Jan. 26, 1932. J. Q. HOLMES 1,842,830

POWER SCREW DRIVER

Filed Oct. 17, 1929 5 Sheets-Sheet 1

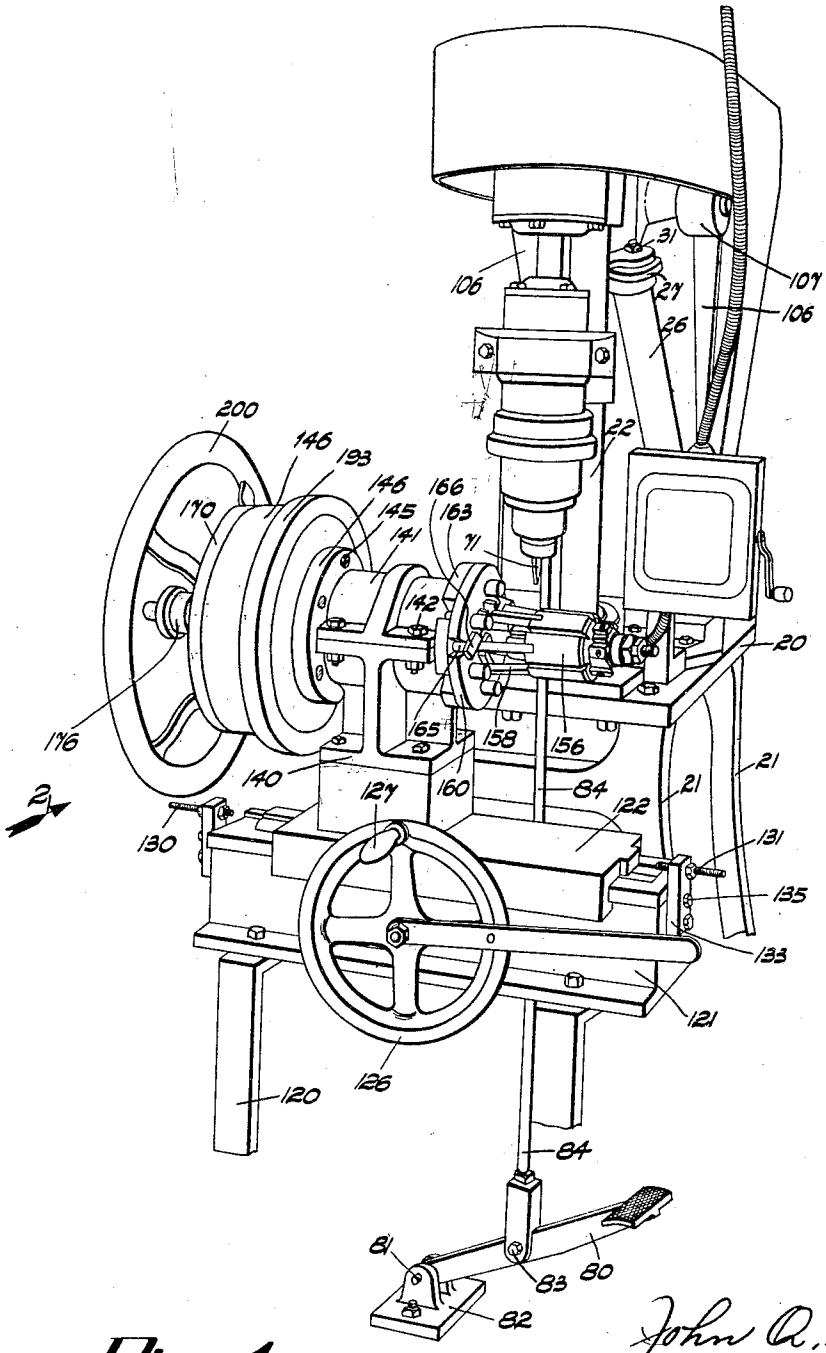


Fig. 1

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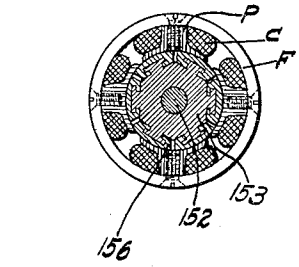


Fig. 2a

Fig. 3

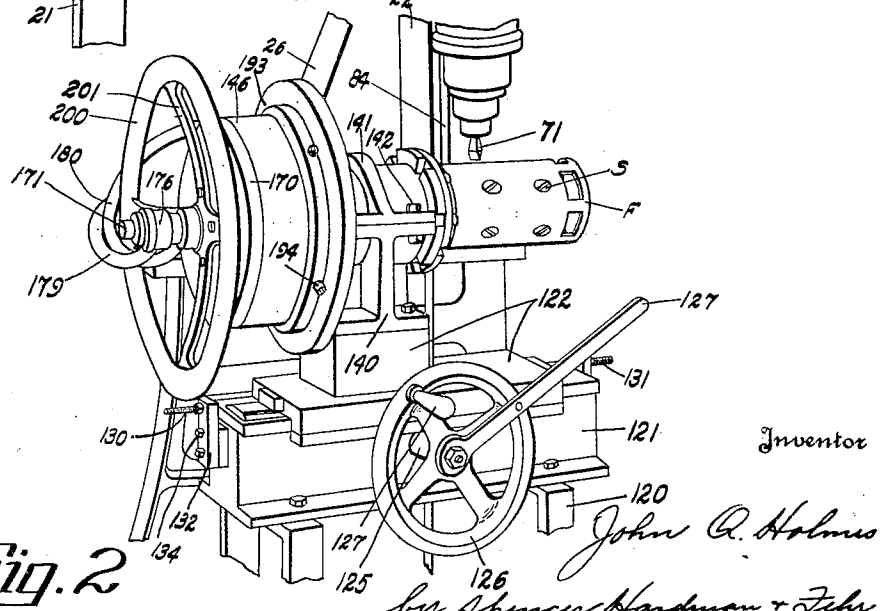


Fig. 2

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POWER SCREW DRIVER

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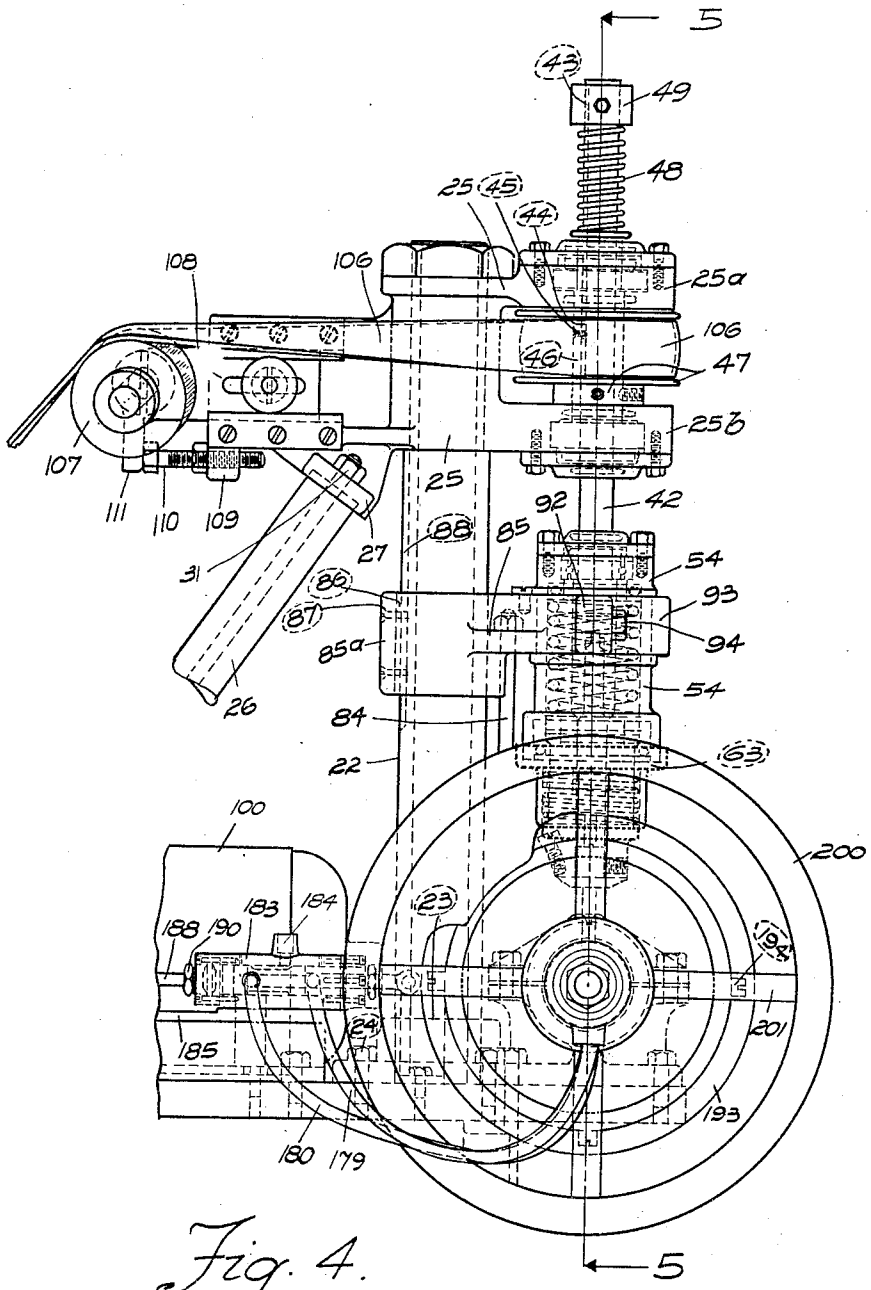


Fig. 4.

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POWER SCREW DRIVER

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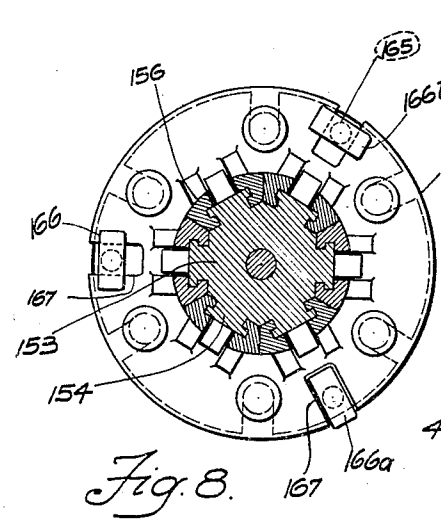


Fig. 8.

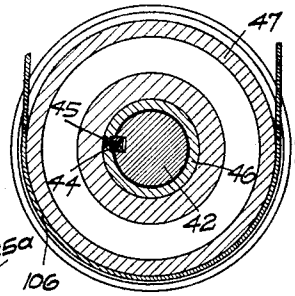
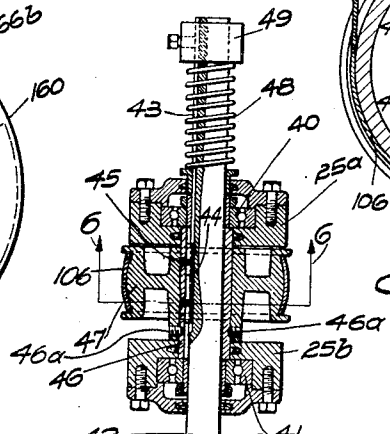
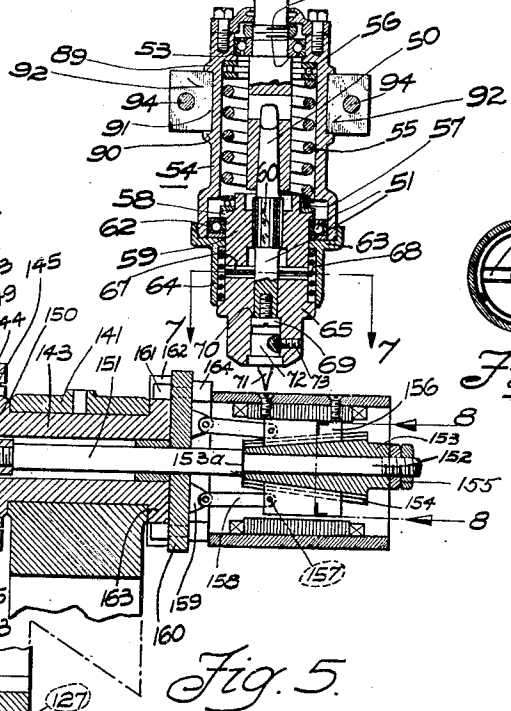


Fig. 6.





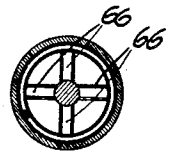
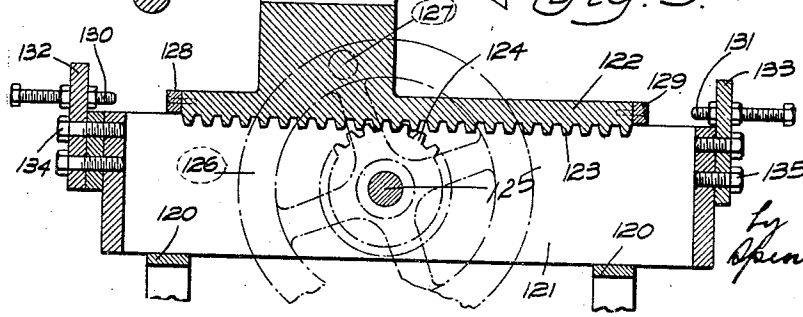


Fig. 7.

Fig. 5.



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POWER SCREW DRIVER

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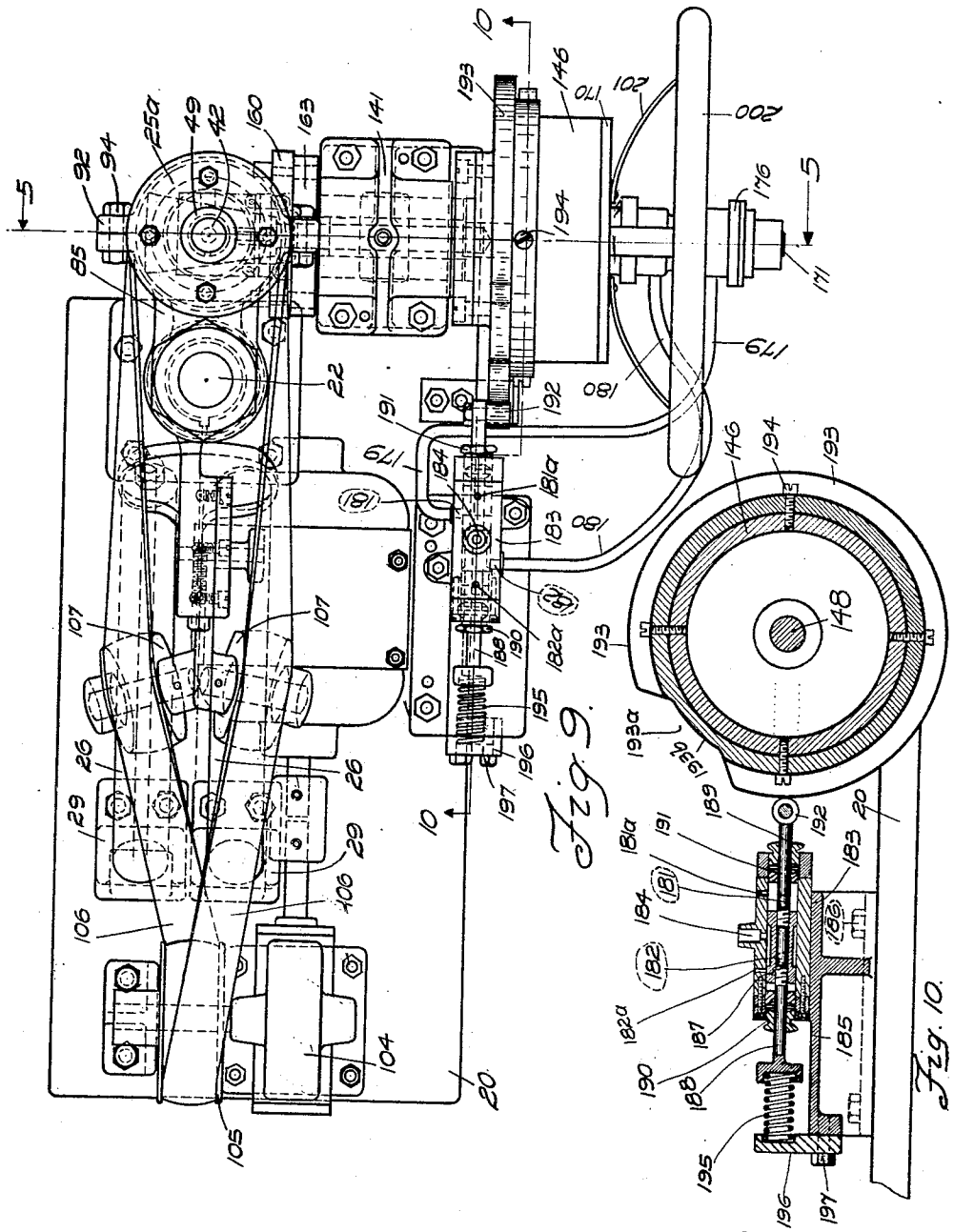


Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE

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POWER SCREW DRIVER

Application filed October 17, 1929. Serial No. 400,425.

This invention relates to power operated screw drivers and the like and more particularly to screw drivers for tightening the screws which are used to attach parts such as pole pieces to the interior cylindrical wall of a tubular body such as the cylindrical field frame of a dynamo electric machine.

One type of power driven screw driver to which the present invention may be applied is described in the patent of Baker and Shaw No. 1,716,365, patented June 11, 1929. This patent discloses a work holder for receiving a dynamo field frame to which screws loosely secure a plurality of pole pieces surrounded by field windings. The work holder includes movable clamping members located within the field frame and movable outwardly to force the pole pieces tightly against the interior of the frame. The work holder is mounted on a turn table which is rotatable coaxially with respect to the field frame so that the various screws which are used to secure the pole pieces to the frame may be located adjacent the screw driver bit. The work holder carries fluid pressure operated means for forcing the clamping members against the pole pieces.

It is one of the objects of the present invention to provide certain improvements in the work holder which may be used with a machine of the kind referred to. More particularly it is an object of the invention to control the fluid pressure operated work clamping devices in response to the turning of the turn table or rotatable work support. The advantage of this feature is to eliminate the manipulation of a valve in addition to the turning of the work support for locating the screws adjacent the screw driver bit. Aside from eliminating an extra movement this invention assures that the work will be securely clamped by the work holder before the screw driver bit is applied.

A further object of the invention is to provide for removability of the work clamping devices that the work holder may receive any one of a series of interchangeable clamping devices adapted respectively to receive work pieces of different dimensions.

Another object of the invention is to provide a work holder, which not only rotates coaxially with the work, but is movable in the direction of the axis of the work. A machine having this feature is adapted to operate upon any screw passing radially through a cylindrical body, and is not limited to tightening screws which are all located in the same annular row.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a fragmentary perspective view of a machine embodying the present invention.

Fig. 2 is a fragmentary perspective view looking in the direction of the arrow 2 of Fig. 1, and showing work mounted upon the work holder.

Fig. 2*a* is an end view of the work which the present machine operates upon.

Figs. 3 and 4 taken together constitute a side view of the machine.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4.

Figs. 6, 7 and 8 are sectional views on the lines 6—6, 7—7 and 8—8 respectively, of Fig. 5; Figs. 6 and 8 being drawn to a larger scale than the other Figs.

Fig. 9 is a plan view of the machine.

Fig. 10 is a sectional view on the line 10—10 of Fig. 9.

Referring to the drawings, a table 20 having legs 21 supports a pedestal 22 attached to the table by a flanged collar 23 and screws 24 and supporting at its upper end a frame 25. The pedestal 22 is braced by inclined tubes 26, the ends of which respectively engage circular bosses 27 and 28 provided by the frame 25 and a bracket 29. The tubes 26 are clamped between the bosses 27 and 28 by bolts 30 and nuts 31. The brackets 29 are secured by screws 32 to the table 20.

The frame 25 includes bearing supports 25*a* and 25*b* which are spaced apart and which support bearings 40 and 41 for a shaft 42 having a longitudinally extending groove 43 for receiving a key 44 attached by screws

45 to a sleeve 46 and this sleeve is attached to a pulley 47 by screws 46*a*. The shaft 42 is therefore connected with the pulley 47 in a manner such that the shaft may move endwise while the pulley remains in position between the supports 25*a* and 25*b* of the frame 25. A spring 48 supported by the portion 25*a* bears against a collar 49 attached to a shaft 42 and tends to maintain the shaft 42 in an upper position.

The lower end of the shaft 42 is provided with a conical socket for receiving the conically tapered end 50 of a rod 51 having a drive fit with the shaft 42. The shaft 42 provides a shoulder 52 which supports a ball bearing 53 in turn supporting a tubular member 54 which encloses a spring 55 having its ends respectively in engagement with ball thrust bearings 56 and 57. The bearing 57 engages an annular flange 58 provided by a clutch member 59 having a driving connection with the rod 51 by longitudinal splines 60 provided by the rod 51. The flange 58 rests upon a ball thrust bearing 62 supported by a cap 63, screw threadedly engaging the lower end of the member 54. The cap 63 is provided with a centrally disposed hole through which the clutch member 59 projects, and with a tubular extension 64 for receiving and guiding a clutch member 65. The member 65 is provided with radially extending grooves 66 for receiving similar ridges 67 provided by the member 59. The clutch member 65 is normally maintained separated from the clutch member 59 by a spring 68 located within the tubular portion 64. Separation of the clutch member 65 from the clutch member 59 is limited by the head of the screw 69 which is threaded into the lower end of the rod 51 and which receives a shoulder 70 provided by the member 65. Clutch member 65 is drivingly connected with a screw driver bit 71 having a shank 72 received by a central recess in the clutch member 65 and attached thereto by a set screw 73.

The shaft 42 is moved vertically by a pedal 80 (see Fig. 1) hinged at 81 upon a bracket 82 attached to the floor and pivotally connected at 83 with a rod 84, which is connected at its upper end as shown in Fig. 4 with a frame 85 having a cylindrical portion 85*a* which slides vertically along the pedestal 22. The frame 85 does not rotate around the pedestal 22 since it is provided with a key 86 secured by screws 87 and having a sliding fit with a longitudinal groove 88 in the pedestal 22. The tubular member 54 shown in Fig. 5 is provided with flanges 89 and 90 defining a groove 91 which receives a semi-cylindrical portion 92 of the frame 85 and a semi-cylindrical cap 93 attached to the portion 92 by screws 94.

The shaft pulley 47 is driven by an electric motor 100 supported by the table 20 and having a shaft 101 connected by a coupling 102 with a shaft 103 of a reduction gear device enclosed by a housing 104 attached to the table 20 and driving a pulley 105. Power is transmitted from the pulley 105 to the pulley 47 by a belt 106 passing over guide pulleys 107 and around the pulley 47 as shown in Figs. 3 and 4. The pulleys 107 are pivotally supported by a frame 108 guided for horizontal sliding movement by the frame 25. Frame 25 provides a lug 109 threadedly engaged by a screw 110, the head of which bears against a lug 111 carried by the frame 108. When the screw 110 is so turned that its head recedes from the lug 109, the frame 108 will be moved toward the left as viewed in Fig. 4 in order to tighten the belt 106.

To the front legs 21 of the table 20 are attached two shelf legs 120 which support a work holder base 121 along which a work holder carriage 122 is slidable. Carriage 122 includes a rack 123 engageable with a gear 124 attached to a shaft 125 which is turned by hand wheel 126 or a lever 127. The carriage 122 carries stop plates 128 and 129 engageable respectively with stop screws 130 and 131 threaded into plates 132 and 133 attached by screws 134 and 135 respectively with the ends of the base 121. The carriage 122 supports a bearing frame 140 which cooperates with a cap 141 attached by bolts 142 to provide a bearing for a tubular work holder shaft 143 having a flange 144 attached by screws 145 to a cylinder 146. Cylinder 146 receives a piston 147 attached to a rod 148 which passes through packing 149 secured by a plate 150 attached to the cylinder 146. The rod 148 is threadedly connected with a rod 151 which passes through the shaft 143 and has a reduced portion 152 which passes through a wedging member 153 having a plurality of extensions 154 which are T-shaped in cross section. The wedging member 153 is clamped against the shoulder 153*a* of the rod 151 by nuts 155. Each T-shaped extension 154 is disposed obliquely with respect to the rod 151 and is received by a similarly disposed T-shaped groove provided by a clamping block 156 which is pivotally connected at 157 with a link 158, pivotally connected with ears 159 integral with a circular plate 160. Plate 160 has studs 161 received by notches 162 in the flange 163 of the shaft 143 whereby the shaft and plate are rotatively connected. Plate 160 is provided with pins 164 which are engaged by the end of a field frame or other tubular body supported by the work holder and which locate the body endwise with respect to the clamping members 156. The plate 160 is attached to the flange 163 by rods 165 pivotally connected with the flange 163 and having oblong heads 166, which when turned in the position 166*a* in Fig. 8 are received by notches 167 provided by the plate 160. When the rods 165 are

turned so that the heads thereof are in the position 166*b* in Fig. 8 the plate 160 will be retained upon the flange 163.

An end plate or cover 170 is attached to the cylinder 146 and supports a rod 171 having a passage 172 communicating with the left hand of the cylinder 146 and having a passage 173 connected by a passage 174 in the cover 170 and by a passage 175 in a side wall of the cylinder 146 with the right hand end of the cylinder. The rod 171 supports a rotatable coupling 176 having passages 177 and 178 in communication respectively with passages 172 and 173 of the rod 171. Passages 177 and 178 are connected by pipes 179 and 180 respectively with ports 181 and 192 respectively of a valve body 183 having also an intake port 184 and vents 181*a* and 182*a*. The body 183 is attached to a bracket 185 secured by screws 186 to the table 20 and receives a valve cylinder 187 attached to rods 188 and 189 which pass respectively through stuffing boxes 190 and 191. The rod 189 carries a roller 192 bearing against a cam 193 attached by screws 194 to the cylinder 146. The roller 192 is urged against the cam 193 by a spring 195 bearing at one end against a plate 196 secured by a screw 197 to the bracket 185, and at the other end against a cup shaped extension of the rod 188.

The cylinder 146 is rotated by hand wheel 200 having its spokes 201 attached to the cylinder cover 170.

The work operated upon by this apparatus comprises the frame F and pole pieces P surrounded by field coils C and secured by screws S (see Figs. 2 and 2*a*). Each pole piece P may be secured to the frame by one or more screws depending upon the length of the pole piece. If two screws S for each pole P are required, these screws will be arranged on a line parallel with the axis of the field frame; and the screws of the longitudinal rows of screws will be spaced the same with respect to the ends of the field frame. Therefore, as shown in Fig. 2 there will be two annular rows of screw heads accessible for tightening by the screw driver bit 71.

The field frame and other parts loosely assembled thereon is placed upon the clamping members 156 while they are in contracted position shown in Fig. 1 and Fig. 5. In order that the members 156 may be located in unclamped position the piston 147 must be located adjacent the right end of the cylinder 146. This will occur when the right end of the cylinder is connected with the vent 182*a* of the valve 183 and the left end of the cylinder is connected with a source of fluid pressure, through the pipe 179 leading from the passages 177 and 172 to port 181 then connected with intake 184. This will occur when the cam 193 has been turned so that its notch 193*a* will receive the roller 192 which then bears against the surface 193*b* of the cam.

After the work has been located upon the rotatable work holder as shown in Fig. 2, the hand wheel 200 is turned so as to bring the plane of one of the longitudinal rows of screws into alignment with the axis of the screw driver bit 71. During the turning of the work into this position the cam 193 will have been turned into a position shown in Fig. 10 in which the notch 193*a* has been moved out of alignment with the roller 192 thereby causing the valve 187 to be located so that the port 182 will be placed in communication with the intake 184 whereby the right hand end of the cylinder will be connected with a source of fluid pressure. This will cause the piston to move from the position shown in Fig. 5 toward the left in order to move the wedging member 153 toward the left and the clamping members 156 outwardly to force the pole pieces firmly against the field shell F and to retain the work upon the clamping members.

The handle 127 is turned so that the vertical plane of an annular row of screws is in alignment with the screw driver axis. Then the bit 71 which is normally rotatively disconnected from the power shaft is inserted in a slot in a screw head and power is applied to the bit by depressing the pedal 80 which causes the shaft 42 to descend carrying the bit 71 with it. When the bit 71 bottoms in the slot of a screw head, downward motion of the driven clutch member 65 is stopped, but further movement of the pedal downwardly causes further downward movement of the shaft 42 and driving clutch member 59 which is caused to engage the driven clutch member 65 through the yielding action of a spring 55. The spring 68, which operates normally to maintain the clutch member 65 separated from the clutch member 59, yields to permit the clutch members 59 and 65 to engage. When the clutch members 59 and 65 are brought together the ridges 67 of the former will be received by the grooves 66 of the latter and motion will be transmitted from the shaft 42 to the bit 71, thereby causing the screws S to be tightened. When the screw S has been driven home the clutch 65 will cease rotating and the clutch member 59 will slip upwardly over the clutch member 65 due to the fact that the clutch members are only yieldingly held together by the spring 55 which permits the clutch member 59 to move upwardly along the splines 60 of rod 51 so that its ridges 67 may slip out of the notches 66.

While the clutch members 59 and 65 are engaged to drive the bit 71, the lost motion between the bit holder 72 and the stop screw 69 is taken up. Therefore while the operator is pressing the pedal to maintain the bit 71 in engagement with the screw slot, motion is transmitted along the shaft 42 non-

yieldingly to the bit 71. Therefore when tightening a screw, the bit 71 does not jump out of the screw slot when the clutch member 59 jumps up out of engagement with the clutch member 65 due to overload. This feature is advantageous since the screw slot is not injured by the present device when the clutch slips, as it might be in screw tightening devices where the screw driver bit is applied to the screw under yielding pressure.

The hand wheel 200 is turned again to bring the next screw of an annular row vertically below the bit 71 and the pedal 80 is pressed in order that the bit 71 will operate upon a second screw. These operations are repeated until all of the screws in an annular row have been tightened. Then the wheel 200 is turned in the same direction until the notch 193*a* will be located adjacent the roller 192. When this occurs the spring 195 will be released to cause the valve 187 to move toward the right in Fig. 10 in order to connect the port 182 with the vent 182*a* and the port 181 with the intake 184. Consequently, the left hand of the cylinder will be connected with a source of fluid pressure and the right hand end with atmosphere thereby causing the wedging member 153 to move into non-clamping position so as to permit ready removal of the work.

If there is an additional row of screws to be tightened the work is not removed at this time, but the wheel 200 is rotated so as to effect the clamping movement of the member 153 in the manner described. Then the handle 127 may be turned in order to bring the plane of another annular row of screw heads vertically under the screw driver bit. This additional annular row of screws is tightened by manipulations of the hand wheel and pedal as described before.

When it is desired to remove a clamping device from the work holder shaft 143 in order that another of different dimensions may be provided in order to receive work differing in dimensions from that previously operated upon, the nuts 155 are removed from the rod 152, and the rod or pins 165 are turned so that their heads are in the position 166*a* registering with the notches 177 of the plate 160. This permits withdrawal of the plate 160 and parts attached thereto from the flange 163 of the shaft 143 and the wedging member 153 from the rod 152.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A work holder embodying a chuck, means for rotatably mounting said work-holder so that it may be turned to different degrees of angular adjustment about the axis of the chuck so that portions of the periphery of the chuck may be brought into or out of alignment with the radial operative range of a working tool, and means caused to operate by said angular adjustment to open or close the chuck.

2. A work holder embodying a rotatable chuck having radially movable work gripping members, means for rotatably supporting the chuck so that it may be turned to different degrees of angular adjustment about the axis of the chuck so that portions of the periphery of the chuck may be brought into or out of alignment with the radial operative range of a working tool, a member movable axially with respect to the chuck mounting means for effecting radial movement of the work gripping members of the chuck, a cam operatively connected with the chuck mounting means and means caused to operate by said cam for effecting the movement of said axially movable member.

3. A work holder embodying a rotatable chuck having radially movable work gripping members, an axially movable wedge member cooperating with said radially movable members for effecting radial movement thereof in response to axial movement of the wedge, means for rotatably supporting said chuck and wedge member so that the chuck may be turned to different degrees of angular adjustment about the axis of the chuck so that portions of the periphery of the chuck may be brought into or out of alignment with the radial operative range of a working tool, a fluid pressure cylinder carried by the chuck mounting means coaxially with respect to the chuck, a piston within said cylinder operatively connected with said wedge, a cam carried by said chuck mounting means, and a valve mechanism operated by said cam for controlling the flow of pressure fluid to said cylinder for the purpose of operating the chuck.

In testimony whereof I hereto affix my signature.

JOHN Q. HOLMES.