P. J. LINCOLN.

ELECTRIC DRILL.

APPLICATION FILED NOV. 18, 1908.

942,396.

Patented Dec. 7, 1909.

3 SHEETS—SHEET 1

Fig. 1.

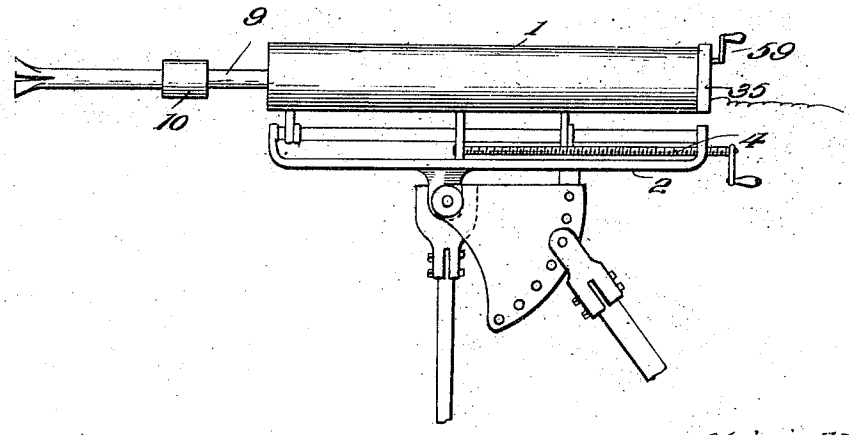

Fig. 10.

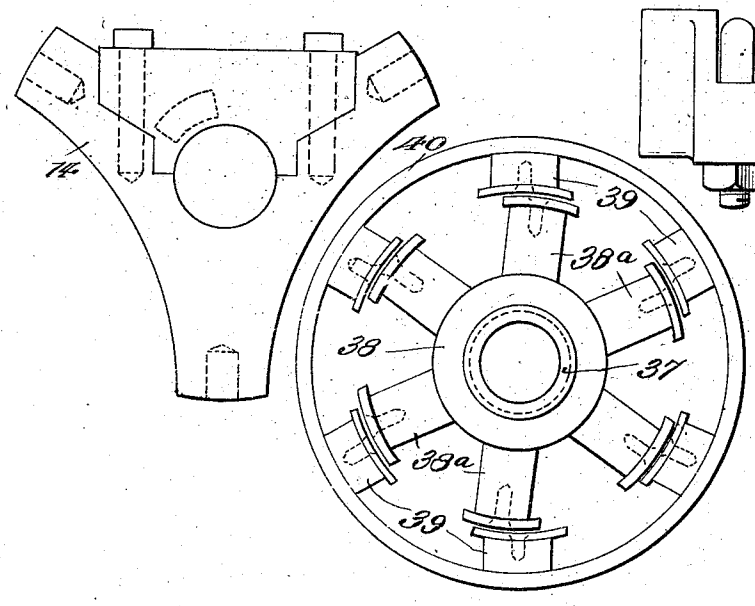

Fig. 11.

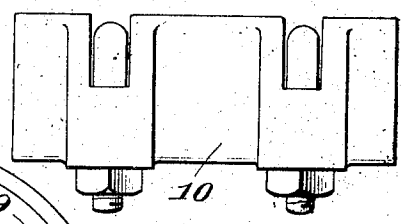

Fig. 6.

Witnesses

Inventor

P. J. Lincoln.

By

Attorneys

P. J. LINCOLN.

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3 SHEETS—SHEET 2.

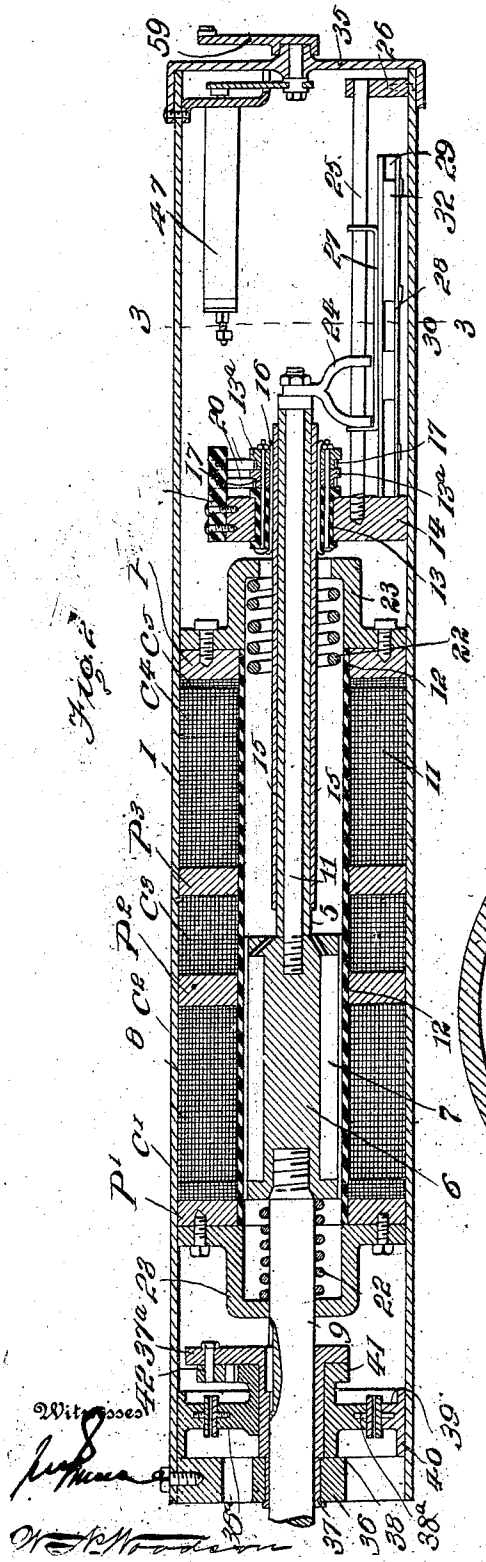

Fig. 2.

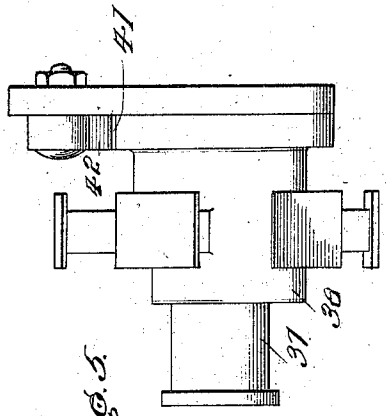

Fig. 4.

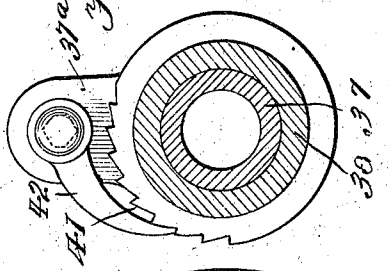

Fig. 5.

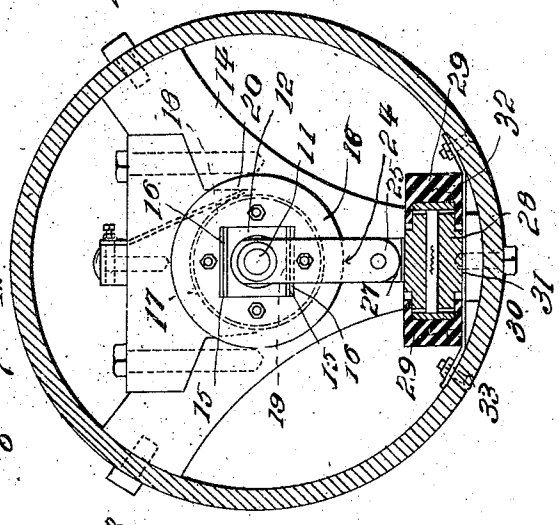

Fig. 3.

Witnesses

Inventor

P. J. Lincoln,

By Hoadley, Attorneys

P. J. LINCOLN.

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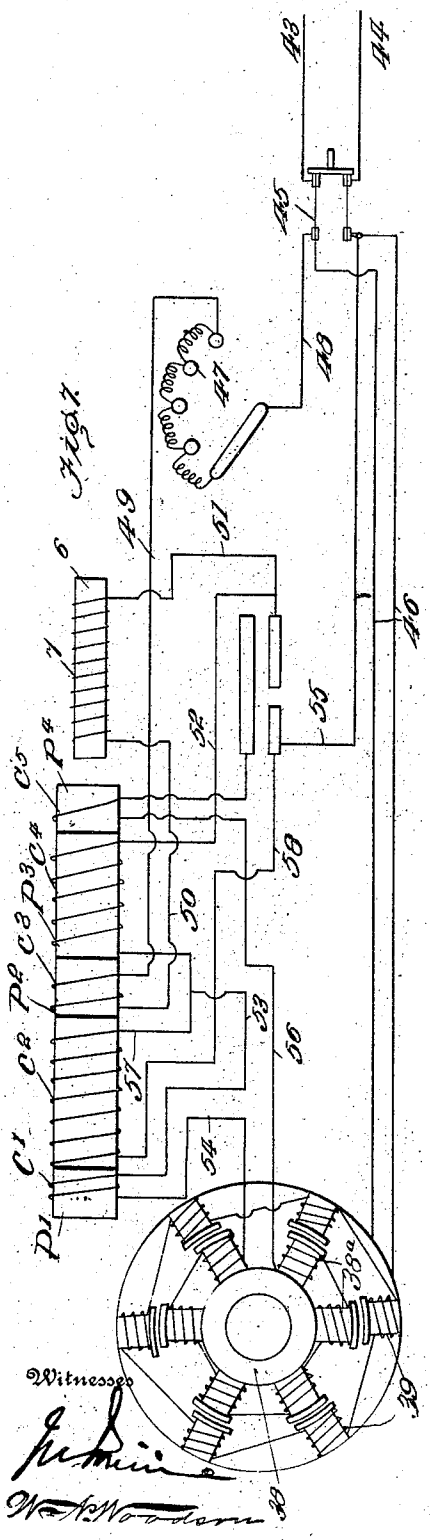
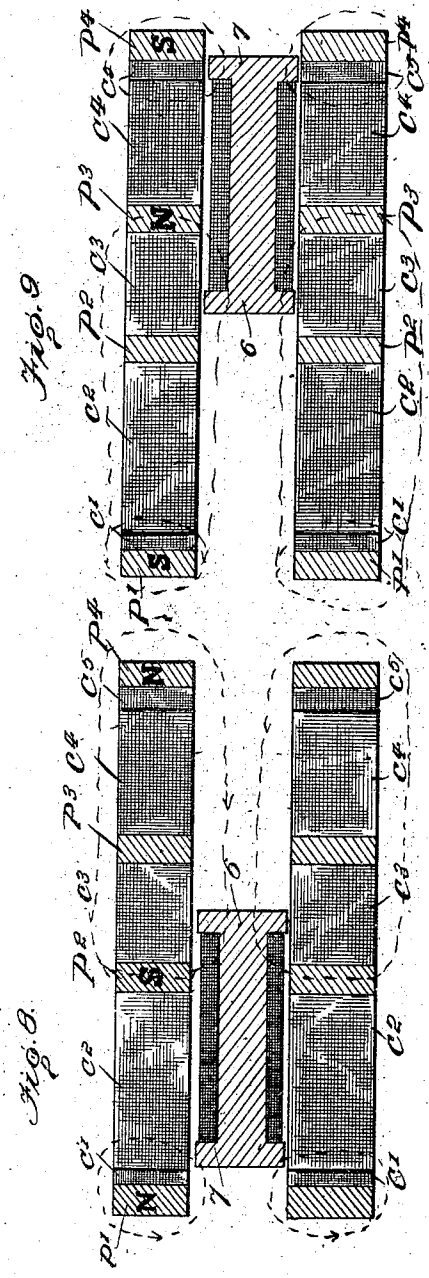
APPLICATION FILED NOV. 16, 1908.

942,396.

Patented Dec. 7, 1909.

3 SHEETS—SHEET 3.





Inventor

P. J. Lincoln.

By Howson & Sayre, Attorneys

UNITED STATES PATENT OFFICE.

PURD J. LINCOLN, OF BIRMINGHAM, ALABAMA.

ELECTRIC DRILL.

942,396. Specification of Letters Patent. Patented Dec. 7, 1909.

Application filed November 18, 1908. Serial No. 463,239.

To all whom it may concern:

Be it known that I, PURD J. LINCOLN, a citizen of the United States, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Electric Drills, of which the following is a specification.

The present invention relates to improvements in drills such as are employed for forming holes in stone, coal, marble, and the like, and the object of the invention is the provision of a drill of this character embodying novel electrically operated means for reciprocating and turning the bit.

The invention further contemplates a rock drill which is compact and durable in its construction so as to be readily carried from place to place, and which can be quickly set up in an operative position.

For a full understanding of the invention and the merits thereof and also to acquire a knowledge of the details of construction and the means for effecting the result, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a side elevation of an electric drill embodying the invention, Fig. 2 is an enlarged longitudinal sectional view through the drill, Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 2, Fig. 4 is a side elevation of the armature for turning the drill and the bushing upon which the armature is mounted, Fig. 5 is a sectional view on the line 5—5 of Fig. 4, Fig. 6 is a side elevation of the drill rotating device, Fig. 7 is a diagrammatic view showing the manner in which the drill is wired, Fig. 8 is a diagrammatic view showing the field when the reciprocating armature is at one limit of its movement, Fig. 9 is a similar view showing the field when the reciprocating armature is at the opposite limit of its movement, Fig. 10 is a detail view of one of the bearings within the casing, and, Fig. 11 is a detail view of the coupling for attaching the drill bit to the drill rod.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Specifically describing the present embodiment of the invention, the numeral 1 designates the casing within which the drill operating mechanism is mounted, the said casing having a tubular formation and being constructed of steel or other suitable material adapted to form a path for a magnetic field. This casing may be supported in any suitable manner and is shown in the present instance as slidably mounted upon the head 2 of a tripod 3, a screw 4 being provided for moving the casing upon the head to feed the drill as required. Arranged within the casing 1 at an intermediate point in the length thereof, are the field coils c^1, c^2, c^3, c^4, and c^5 which are wound upon a brass tube 5. A series of collars of wrought iron or similar material which constitute the poles of the field magnets, are fitted upon the brass tube 5 for holding the field coils in position, one of these pole pieces p^1 being located at one end of the field coils adjacent the coil c^1, a second pole piece p^2 being located between the coils c^2, and c^3, a third pole piece p^3 being located between the coils c^3 and c^4, while a fourth pole piece p^4 is located at the opposite end of the field adjacent the coil c^5.

Mounted to reciprocate longitudinally within the tube 5 of the field is an armature 6 which is wound with a coil 7. Fitted around this coil is a bronze sleeve 8 the ends of which are soldered or otherwise rigidly connected to the poles of the armature. A brass drill rod 9 is connected to one end of the armature 6 and extends through one end of the casing, the extremity of the rod being designed to have the drill bit secured thereto by any suitable means such as by the coupler 10. Projecting from the opposite end of the armature and rigidly connected thereto, is a slide operating rod 11 which extends beyond the end of the brass tube 5 of the field and is surrounded by a sleeve 12 of fiber or other insulating material. This sleeve is square in cross section and passes loosely through a hub 13 which is also formed of insulating material and is journaled within a bearing 14. It will thus be obvious that the hub will turn with the rod 11 but will permit the rod to slide freely through the same. Strips 15 of copper or other conducting material, are secured to opposite faces of the square sleeve 12 and have their inner ends connected to the terminals of the armature coil 7. A pair of contact strips 16 are arranged within opposite sides of the opening through the hub 13 and bear frictionally against the strips 15 so as to be in electrical connection therewith. A pair of detachable end sections 13^a are secured to the hub 13 by bolts

or other suitable means and the inner edges of these end sections are rabbeted to provide a pair of annular grooves within which collecting rings 17 are arranged, one of the rings being connected by a wire 18 to one of the contact strips 16 while the opposite collecting ring is connected by a wire 19 to the opposite contact strip 16. These two collecting rings are frictionally engaged by brushes 20 carried by a brush holder 21 which is formed of fiber or other insulating material and is secured to the bearing 14 so as to project laterally therefrom. With this construction it will be apparent that by connecting the brushes 20 to a pair of feed wires, an electric current may be caused to pass continuously through the armature coil as the armature is reciprocated back and forth and rotated about its axis.

Buffer springs 22 which serve to engage the armature as it reaches the opposite limits of its movement, are fitted within housings 23 secured respectively to the pole piece p^1 and the pole piece p^4. These springs form cushions for engaging the armature and take up the shocks and jars which would tend to injure the drill and shorten the life thereof. Loosely connected to the extremity of the slide operating rod 11 so that the rod can rotate within the same, is a slide 24 which is loosely mounted upon a guide rod 25, one end of the guide rod being shown as threaded in the bearing 14 while the opposite end is supported by a bracket 26 projecting inwardly from the casing 1. As the armature approaches the opposite limits of its movement, this slide is designed to engage the arms of a fork 27 upon a brush holder 28. This brush holder is slidably mounted between a pair of channeled insulating bars 29 and provided with a transverse opening within which a pair of brushes or plungers 30 are arranged. These brushes or plungers are in electrical connection with each other and are normally forced outwardly by means of a spring 31 which is interposed between them. Secured within the channeled portion of one of the bars 29, is a long contact strip 32 while a pair of short contact strips 33 and 34 are secured within the channeled portion of the opposite bar 29, the short strips being located directly opposite the end portions of the long strip. When the brush holder has been moved to one limit of its movement, the plungers or brushes 30 produce an electrical connection between the long contact strip 32 and the short contact strip 33, while when the brush holder has been moved to the opposite limit of its movement the plungers produce an electrical connection between the long contact strip 32 and the short contact strip 34.

One end of the tube 5 is closed by a cap 35 while the opposite end is provided with a bearing 36 through which the drill operating rod extends. Surrounding the drill operating rod and journaled within this bearing, is a brass bushing 37 which has a feather and spline connection with the rod so that it rotates with the rod but permits the rod to move longitudinally therethrough. The inner end of the bushing is formed with an outwardly extending flange 37^a and journaled upon the bushing between this flange and the bearing 36, is a rotary armature 38 for actuating the drill turning device, the said armature being formed with a series of radially extending poles 38^a. A field which is disposed about the armature 38 and cooperates therewith, comprises a series of corresponding poles 39 which are carried by a yoke or ring 40 fitted within the casing 1. One end of the armature 38 is formed with a ratchet 41 which is engaged by a pawl 42 upon the flange 37^a of the bushing. The armature is adapted to be alternately rotated in opposite directions and with this pawl and ratchet connection between the armature and drill operating rod it will be obvious that the drill operating rod will be turned with the armature when the armature is revolved in one direction but will not be influenced by the armature when it revolves in the opposite direction. In the present instance both the armature and the field are formed with six poles and the armature is designed to revolve back and forth through an arc of 50 degrees.

By reference to the wiring diagram shown in Fig. 7, it will be observed that the windings of the poles 39 of the drill turning device are in a shunt circuit from the main line, while the windings of the poles 38^a of the armature are in series with the coils of the drill reciprocating device. With this construction, it will be obvious that when the direction of the current flowing through the armature coils is reversed, the polarity of the armature poles will be changed and the armature will revolve until the poles thereof are opposite the next adjacent poles of the field. The positive feed wire is designated by the numeral 43 and the negative feed wire by the numeral 44, the flow of current to the drill being controlled by a switch 45. Wires 46 lead from the opposite terminals of the switch to the field windings of the drill turning device so that when the switch is closed the said field windings are in a shunt circuit. Leading from the positive terminal of the switch to a rheostat 47 which may be of any approved construction and is carried by the cap 35, is a wire 48, and from this rheostat the current flows through a wire 49 to the field coil c^3 of the drill reciprocating device, thence through a wire 50 to the armature coil 7 of the drill reciprocating device. With the armature 6 at the outer limit of its movement so that the brushes 30 of the brush holder 28 pro-

duce an electrical connection between the contact strips 32 and 33, the current will then flow through the wires 51 and 52 to the field coil c^4 and thence through the wire 53 to the field coil c^1, and thence through the wire 54 to the armature windings of the drill turning device. From these armature windings the current passes through a wire 56 to the field coil c^5 and from thence to the contact strip 32 from which it is carried through the brushes to the contact strip 33 which is connected to the negative terminal of the switch by the wire 55. A diagram of the magnetic field thus produced is shown in Fig. 8, and it will be observed that the field coils c^3 and c^4 and c^5 coöperate to produce a single field of which the pole piece p^2 is the south pole and the pole piece p^4 the north pole, the intermediate pole piece p^3 being dead. The field thus produced acts upon the field produced by the armature and tends to draw the armature toward the opposite limit of its movement. In this connection it may be noted that no current passes through the field coil c^2 and that the current passing through the field coil c^1 flows in a reverse direction to that passing through the coils c^3, c^4 and c^5 so that the pole piece p^1 is the north pole. By thus magnetizing these remote pole pieces all danger of the armature field leaking into the outer casing 1 is eliminated.

When the armature has reached the limit of its inner movement, the slide 24 will have engaged the fork 27 and moved the brush holder so that the brushes 30 carried thereby electrically connect the contact strips 32 and 34. The current now passes from the positive terminal of the switch 45 through the rheostat 47, through the wire 49 and the field coil c^3 and through the wire 50 and armature coil 7, as in the previous instance. From the armature coil however, the current passes to the contact strip 34 and through the brushes 30 to the contact strip 32. Thence it flows through the field coil c^5 in a reverse direction to that in which it previously passed through the said coil, and from this coil it flows through the wire 56 to the armature windings of the drill rotating device, also passing through these windings in a reverse direction so as to change the polarity of the armature poles and cause the same to rotate through an arc of 50 degrees as previously described. From these armature coils the current flows through the wire 54 to the field coil c^1 and thence through the wires 53 and 57 to the field coil c^2 from which it passes through the wire 58 to the contact strip 33 and through the wire 55 to the negative pole of the switch. It will be observed that in this instance the field coil c^4 is dead and the current flows through the end coils c^1 and c^5 in an opposite direction to that followed in the previous instance and to that shown in Fig. 9, the coils c^1, c^2, and c^3 coöperate to produce a single field of which the pole piece p^2 is the north pole and the pole piece p^1 the south pole, the pole piece p^2 being dead. It will also be observed that the pole piece p^4 is a south pole, such an arrangement serving as previously mentioned to prevent leakage of the field from the armature. This main field acts upon the field armature to move the armature back to its original position. In this manner the armature is reciprocated back and forth, the brushes 30 and contact strips 32, 33 and 34 forming a switch device for automatically directing the current through the various coils in the required manner. The rheostat 47 is operated by means of a handle 59 at one end of the casing and by turning this handle various amounts of resistance can be introduced into the circuit so as to cause the drill to give either a light or a heavy blow as desired. In this manner the drill will be given the usual reciprocating movement and also rotated about its axis so as to act effectively upon the stone or other material being drilled.

Having thus described the invention, what is claimed as new is:

1. The combination of a central field coil, a field coil on each side of the central field coil, an end field coil for each of the side field coils, an armature mounted to reciprocate within the field coils, a drill operating rod carried by the armature, and means for introducing the central coil and two end coils into an electric circuit alternately in series with the respective side coils to actuate the armature.

2. The combination or a central field coil, a field coil on each side of the central coil, an end field coil for each of the side field coils, poles interposed between the central coil and the side coils and also located at the outer ends of the end coils, an armature mounted to reciprocate within the field coils, a drill operating rod carried by the armature, and means for introducing the central coil and two end coils into an electric circuit alternately in series with the respective side coils.

3. The combination of a casing, a series of field coils within the casing, an armature mounted to reciprocate within the field coils, a coil upon the armature, a rod projecting from the armature, an angular sleeve fitted over the rod, conductor strips applied to the angular sleeve and insulated from each other, the said conductor strips being connected to the terminals of the armature coil, a hub journaled within the casing and formed with an angular opening loosely receiving the before mentioned sleeves, contacts upon the hub for engaging the before mentioned conductor strips, collector rings upon the hub in electrical connection with

the contacts, brushes engaging the collector rings, and a switch mechanism actuated by the rod for introducing selected ones of the field coils alternately into an electric circuit in series with the armature coil.

4. The combination of a casing, a rod, means for reciprocating the rod, a rotatably mounted armature carried by the rod and formed with a plurality of radially projecting poles, a pawl and ratchet connection between the armature and the rod, a field with poles corresponding to the poles of the armature and adapted to coöperate with the armature to turn the same, and means for periodically reversing the polarity of the poles of the armature to cause the same to revolve alternately in opposite directions through a fixed arc.

5. The combination of a series of field coils, an armature mounted to reciprocate within the field coils, a drill operating rod projecting from the armature, feed wires, a rotary armature carried by the rod and provided with armature coils, a field coöperating with the rotary armature and provided with coils in a shunt circuit with the feed wires, and means for introducing selected ones of the field coils alternately into circuit with the feed wires in series with the armature coils.

6. The combination of a series of field coils, an armature mounted to reciprocate within the field coils, a coil upon the reciprocating armature, a drill operating rod projecting from the reciprocating armature, a rotary armature carried by the rod and having an operative connection therewith, the said rotary armature being provided with coils, feed wires, a field coöperating with the rotary armature and provided with coils in a shunt circuit with the feed wires, and a switch mechanism actuated by the reciprocating armature for introducing selected ones of the field coils alternately into circuit with the feed wires in series with the coils of the reciprocating armature and the coils of the rotary armature.

In testimony whereof I affix my signature in presence of two witnesses.

PURD J. LINCOLN. [L. S.]

Witnesses:
WILLIAM A. PARSONS,
FRANK G. WERTZ.