(No Model.) 2 Sheets—Sheet 1.

H. N. MARVIN.

ELECTRIC ROCK DRILL.

No. 368,405. Patented Aug. 16, 1887.

Fig. 1.

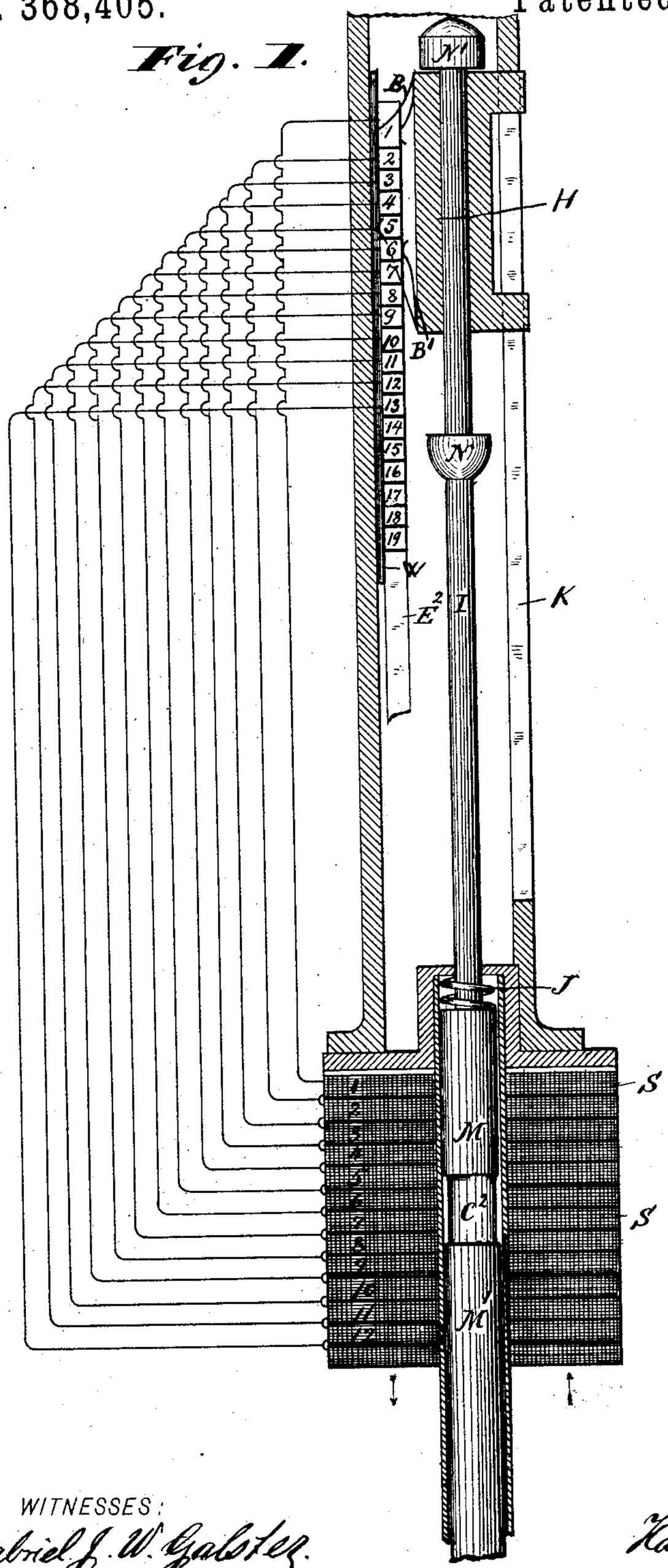
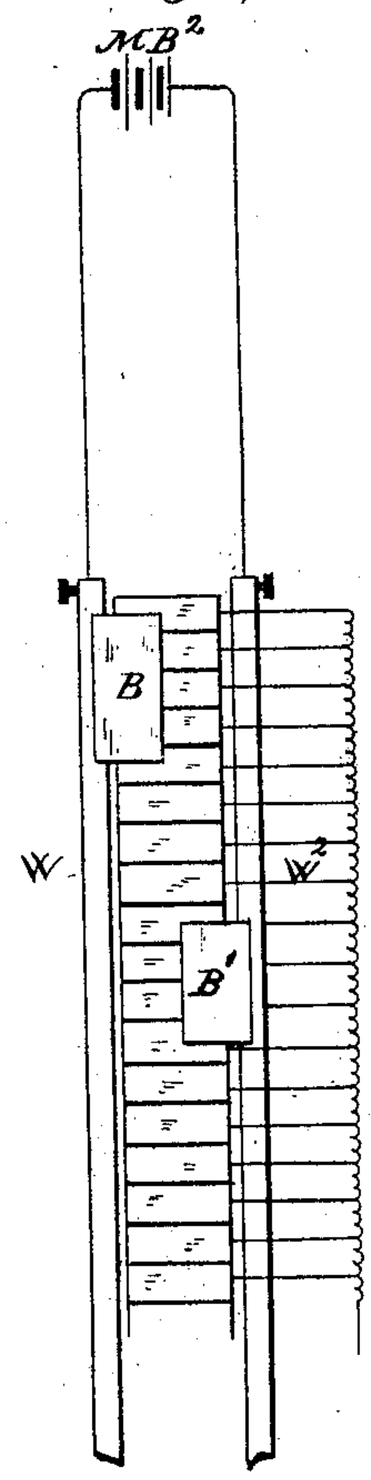


Fig. 2.



WITNESSES:
Gabriel J. W. Gabler.
Wm. H. Capel

INVENTOR
Harry N. Marvin
BY
Timmons & MacArthur
ATTORNEYS

(No Model.) 2 Sheets—Sheet 2.

H. N. MARVIN.

ELECTRIC ROCK DRILL.

No. 368,405. Patented Aug. 16, 1887.

Fig. 3.

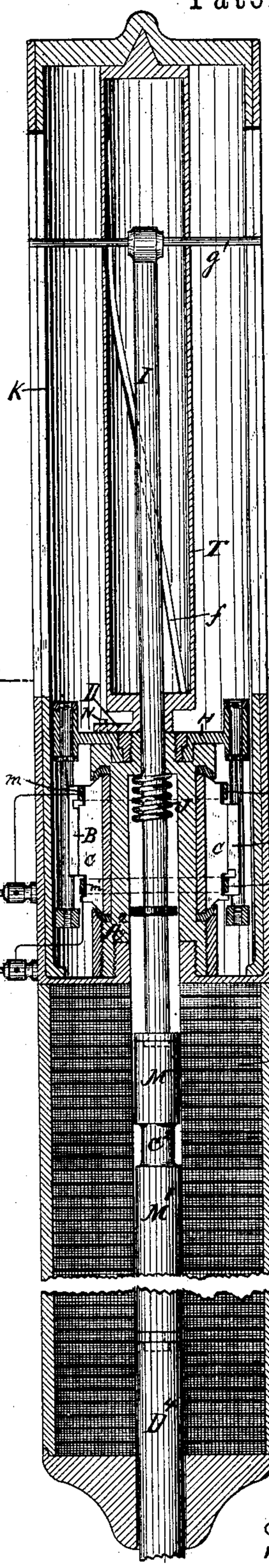


Fig. 4.

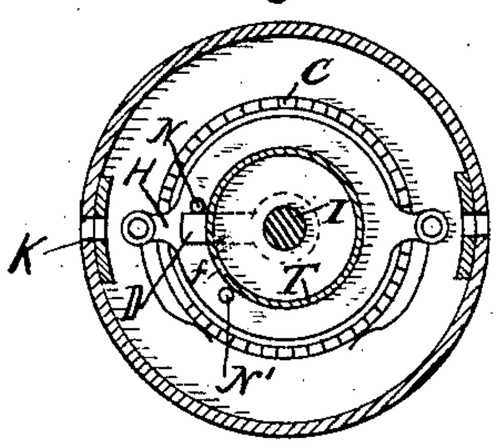


Fig. 5.

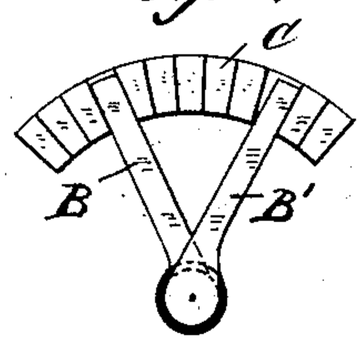
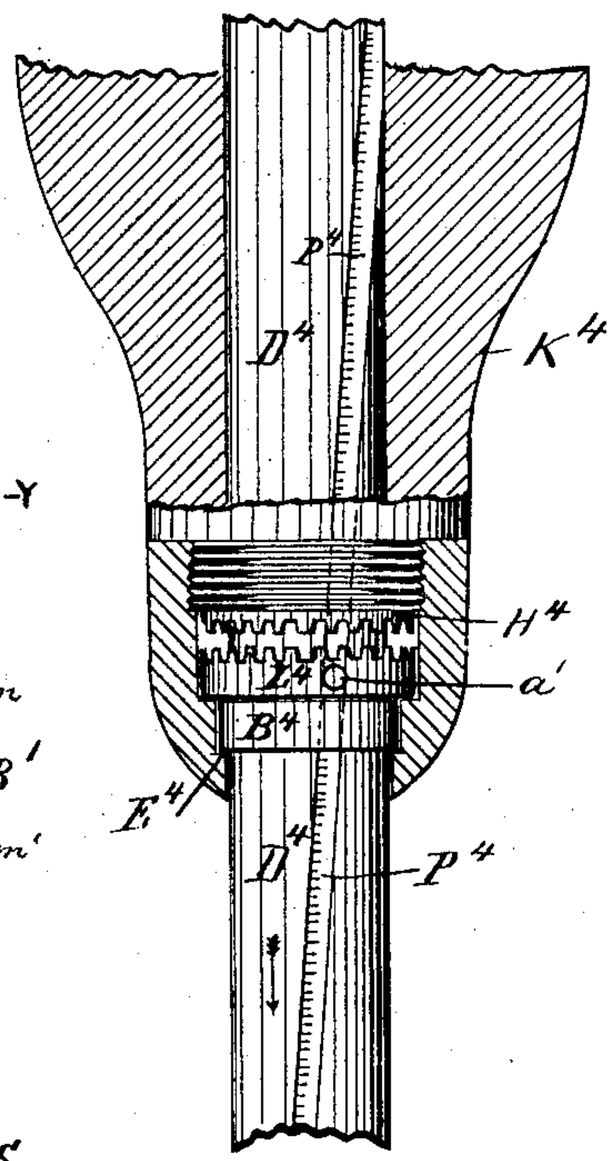


Fig. 6



WITNESSES:
Gabriel J. W. Galster.
Wm. J. Thorpel

INVENTOR
Harry N. Marvin
BY
Townsend & MacArthur
ATTORNEYS

UNITED STATES PATENT OFFICE.

HARRY NORTON MARVIN, OF SYRACUSE, NEW YORK.

ELECTRIC ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 368,405, dated August 16, 1887.

Application filed January 28, 1887. Serial No. 225,744. (No model.)

To all whom it may concern:

Be it known that I, HARRY NORTON MARVIN, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Electric Rock-Drill, of which the following is a specification.

My invention relates to apparatus in which a reciprocating movement is obtained by electro-magnetism, and is designed more particularly with reference to reciprocating tools, such as rock-drills, dental pluggers, hammers, &c., in which the tool is connected with a reciprocating core or cores of an electro-magnet.

My invention consists, first, in the combination, with two or more magnet-cores, of a series of coils and a commutator suitably constructed to shift the current in the coils progressively, so as to keep an active magnetic field constantly in advance of a core, and at or near the end of the stroke to change the current to a set of coils in proper relation to the other core to draw the same in the opposite direction, the continued reverse movement of the latter being kept up by a progressive shifting of the current in preferably the same series of coils that is employed in moving the first-named coil.

My invention consists, further, in the combination, with a reciprocating magnetic core and a series of coils, of a circular commutator having its plane preferably transverse to the line of movement of the core and preferably arranged with its center practically coincident with the line of movement of the core.

My invention consists, also, in the combination, with a reciprocating core, of a set of coils connected in a continuous series, a series of commutator plates or contacts connected to the junctions of the coils, and two commutator springs or contacts actuated by the core and in constant connection, respectively, with the opposite poles of the generator.

My invention consists, further, in certain details of construction and combinations of parts, that will first be described in connection with the accompanying drawings, and then specifically stated in the claims.

Referring to the drawings, Figure 1 is a vertical section of the upper portion of an electro-magnetic drill constructed in accordance with my invention. Fig. 2 is a plan of the commutator devices. Fig. 3 is a vertical section of an improved form of apparatus in which the commutator is a circular commutator and is operated by suitable connections with the reciprocating core, as will be presently described. Fig. 4 is a plan of a portion of the commutator shown in Fig. 3. Fig. 5 shows a modified construction of commutator. Fig. 6 is a vertical section of the lower portion of the apparatus, and illustrates the mechanism for turning the drill-rod.

Referring to Fig. 1, M indicates a core of soft iron, and M′ a second core, which may, if desired, constitute the upper end of the drill-rod, while S indicates a set of coils thrown into and out of action to effect a movement of the core or cores, as will be presently described.

C^2 indicates a rod or connection of brass or other non-magnetic material connecting the two cores.

In the position of the parts shown it is apparent that if coils 1 to 5 convey current, the core M will be moved downward, and will continue to move so long as coils are thrown successively into action ahead of the core and are thrown out of action at the rear of the set by which the movement is effected. In this operation the core M′ is unaffected, since the set of coils at any time in action are too far above it to produce any active effect. If, now, the movement of the system ceases and the current is shifted to a set of coils which shall be in proper relation to the core M′ to exert an upward pull on the same, and shall not at the same time pull downward on the core M, it is obvious that a reverse movement will take place and will be continued so long as the coils are put into and out of circuit in proper manner to keep the core under the influence of a set of coils above it. Thus, for instance, when the system comes to a rest in its downward movement, the shifting of the current to a set of coils which shall bear the same relation to the core M′ that the coils 6, 7, 8, 9, and 10 bear in the position of the parts shown in the drawings, M′ will immediately be drawn upward and will continue to move upward as coils are thrown into circuit above it and are thrown out of circuit, so as to keep substantially the

same number of coils in action, the set of coils acting being, however, at all times in proper position to draw the core M′ upward.

I will now proceed to describe a commutator and arrangement of circuits whereby the desired shifting of current may be effected and an actuating magnetic field advancing ahead of the core may be maintained.

Connected to the reciprocating cores, or to a part moving therewith, is a rod, I, bearing a block, H, preferably of insulating material, which has a limited free movement on the rod between two stops, N N′. The block H fits somewhat tightly on the rod, so that it will maintain the position shown during the downward stroke, but will, on sudden cessation of movement of the rod I, move on said rod down to stop N. Extensions from the block move in a guideway in the frame K. The block H carries two springs or sets of springs, B B′, which are suitably insulated from one another, but bear upon a set of commutator strips or plates, E^2, at points sufficiently far apart to include between them a number of the blocks or plates corresponding to the number of coils S to be maintained in action. The coils S are connected to one another in series, after the manner indicated in Fig. 2, and their terminals are connected to the terminal blocks of the set of commutator-plates E^2, while the intermediate blocks or plates are connected in succession to the circuit of the coils at points joining the coil-sections. The two commutator-springs B B′ are kept in continuous connection with any suitable source of electricity, M^2B^2, by means of continuous strips, plates, or rods W W^2, upon which a portion of the brushes or supplemental brushes electrically connected with them constantly bear. The commutator-plates E^2 are mounted in the frame in any suitable manner and kept insulated from one another, as is well understood in the art, and the continuous strips or rods W W^2 are also properly mounted on the frame and insulated therefrom in any suitable way. Suitable binding-posts may be attached for the connection of the wires leading from the source of electricity.

When the parts are in the position shown in Fig. 1, and the electric current is allowed to pass to the brushes B B′, the coils 1, 2, 3, 4, and 5 will act on core M, drawing the same down, and as said core moves down, carrying with it the block H, coils 6 will come into action, and at the same time coil 1 will be thrown out of action. In the same way coils 7 8 9 10, &c., come successively into action, while coils 2 3 4 5, &c., are successively thrown out of action, thus producing a continuously-advancing magnetic field ahead of the core and moving at the same speed therewith. The movement of the core M continues until the tool strikes an object, when the momentum of the block H carries it down to contact with stop N, thus shifting the current to a set of coils which will act on the core M′, drawing the same upward. The movement continues upward in obvious manner through the successive transfer of the current, in the manner already explained, until the connected cores strike the spring stop or cushion J, when the block H, by its acquired momentum, automatically shifts itself to the position shown in Fig. 1, and the movement is thereupon repeated.

The drill may be turned at each complete movement by the devices shown in Fig. 6, to be presently described.

I prefer to use a commutator of substantially circular form, on account of the increased simplicity and compactness. The reciprocation of the brushes or other portion of such commutator is preferably in a circular line whose plane is transverse to the movement of the cores, but might be in any other plane.

In Fig. 3 a construction whereby a circular commutator disposed transversely to the line of movement of the cores may be operated is shown. The commutator-blocks C are mounted on the frame-work and are arranged in the form of a cylinder, being suitably insulated from one another, as is well understood by electricians. The form of commutator herein shown is substantially the same as is frequently employed with some forms of dynamo-electric machines. The commutator-blocks are mounted on a suitable hub, A^2, and over them move brushes B B′, properly secured in clamps or holders carried by a rocker bar or frame, H, which in turn is secured to a hub or sleeve encircling the hub A^2. The current is conveyed to the brushes through the bands or hoops *m m′*, which are applied to the surface of the cylindrical commutator, the latter being preferably turned down, as indicated, and the hoops being insulated from the plates C by an interposed band of insulating material. The brushes B B′ are slit or made in two parts, as indicated, one part bearing on a ring or hoop and the other upon the series of commutator-plates. The plates or blocks C are connected to the coils S in substantially the manner already explained.

The plate H is reciprocated by means of an arm, D, which plays between the stops N N′, secured to the plate. The arm D projects from a tube or frame, T, mounted in proper bearings and having an inclined guide or slot, *f*, (one or more,) with which an arm or arms, *g*, carried by the rod I, engage. The arm *g* and rod I are prevented from turning through the engagement of the arms with the guide-slots in the frame K, so that, as will be obvious, the up-and-down movement of the cores and rod I will impart a rotary reciprocating movement to the frame or tube T and the connected rod or arm D. As the cores move down, the arm D, turning in the direction of the arrow, Fig. 4, engages with pin N, and moves the plate H and connected commutator-brushes, thus producing the proper shifting of the current in the set or series of coils S to continue the movement downward. When the cores come to rest, however, the acquired momentum of the arm or plate H carries it around still far-

ther, thus shifting the current to a set of coils still farther down, which will pull upward on the core M'. The movement of the plate H in producing this shift of the current is stopped by engagement of the pin N' with the arm D, and the reverse movement of the latter, which now takes place under the upward movement of the parts, carries the plate H in the opposite direction, thus causing a continuous shifting of current in the coils to progress upwardly, and causing the core M' to move upward until the tool and cores are brought to rest by the stop J, when the acquired momentum of the plate H causes it to continue its own movement until it is brought to rest by the stop N engaging with the arm D. This continued movement of plate H and its connected contact-brushes B B' or springs shifts the current upwardly through the coils to a set of the latter, which will pull downward on the core M, and the movement is then repeated.

It is obvious that the brushes B, instead of moving over the periphery of the commutator-cylinder, may move over the face of a plate carrying a series of commutator-blocks, as indicated in Fig. 5.

Other constructions of circular or cylindrical commutator might obviously be employed without departing from the invention.

The means for rotating the drill-rod is shown in Fig. 6. D^4 indicates the drill-rod, which is swiveled to the magnet-core M', or to an extension from the same, as indicated in Fig. 3, and K^4 indicates the head or lower part of the frame of the drill. L^4 indicates a collar, within which the rod D^4 is adapted to rotate, and H^4 indicates an abutment on the frame K. The abutment serves to limit the upward movement of the sleeve L^4 and to hold the latter firmly from rotation, the engaging surfaces or portions of the collar and abutment being suitably toothed, roughened, or otherwise formed for this purpose. When the collar is thus held from rotation and the drill is raised, the latter is caused to turn by means of the inclined guide or groove P^4 in the rod and the pin or projection a^4, which is carried by the sleeve and engages with the groove. The sleeve L^4 is frictionally supported by the rod, so that the latter may raise the sleeve to engagement with the abutment, and may be moved downward independently of the sleeve when the latter, in moving downward out of engagement, is stopped by a suitable abutment that limits its downward movement. For the purpose of thus supporting the sleeve I prefer to employ a separate sleeve, B^4, upon which sleeve L^4 rests freely and which itself engages frictionally with the rod. The latter sleeve may consist of some spring material, such as a clock-spring, which springs upon the rod D^4 with sufficient force to sustain the weight of the collar L^4. The abutment E^4, formed on the frame, limits the downward movement of the two sleeves. When the sleeve B^4, being carried down by the rod, engages with the abutment E^4, the rod slides through it with a little friction. When the rod is moving downward, the parts being in the position shown, the pin a^4 will follow the guide and the collar L^4 will turn freely on the rod. When the motion of D^4 is reversed, the collar B^4 rises, lifting L^4 against the abutment H^4. The sleeve being then prevented from rotating, the rod must rotate. Thus at each stroke the drill is rotated a little on the upward movement, but on the downward stroke the rod is perfectly free. Therefore should the drill strike a seam or "dodge" there would be no undue strain upon the turning devices—such as might occur were the devices connected with the rod at that time.

What I claim as my invention is—

1. The combination, with the reciprocating magnetic core, of a circular or cylindrical commutator whose plane of rotation is transverse to the line of reciprocation of the core, and connections between said core and commutator, as and for the purpose described.

2. The combination, with a reciprocating magnetic core and its sectional actuating-coil, of a circular or cylindrical commutator concentric with the coils, as and for the purpose described.

3. The combination, with the two reciprocating connected cores, of a series of actuating-coils and a commutator having limited free movement independently of the cores, whereby the current may be shifted from a set of coils acting on one core to a set of coils acting in the opposite direction on the other core.

4. The combination, with the two reciprocating connected cores, of actuating-coils connected in series, a series of contacts connected to the junctions of the coils, two insulated commutator-brushes, and mechanical connections between the brushes and cores adapted to permit a movement of the brushes independently of the cores at the end of a stroke.

5. The combination, with a series of commutator strips or blocks and the brush for forming connection successively with the same, of a continuous conducting-strip applied to the surfaces of said blocks, but insulated from the same, as and for the purpose described.

6. The combination of the series of commutator-plates connected to the junctions of a series of coils, a continuous conducting-strip applied to the series of plates, and a commutator-brush bearing simultaneously on the strip and plates, as and for the purpose described.

7. The combination, with the cylindrical commutator, of the continuous conducting-band applied thereto in the same plane with the commutator-blocks and the brush or brushes bearing on blocks and strip, as and for the purpose described.

8. The combination, with the two reciprocating cores, of a series of coils thrown progressively into and out of action as the cores move in one direction, and a commutator movable with the cores for automatically shifting the current at the end of a stroke from

that portion of the series of coils acting upon one core to a portion of the series which will act in the opposite direction on the other core, as and for the purpose described.

9. The combination, with a series of coils, of a core, a circular commutator, a curved or inclined guide, and a pin or rod engaging with the same, whereby the rectilinear movement of the core may rotate the movable portion of the commutator in a plane transverse to the line of movement of the core.

10. The combination, substantially as described, of a series of coils, a core actuated thereby, a cylindrical or circular commutator, and a rod extending from the core through the axis of the commutator, and mechanism for imparting a circular movement to the commutator-brushes, as and for the purpose described.

11. The combination, with the reciprocating core and a series of coils for actuating the same, of a circular commutator, a brush-supporting plate, H, two pins or stops, N N′, carried thereby, and an arm, D, arranged between said stops and connected with a frame or support which is rotated by the reciprocating core.

12. The combination, with a movable core and a series of coils actuating the same, of a circular or cylindrical commutator having a series of plates or segments connected to the points of junction of the coils, a brush holder or support, a rotating frame, T, and a connected arm playing between the stops or projections, as and for the purpose described.

13. The combination, with the drill-rod, of a sleeve frictionally supported thereon, a fixed abutment above the sleeve for holding the same from rotation during backward movement of the rod, and an inclined guide upon the drill-rod upon which the sleeve engages, as and for the purpose described.

14. The combination, with the drill-rod, of the sleeve frictionally supported thereon and having a limited play between two stops or abutments, one of which is above the sleeve and when engaged by the sleeve holds the same from rotation, an inclined guide on the rod, and a pin or projection on the sleeve engaging with said guide, as and for the purpose described.

15. The combination, with the drill-rod, of the sleeve L^4, capable of rotating freely thereon, an inclined guide on the rod engaged by a pin on the sleeve, a supporting-sleeve, B^4, having sufficient friction on the rod to permit the latter to raise the sleeve L^4, a stop for limiting the downward movement of sleeve B^4, and an abutment for holding the sleeve L^4 from rotation when the latter is lifted by the rod, as and for the purpose described.

Signed at Syracuse, in the county of Onondaga and State of New York, this 25th day of January, A. D. 1887.

HARRY NORTON MARVIN.

Witnesses:
ARTHUR H. SHELDON,
DEFOREST SETTLE.