the centering-chuck. The upper portion of each of the jaws 53 fits loosely between an adjacent pair of the lugs 52, the sides of the jaws having notches 54 therein, as best shown in Fig. 8, to receive the lugs. In the outer faces of the jaws, near the lower ends thereof, are rounded grooves 55 in which is disposed an annular coil spring 55′ which tends to draw the lower portions of the jaws together, whereby to form between them a funnel-shaped opening, as indicated in Figs. 5 and 7. By outward pressure upon the jaws, however, the funnel-shaped passage is expanded, the annular spring 55′ being elongated and the jaws moving pivotally about their upper inner corners and on the lugs 52. At the upper end of the feed-tube 44 a collar 56 is secured by means of screws 57, as shown in Fig. 9, and downward movement of the feed-tube relative to the housing-tube 37 is limited by engagement of said collar with a ring 58 which fits loosely around the feed-tube at a level slightly below the end of the tube 37. The ring 58 is fixedly connected with the housing-member 24 by means of bars 58′ which extend up from the ring past the collar 56 to the gear-housing, as best indicated in Fig. 6. The ring 56 also serves to retain the lower end of the screw-magazine 59 in proper relation to the feed-tube, said lower end of the magazine being secured to said ring as shown, and the magazine extending diagonally upward therefrom, so as to pass through a lug 60 which projects from one end of the housing-member 24, as shown. The inner side of the tubular magazine at the lower end is open, the metal forming the tube at said end being longitudinally slit and portions thereof opened out to form parallel wings 61, as shown in Fig. 2. Said wings 61 extend in to the side of the feed-tube, and between them is disposed the tongue or flap 62 which is pivotally mounted at its upper end, by means of lugs 63 which extend laterally into notches above the upper edges of the wings 61, being retained therein by an annular band 63′, extending around the magazine as shown. On the side of the feed-tube adjoining the magazine there is secured a cam or track-bar 64 which is adapted to engage the pivoted tongue 62 and swing the same outwardly from the feed-tube as shown in Fig. 5, whereby to partially close the lower end of the magazine and prevent the descent of screws therefrom, except when the feed-tube is raised to its uppermost position as shown in Fig. 1. In the latter position the tongue is opposite the beveled lower end-portion of the track-bar, and is thus permitted to swing inwardly and fully open the passage through the magazine. In the side of the feed-tube, below the track-bar and in alinement with the magazine, there is an opening of which all but the uppermost portion is covered by the pocket or cup-member 65. Said cup-member is secured on the side of the feed-tube in a position such that its upper end adjoins the lower end of the magazine when the feed-tube is in the fully retracted position indicated in Fig. 1. The depth of the cup is such as to enable the same to contain the body-portion of the longest screws which are to be used in the machine, and the width of the cup at its

upper end is less than the diameter of the head of the smallest screw to be used. The opening through the side of the feed-tube adjoining the pocket or cup 65 is continued through the center-tube 45, the opening 66 in the latter member extending to the upper end thereof. On the lower end of the housing-tube 37 there is finger 67, alined with the opening or slot 66 in the center-tube, the parts being so proportioned that said finger extends down into said slot when the feed-tube is in the retracted position. By the described construction, when the feed-tube is raised or retracted so that the track-bar 64 permits the opening of the pivoted tongue 62, the lowermost screw in the magazine is permitted to drop down into the cup 65 until the head of the screw engages the upper edges of the cup. The latter are slightly inclined inwardly so that the screw tends to slide in through the opening in the side of the feed-tube, and through the registering slot 66 in the center-tube, but such movement is prevented by the finger 67 until said finger is withdrawn from the slot by movement of the feed-tube downwardly, or outwardly from the housing-members, toward the position thereof shown in Fig. 5. Upon the withdrawal of the finger 67 from the slot 66 the screw is permitted to pass into the center-tube and drop to the bottom thereof, so that the point thereof enters the funnel-shaped space between the jaws 53 of the centering-chuck. The bore or internal diameter of the center-tube 45 is such as to receive slidably the heads of the screws of largest size to be fed therethrough, and when smaller screws are to be used a tubular liner 68 is inserted in the center-tube, being held therein by the screw 50, as shown in Fig. 5, the bore of the liner being such as to properly center the heads of the smaller screws, and thus to hold the screws in a vertical position ready for engagement by the driver or bit 41. It will be noted that the body of the bit 41 is cylindrical and of nearly the same diameter as the heads of the screws with which it is used. For round-head screws, such as are shown in Figs. 1 and 5, the end of the bit is preferably spherically recessed so as to fit over the screw-heads, and is provided with an inset cross-bar 69 for entering the slot of the screw-head. The use of the full cylindrical body for the driver-bit insures the proper engagement thereof with the screw-head when the bit is moved to contact with the screw after the same is positioned in the center-tube and centering-chuck as shown in Fig. 5. For flat-head screws the end of the bit is formed as shown in Figs. 17 and 18, the body 41′ being cylindrical, the lower end thereof being flat, the inset cross-bar 69′ projecting beyond said flat face so as to enter the slot of the screw-head, and the ends of the cross-bar being beveled to conform with the inclined lower face of the screw-head. For convenience in removing the bits from the taper socket in the chuck-spindle, the feed-tube is provided with slots 70, shown in Fig. 6, adapted to register with the slot 42 through the spindle and housing-tube 37, when the feed-tube is in the retracted position.

It will be seen that, when a screw has been fed into the center-tube, as described and as shown in Fig. 5, if the bit 41 be rotated and moved downwardly relative to the feed-tube, the screw-head will be properly engaged by the bit and the screw thus actuated to enter the work against which the ends of the centering-chuck jaws 53 are held. It will also be seen that the screw will be held in a position perpendicular to the work, by reason of the screw-head being guided by the center-tube, while the point of the screw is guided by the chuck-jaws 53, the latter expanding as required to permit the body and head of the screw to pass between them.

The chuck-spindle 34, and bits carried thereby, are driven from the clutch-gear 32 through the medium of a friction-clutch arranged between said gear and the head-member 33 of said spindle, it being understood that the gear 32 may be either driven continuously or stopped and started at the will of the operator by stopping and starting the motor which drives the reducing-gear train as hereinbefore described. Arcuate clutch-shoes 71 are arranged within the drum formed by the annular rim of the gear 32, as best shown in Fig. 10, each of said clutch-shoes being pivotally connected at one end to a link 72, and the opposite end of said link being connected pivotally with lugs on the head-member 33. The other end of each clutch-shoe is pivotally connected with a link 73, and the opposite or inner end of said link is connected pivotally with the hub-portion 74 of the control-plate 75, the hub 74 fitting revolubly about the lower portion of the sleeve 36, intermediate the head 33 and the lower side of the housing 24. The links 72 normally extend radially of the spindle 34 and are so proportioned that when in said normal position the adjacent outer faces of the clutch-shoes will lightly engage the inner face of the drum formed by the gear-rim. The links 73 are so proportioned and arranged that when the clutch-shoes are engaged with the drum said links will extend at an angle to a radius from the spindle-axis, or, in other words, so that a line through the pivotal axes at the inner and outer ends of each link will be tangent to a circle about the spindle-axis. The direction of rotation of the gear 32 is shown by the arrow A in Fig. 10, and, for convenience of description and with reference to said direction of rotation of the parts, the links 72 may be considered as connected to the forward ends of

the clutch-shoes, and the links 73 as connected to the rearward ends of the shoes. To the rear end of each clutch-shoe is connected a coil spring 77 of which the opposite end is connected with a post 78 extended up from the control-plate 75. The tension of said springs 77 tends to move the clutch-shoes rearwardly and swing the inclined links 73 toward a radial position, and thus to press outwardly upon the rearward portions of the shoes. Outward movement of the shoes being limited by the engagement thereof with the drum, the action of the springs results in the production of a definite frictional contact between the shoes and the drum, sufficient to normally prevent slippage between the engaged clutch-surfaces. The driving impulse imparted by the drum to the shoes is transmitted to the head 33 partly by the links 72 and partly through the medium of springs 79 which are arranged circumferentially between the links 72 and arms 80 which extend out from said head 33. Said springs 79 are disposed around arcuate rods 81 which are fixedly connected with the links 72 and pass loosely through openings in the arms 80, the ends of said rods being threaded and provided with nuts 82 by which the initial compression of the springs may be adjusted. It will be seen that when the head 33 is being driven by the clutch connection between the same and the gear 32, the control-plate 75, which is connected with the shoes through the medium of the links 73 and springs 77, will normally rotate with the other clutch-parts and maintain the same relation thereto as when the parts are stationary. If, however, the rotary movement of the plate 75 is checked or stopped, its relation to the shoes will be changed in the same way as if it were to be moved rearwardly, or in a direction opposite to the arrow A, while the drum, shoes and head 33 were stationary. It will be apparent that such relative movement of the control-plate will increase the inclination of the links 73, causing the outer ends of said links to swing inwardly and thus tending to pull the rear ends of the clutch-shoes inwardly and disengage them from the drum. The clutch-shoes will not be completely disengaged from the drum, however, because after a very slight movement thereof the friction between the faces thereof and the drum will be so reduced that slippage will occur between the engaged faces, and the rotation of the shoes and head 33 will be stopped, while the drum continues to revolve. Thus it will be seen that the clutch-mechanism may be rendered inoperative or ineffective in driving the head 33, by first checking, retarding or stopping the rotation of the control-plate 75. Stop-posts 76, which extend up from the plate 75 between the links 72 and 73, serve to limit the rotation of the control-plate relative to the other clutch-parts. Automatic control of the clutch mechanism is effected in two ways, both of which operate by so connecting the control-plate 75 with the housing-member 24 as to prevent rotation of the plate.

On the lower side of the control-plate 75 there is an annular row of inclined recesses which form in effect a series of ratchet-teeth 83 (shown in Fig. 12) adapted for engagement by fingers 84 extending through openings in the bottom of the housing 24. Said fingers 84 are formed integrally with a collar 85 which is disposed slidably upon the housing-tube 37 at the upper end thereof. At one side of the collar 85 is a tubular boss 86, the outer end of the opening through said boss being closed by a screw 87, a ball 88 being disposed in the inner portion of the opening, and the ball being pressed toward the side of the tube 37 by a small coil spring 89 arranged between the ball and the screw 87, as shown in Fig. 14. In the side of the tube 37 within the collar 85 there are two sphero-segmental recesses 90 and 91 into which the ball 88 may drop to frictionally retain the collar in definite relations to the housing. Thus, when the ball is engaged in the upper recess 90 the collar is held in the raised position shown in Fig. 11, so that the fingers 84 are in position to engage the ratchet-teeth 83 on the control-plate and prevent rotation thereof; and when the ball is engaged in the lower recess 91 the collar is held at a lowered position at which the fingers 84 are disengaged from the control-plate. Rods 92 are connected with the collar 85 and extend downwardly therefrom, passing slidably through lugs 93 on the collar 56, and at their lower extremities having short outwardly turned portions 94 which are positioned between pairs of lugs 95 extending outwardly from the ring 58. Around the upper portions of the rods 92 are disposed coil springs 96 of which the normal length is such that the same are slightly compressed when the feed-tube 44 is retracted to a position such as shown in Figs. 1 and 11, or at which the collar 56 engages the lower end of the collar 85. The parts are so proportioned that when the feed-tube is moved downward or outwardly from the housing to the screw-feeding position shown in Fig. 5, the end-portions 94 of the rods 92 are engaged by fingers 97 on the lugs 93, and the rods and collar 85 thus pulled outwardly from the housing, whereby to disengage the fingers 84 from the control-plate 75. The clutch mechanism is thus freed so that actuation of the spindle 34 is started, providing, of course, that the clutch-gear 32 is being driven by the motor. In the lowered position of the collar 85 the ball 88 is engaged in the recess 91, which retains said collar in the clutch-releasing

position until the same is forcibly moved upward again by the engagement of the collar 56 therewith. Such engagement occurs as the feed-tube approaches the fully retracted position shown in Fig. 1, at which the driving of the screw is nearly completed. After the application to the collar 85 of sufficient force to dislodge the ball 88 from the recess 91, so that the upward movement of the collar is thereby started, the springs 96 expand and cause a rapid completion of the upward movement, at the end of which the ball enters the recess 90. The rapid movement of the collar to the clutch-engaging position is thus effected independently of the rate at which the feed-tube is being moved upwardly relative to the housing-tube 37, and insures a complete engagement of the fingers 84 with the ratchet-teeth 83 on the control-plate 75, without preliminary dragging or partial engagement between said fingers and teeth.

The group of mechanism last above described comprises the first of the two means for automatically controlling the clutch mechanism, and it will be seen that the driving of the chuck-spindle and driver-bit will be stopped when a screw has been driven into the work a predetermined distance. The exact extent to which the screw will enter the work before the driving connection is broken, may be varied within the required limits by adjusting the position of the center-tube 45 relative to the feed-tube, by means of the crank-stud 46 as before described. Thus, by raising the center-tube, the total length from the upper end of the feed-tube to the ends of the centering-chuck jaws 53, which rest against the work, will be reduced with the result that the end of the bit engaging the screw-head will be closer to the work before the control-collar 85 is engaged and moved to effect the throw-out of the clutch connection. Extending or lowering the center-tube relative to the feed-tube will cause an opposite effect, and the screw will be driven less deeply into the work before the throw-out of the driving connection.

On the control-plate 75, and positioned normally beneath the outer ends of the arms 80, there are flat springs 98 which are secured to the plate at one end, and at the other end carry the pawl-blocks 99 which extend downward through openings in the plate, as shown in Fig. 16. Said springs 98 normally hold the pawl-blocks in the raised position represented in said figure, but if the free ends of the springs be pressed downwardly the pawl-blocks are caused to project beneath the plate to engage ratchet-teeth 100 which are formed on the adjacent portion of the housing 24 by an annular series of inclined recesses, similar to the recesses which form the teeth 83 on the control-plate. On the ends of the arms 80 are pivoted small angle-levers 101, each having a lower arm which extends adjacent to the spring 98, and an upper arm which lies adjacent to the forward end of the respective clutch-shoe. The described devices constitute a means for stopping rotation of the control-plate, and thus throwing-out the clutch, when the resistance offered to rotation of the driver-bit is greater than a predetermined amount. As previously noted, the driving impulse received from the gear 32 is transmitted from the clutch-shoes through the links 72, springs 79 and arms 80, to the head-member 33. The initial or normal compression of the springs 79 is so adjusted that there will be but little additional compression of said springs under the normal driving-load, or by the transmission through the clutch-mechanism of the force necessary to drive the screw into the work. Should the screw meet with excessive resistance, however, the springs 79 will be compressed and the forward ends of the clutch-shoes will approach the arms 80, thereby engaging the upper arms of the angle-levers 101, pressing the same toward the arms 80 and thus moving the lower arms of said angle-levers downwardly so that they will press upon the springs 98. Then, after said springs have been pressed downward slightly, the pawl-blocks 99 will engage the teeth 100 on the housing, thus interconnecting the control-plate and housing and causing the throw-out of the clutch-mechanism.

The last described, or second, means for stopping rotation of the control-plate serves as a safe-guard to prevent the application to a screw of sufficient force to break the head thereof or to injure the driver-bit. The said controlling or stopping means is also useful when screws are to be driven so that the heads thereof enter a counter-bore in the work. For such conditions, there is used a bit of greater length than that usually employed, so that when the other parts are in the positions shown in Fig. 1 the lower end of the bit will extend through the center-chuck jaws far enough to enable it to enter the counterbore and engage the head of the screw therein without causing the jaws 53 to engage the work and thus raise the feed-tube far enough to actuate the control-collar 85. The throw-out of the clutch mechanism is then effected solely by the increased resistance offered when the screw has been fully driven, so that the head thereof is engaged with the work.

Now, having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocating screw-guiding means, clutch controlling mecha-

nism having a member movable into and out of engagement with the clutch, and means for connecting the said member with the screw-guiding means for actuating the member at the ends of the movements of the screw-guiding means to move the said member alternately in opposite directions into and out of engagement with the clutch.

2. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocating screw-guiding means, clutch controlling mechanism having a member movable into and out of engagement with the clutch, means for connecting the said member with the screw-guiding means for actuating the member at the ends of the movements of the screw-guiding means to move the said member alternately in opposite directions into and out of engagement with the clutch, and a spring arranged to be compressed to produce a rapid movement of the said member towards the clutch.

3. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocating screw-guiding means, clutch controlling mechanism having a slidable member, a rod connected with the slidable member and having an outer terminal portion arranged to be engaged by the screw-guiding means to move the member away from the clutch, said member being directly engaged by the screw-guiding means to move it towards the clutch.

4. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocating screw-guiding means, clutch controlling mechanism having a slidable member, a rod connected with the slidable member and having an outer terminal portion arranged to be engaged by the screw-guiding means to move the member away from the clutch, said member being directly engaged by the screw-guiding means to move it towards the clutch, and a spring disposed on the rod and arranged to be compressed to cause a rapid movement of the member in engaging the same with the clutch.

5. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocatory screw-guiding means, a sliding collar provided with fingers for engaging the clutch, rods secured to the collar and having projecting terminal portions arranged to be engaged by the screw-guiding means to move the collar away from the clutch, said collar being directly engaged by the screw-guiding means to move it towards the clutch, and springs disposed on the rods and arranged to be compressed to cause a rapid movement of the collar towards the clutch.

6. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, reciprocating screw-guiding means having a collar provided with projecting lugs, a clutch engaging collar, rods connected with the same and extending through the collar of the screw-guiding means, and having projecting terminal portions arranged to be engaged by the lugs of the screw-guiding means, and a relatively fixed collar provided with means for guiding the rods.

7. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor, screw-guiding means, clutch controlling mechanism including a member movable into and out of engagement with the clutch and actuated by the screw-guiding means, and means for locking the slidable member in and out of engagement with the clutch.

8. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor screw-guiding means, clutch controlling mechanism including a member movable into and out of engagement with the clutch and actuated by the screw-guiding means, and yieldable means for automatically locking the slidable member in and out of engagement with the clutch.

9. In a machine of the class described, a motor, a spindle, a clutch having a relatively movable control plate adapted to be actuated to connect the clutch with and disconnect the clutch from the spindle and provided with teeth, screw-guiding means, and a member actuated by the screw-guiding means and having a finger carried into and out of engagement with the control plate to operate the clutch.

10. In a machine of the class described, a motor, a spindle, a clutch having a relatively movable control plate adapted to be actuated to connect the clutch with and disconnect it from the spindle and provided with an annular series of teeth, work-engaging means, and a slidable member actuated by the work-engaging means and having a finger movable into and out of engagement with the said teeth.

11. In a machine of the class described, a relatively fixed tubular member, a spindle operating in the tubular member, a magazine consisting of an inclined tube having its lower end located adjacent to the tubular member, a feed tube slidable on the tubular member for feeding screws from the magazine to the spindle, a collar surrounding the feed tube and carrying the magazine, supporting bars connected at their upper ends with the tubular member and located at opposite sides of the feed tube and connected at their lower ends to and supporting the said collar.

12. In a machine of the class described, a tubular member, a spindle operating in the

tubular member, a magazine, a feed tube slidable on the tubular member for feeding screws from the magazine to the spindle, said feed tube being provided with means for closing the magazine and for permitting the same to open, said latter means including a pivoted plate, means carried by the feed tube for holding the plate in its closed position during a portion of the travel of the feed tube, and means on the tubular member for closing the opening to the feed tube during a portion of its travel.

13. In a machine of the class described, a relatively fixed tubular member, a spindle operating in the tubular member, a magazine supported upon the tubular member, a feed tube slidable on the tubular member for feeding screws from the magazine to the spindle, said feed tube being provided with means for closing the magazine and for permitting the same to open, said latter means including a pivoted plate, and a cam track carried by the feed tube and arranged to hold the pivoted plate in its closed position during a portion of the travel of the said feed tube.

14. In a machine of the class described, a tubular member, a spindle operating in the tubular member, a magazine, a feed tube slidable on the tubular member and provided with a screw receiving pocket carried to and from the magazine by the feed tube, said pocket being open at the top and inner side, and a finger extending from the tubular member and arranged to close the inner side of the pocket during a portion of the travel of the feed tube.

15. In a machine of the class described, a tubular member, a spindle operating in the tubular member, a feed tube slidable on the tubular member and provided with an opening adapted to be carried beyond the spindle, a magazine, a screw receiving pocket mounted on the feed tube at the opening thereof and carried to and from the magazine by the said feed tube for feeding screws to the spindle, and a finger on the tubular member for stopping the opening to the feed tube when the pocket adjoins the magazine.

16. In a machine of the class described, a tubular member, a spindle operating in the tubular member, a feed tube slidable on the tubular member and provided at one side with an opening, a magazine, a pocket carried by the feed tube to and from the said magazine, said pocket being open at its inner side and having an inclined upper edge for causing the screws to slide inwardly, and means on the tubular member for holding the screws against such inward movement when the pocket adjoins the magazine.

17. In a machine of the class described, a tubular member, a spindle operating in the tubular member, a feed tube slidable on the tubular member and provided at one side with an opening, a magazine, a pocket carried by the feed tube to and from the said magazine, said pocket being open at its inner side and having an inclined upper edge for causing the screws to slide inwardly, and a fixed finger extending longitudinally of the feed tube and arranged to hold the screws against inward movement during a portion of the travel of the feed tube.

18. In a machine of the class described, a tubular member, a spindle operating in the tubular member, a magazine consisting of an inclined tube provided at its lower end with a pivoted plate arranged to swing inwardly and outwardly to open and close the magazine, a feed tube slidable on the tubular member and provided with a pocket carried to and from the magazine by the feed tube, and a cam track also carried by the feed tube and arranged to hold the pivoted plate in its closed position during a portion of the travel of the feed tube and permitting the pivoted plate to open during another portion of the travel of the feed tube.

19. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor and for disconnecting it therefrom, reciprocating feeding means having a slidable feed tube, means operated by the slidable feed tube for controlling the clutch, and means for varying the effective length of the feed tube and the consequent periods of operation of the clutch.

20. In a machine of the class described, a motor, a spindle, a clutch for connecting the spindle with the motor and for disconnecting it therefrom, reciprocating feeding means having a slidable feed tube, means operated by the slidable feed tube for controlling the clutch, a liner sleeve arranged within the feed tube for varying the diameter and length of the same, and means for adjusting the liner sleeve and for securing the same in its adjustment.

21. In a screw-driving mechanism, a rotary driver-bit, a tubular screw-magazine mounted in fixed relation to the axis of said driver-bit, a feed-tube disposed coaxially with the bit and movable longitudinally from a retracted position at which the bit extends through the same to an extended position at which the bit is withdrawn therein, a pocket-member carried upon said feed-tube, there being a feed-passage from said pocket-member through the side of the tube into the bore thereof, said pocket-member having an open end extending adjacent to the end of the magazine-tube when the feed-tube is in retracted position, means for preventing egress of screws from the magazine-tube, said means being releasable by retraction of the feed-tube, whereby to deliver a screw into the pocket-member when the feed-tube is moved to retracted position, and a member held in fixed longitudinal relation to the

bit and movable into the feed-passage between the pocket-member and the bore of the tube when the latter is in retracted position, said member being withdrawn from said passage to enable delivery of a screw from the pocket to the bore of the tube when the latter is in its extended position.

22. In a machine of the class described, a motor, a spindle, a clutch for connecting the motor and spindle, said clutch having a control plate mounted thereon and normally rotating therewith, said control plate being arranged to throw out the clutch when rotation of the plate is checked relatively to the clutch, work-engaging means movable longitudinally of the spindle, a member actuated by said work-engaging means and engageable with the control plate to check rotation thereof and throw out the clutch, a fixed member, and means on the control plate engageable with said fixed member to check rotation of said plate, said means arranged to be actuated when the spindle meets with predetermined resistance.

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