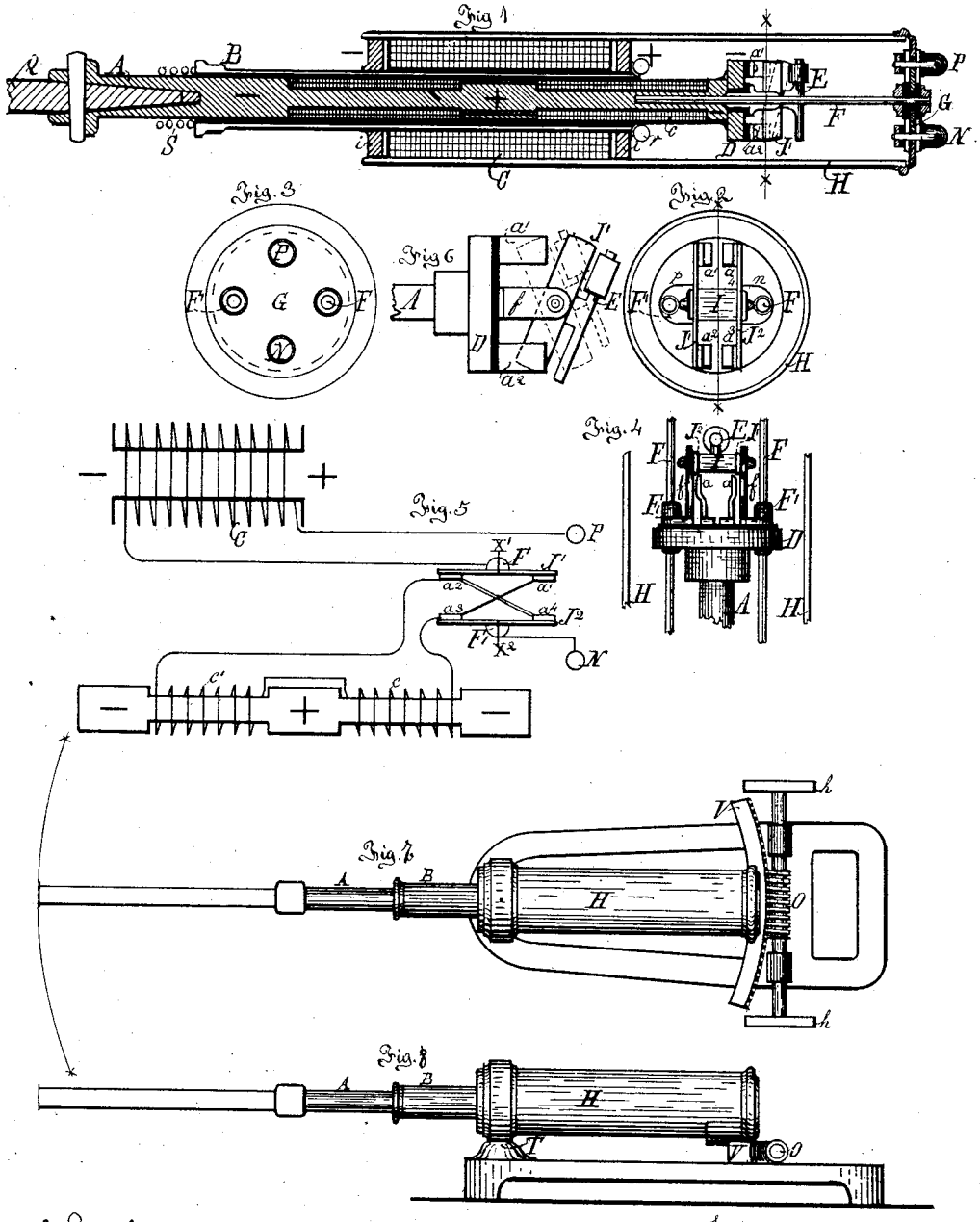
(No Model.) 2 Sheets—Sheet 1.

C. J. VAN DEPOELE.

APPARATUS FOR OPERATING TOOLS BY ELECTRICITY.

No. 307,884. Patented Nov. 11, 1884.



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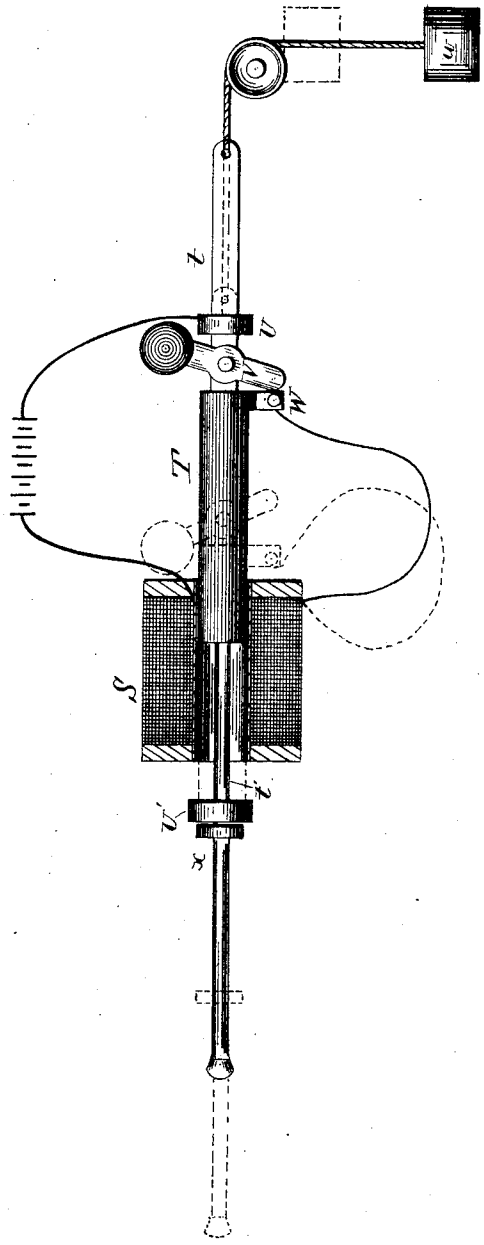


Fig. 9.

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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF CHICAGO, ILLINOIS.

APPARATUS FOR OPERATING TOOLS BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 307,884, dated November 11, 1884.

Application filed February 14, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Operating Tools by Electricity, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to a new and useful improvement in apparatus for operating tools by electricity; and it consists, first, in an apparatus in which tools are operated by means of an electro-magnetic core working inside of a solenoid or hollow magnet; and, secondly, in certain combinations and construction and arrangement of parts hereinafter more particularly described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal cross-section through the center of the machine, showing the solenoid, the electro-magnetic core, the automatic circuit-changer, &c. Fig. 2 is a plan view taken through the line *x x* of Fig. 1, showing the automatic circuit-changer, casing, &c. Fig. 3 is an end view of the apparatus, showing the binding-posts and contact-rods all carried by the movable disk G. Fig. 4 is an elevation of a detached part, showing the automatic circuit-changer carried by the electro-magnetic core A. Fig. 5 is a diagram of connections and circuits through the machine. Fig. 6 is a diagram showing the alternate positions of the circuit-changer. Figs. 7 and 8 are a plan and elevation, respectively, showing the machine ready for operation and carried by a frame, upon which it is pivotally mounted, and provided with a worm-gear which will allow the variation of the position of the cutter in a certain range without moving the apparatus. Fig. 9 is a diagrammatic sectional side view of a modification.

In the different figures similar letters indicate similar parts.

A represents an electro-magnetic core movable longitudinally in the solenoid or hollow magnet C, and so wound and connected as to have the same polarity at its opposite extremities, while its center is always of a different polarity from that existing at its ends.

At the end or extremity of the core A is a circuit-changer operated automatically by the inertia of the same, owing to the sudden stoppage of the movement of the core when moving in either direction. This circuit-changer will reverse the polarity in the core A, so that at one time the center will have a north polarity, while the two extremities will have a south polarity. The polarity in the solenoid C is not reversed; consequently the core A will be thrust in one direction, when suddenly the polarity in said core A will be south in the center and north at the two extremities, causing a motion in the opposite direction, and so on as long as the current is established.

B is a tube of brass or bronze, in which the core A is intended to move to and fro, and forms also part of the bobbin upon which the coils of the solenoid C are wound.

i i are two iron rings forming the end of the solenoid C.

c c are the coils around the core A.

D is a disk of soft iron permanently fixed to the core A and forming part thereof. Upon this disk are mounted four contact-springs, a' a^2 a^3 a^4, as also two contact-sleeves, F′ F′, through which work the two contact-bars F F, all insulated from the core A.

Attached to and forming part of the sleeves F′ F′ are two uprights, *f f*, carrying two trunnions, X′ X^2, which form part of the contact-plates J′ and J^2, respectively, thus forming a positive and a negative pole, *p* and *n*. The contact-plates J′ and J^2 are held together by a block, I, of some insulating material—such as wood, vulcanized fiber, or the like.

Upon the block I is mounted a weight, E, which oscillates the plates J′ and J^2, the whole being carried by the trunnions X′ and X^2 in the uprights *f f*, and the oscillation of this weight will cause the reversal of the current in the coils of A in a manner hereinafter explained.

F F are two guide-rods, which are also electrical conductors passing freely through the sleeves F′ F′, giving passage of the current to the circuit-changer, which rods are properly insulated from the plate G.

At *r* is shown a heavy rubber ring encircling the core A, and intended to stop the motion of the latter, in case that no other obstacle obstructed its course, and this will prevent injury to the machine by the force of the blow.

S is a coiled spring around the core A, and is intended to check the back motion or course of A, and also assist in starting the core in the positive or forward thrust.

G is a disk or plate of brass or other suitable material, carrying the rods F F and the main binding-posts P and N, which disk G can be rotated, when found necessary, to turn the core A to any position required by the tool Q.

H is a casing, of brass or other suitable material, protecting the different parts from dust, preventing also inflammable gases from contact with possible sparks from the circuit-changer.

The circuits in the apparatus are clearly shown in the diagram Fig. 5. The current entering by the post P passes by suitable conductor to the solenoid C, the free end of the coil of which is connected by a suitable conductor to the contact-rod F, from whence it passes to sleeve F′ and upright *f*, to contact-plate J′, to contact-spring a^2 or a', by proper conductor to coils c' c, around the core A, and by proper conductors to a^3 or a^4, by plate J^2 and by suitable connections, F′ F, &c., as shown, to the negative binding-post of machine at N.

Having described the different parts of the machine, as well as the electrical circuits through the different parts of the same, I will now proceed to explain its operation. The current being established with a suitable source of electricity, we will suppose the circuit-changer to stand as indicated in Fig. 6, and the coils of the solenoid and its core being wound and connected as described and shown in Figs. 1 and 5, it will readily be understood that the core A will be thrown forward with a power dependent upon the size of the machine and the strength of the current furnished, and the tool Q (which may represent a hammer, chisel, or preferably a drill for boring rock or mining) will strike either the rock, iron, or other substance that may be in its way, and the material or substance struck, being a solid, will prevent any further motion than what the blow can make way for, so that at this instant the core A, being stopped suddenly, the weight E, pivoted in *f f*, will continue its course and make contact between the plates J′ and J^2 with the two contact-springs *a a*, which are of opposite polarity to those they were in contact with in the forward thrust. The current being thus reversed in A, a motion backward takes place instantaneously, until the collar on A strikes the spring S, when A will again be stopped, and the weight E will, by continuing its motion, move farther backward, thus throwing the contact-plates J′ and J^2 in the same position as at the starting of the machine, when the core is again thrown forward, and so on as long as the current is supplied. In the forward stroke it is not necessary that the core travel the whole length of its stroke in order to reverse the current; but the moment the blow is given, no matter how short or how long the length of its stroke, the weight will be thrown over, reversing the current and polarity in A, which will instantly be driven backward, and thus the apparatus accommodates itself to a stroke from a few inches up to its whole length.

It is evident that this apparatus can be used for a variety of purposes—such as forging, stamping, mining, &c.—by simply changing or modifying the tool carried by the fore end of the movable core, and that any form of cutter, hammer, drill, or other tool may be employed.

I do not desire to confine myself to the exact construction here given, since I can modify the apparatus to suit the work it will have to perform without departing from the spirit of my invention.

Where I use the word "changer" in the claims I mean to be understood as covering also a device used for simply opening or closing a circuit, such as is shown in Fig. 9, in which S represents an ordinary solenoid; T, a soft-iron core working therein, carrying a drill, and at its opposite ends guide-rods *t t′*, working through fixed guides U U′. The guide-rod *t* carries a pivoted and weighted circuit-breaker, V, substantially the same as that used for changing or reversing the current shown in Figs. 1 and 6, except that, instead of changing or reversing the current, it opens and closes the circuit, but, like that, it is operated by its inertia when the motion of the core suddenly ceases. This circuit-breaker, when in the position shown in full lines in the drawings, is in electrical connection with the battery through the guide U and rod *t*, and with the solenoid through the contact W, (which is insulated from the circuit-breaker lever,) and thus the circuit is established through the solenoid, causing it to draw in the core. When the core has been drawn in and the drill has struck its blow, the inertia of the weight on the circuit-breaker causes the latter to assume the position shown in dotted lines, thus breaking the circuit and allowing the weight *w*, which is connected with the rod *t*, to draw the core out of the solenoid until a collar, *x*, on the rod *t* strikes the guide U′, when the inertia of the weight on the circuit-breaker causes the current to be again re-established.

I have shown the apparatus mounted on and having its forward end pivoted at T to a frame, which carries a screw, O, working in the curved rack V, which screw O may be turned by the hand-wheels *h h*, and thus a considerable range of motion may be readily given to the drill.

The special construction of the apparatus as I intend to build it will allow of its being worked at any possible angle or position; but the mechanism that will be employed for guiding and holding it to produce this range of motion is not here shown or claimed, as it will form the subject-matter of a separate application.

What I claim as new is—

1. The combination of a solenoid or hollow magnet, and a core working therein having

two poles of like polarity at its opposite extremes, and a central pole of a different polarity from those at the ends, with a circuit-changer and suitable electrical connections with the source of power, whereby the three poles of the core react upon the poles of the solenoid and induce a reciprocating motion in the core, substantially as described.

2. The combination, with a solenoid or hollow magnet, of a core working therein and having coils wound on it in opposite directions, a circuit-changer, and an electric circuit connecting the solenoid, the core, and circuit-changer with the source of power, substantially as described.

3. The combination of a solenoid, an electro-magnet as a core, suitable electrical connections to cause one of said instruments to give motion to the other, and a tool operated by the motion of the moving instrument, substantially as described.

4. The combination of a solenoid, an electro-magnet as a core, suitable electrical connections to cause one of said instruments to give motion to the other, and a tool attached to the end of said core and moving therewith, substantially as described.

5. The combination of a solenoid, a core carrying two coils wound in opposite directions, a circuit-changer constructed and arranged to send the current through the coils of the core in opposite directions, and a tool operated by the motion of the core, substantially as described.

6. The combination of a solenoid and a core carrying a tool, and having two coils wound in opposite directions, with a circuit-changer constructed and arranged to send the current through the coils in opposite directions, substantially as described.

7. The combination of a solenoid, a core, suitable electrical connections to cause one of said instruments to give motion to the other, a tool operated by the moving instrument, and an automatic circuit-changer operated by the stoppage of said moving instrument, substantially as described.

8. The combination of a solenoid, a core, suitable electrical connections to cause one of said instruments to give motion to the other, a tool operated by said moving instrument, and an automatic circuit-changer operated through its inertia, substantially as described.

9. The combination of a solenoid, a core, suitable electrical connections to cause one of said instruments to give motion to the other, a tool carried by the moving instrument, and a circuit-changer provided with a weight constructed to travel farther at each stroke than the device carrying it, and thus change the circuit, substantially as described.

10. The combination of a solenoid, a core, suitable electrical connections to cause one of said instruments to give motion to the other, a tool carried by the moving instrument, and a circuit-changer provided with an oscillating weight connected with swinging contact-plates to change the circuit, substantially as described.

11. The combination of a helix forming part of an electric circuit, a device moved by the energizing of said helix, and a circuit-changer attached to said moving device and constructed to be moved by the cessation of the motion thereof, substantially as described.

12. The combination of a helix forming part of an electric circuit, a device moved by the energizing of said helix, and a circuit-changer attached to said moving device and operated through the inertia of said changer, substantially as described.

13. The combination of a solenoid, a core moving therein, and a current-changer mounted upon the core constructed to change the current operating the core, substantially as described.

14. The combination of a solenoid, an electro-magnet as a core moving therein, and an automatic circuit-changer mounted upon the core, constructed and arranged to send the current through the coils of said core in opposite directions alternately, substantially as described.

15. The combination of a solenoid, a core moving therein, and an automatic circuit-changer mounted upon the core, and constructed to be moved on the cessation of the movement of said core and change the current passing through the coils of the core, to drive the core in the opposite direction, substantially as described.

16. The combination of a solenoid, a core moving therein, having coils wound in opposite directions, and a circuit-changer mounted upon said core, and constructed to be moved through its own inertia, whereby the current is sent in opposite directions through the coils of the core, substantially as described.

17. The combination of the solenoid and a core carrying at one end a tool, and at the other end an automatic circuit-changer, whereby the current is changed after the tool strikes, substantially as described.

18. The combination of a solenoid and electro-magnet as a core, having two oppositely-wound helices, and carrying at one end a tool, and at the other a circuit-changer, whereby the current of the core-coils is changed after the tool strikes, and the current is sent through said coils in an opposite direction, thus carrying the core back again to give another blow with the tool, substantially as described.

19. The combination, in a tool-operating apparatus, of a solenoid wound upon a diamagnetic tube between iron rings surrounding the ends of the tube, an electro-magnet as a core working freely in the tube of the solenoid, constructed to have its opposite ends of the same polarity, and its center of a different polarity from the ends, and an automatic circuit-changer, and suitable circuits connecting the solenoid, the core, and the circuit-changer with the source of power, substantially as described.

20. The combination of a solenoid, a core moving therein, having coils wound in opposite directions, and suitable electric connections to make one instrument give motion to the other, with a circuit-changer consisting, essentially, of two contact-plates constructed to oscillate on pivots by the joint action of the moving instrument and the inertia of a weight connected with said contact-plates, and to change the circuits by contact with contact-springs electrically connected with the coils of the core, substantially as described.

21. The combination of a solenoid, C, a core, A, suitable electrical connections to cause one of said instruments to give motion to the other, an oscillating weight, E, connected with and moving oscillating contact-plates J' J^2, stationary contact-points a' a^2 a^3 a^4, electrically connected with the coils of the core, and the stationary rods F, for connecting the same with the source of power, substantially as described.

22. The combination of a solenoid, a core moving therein, suitable electrical connections to cause one of said instruments to give motion to the other, and a spring, normally out of action, arranged to resist the motion of the core near the end of one stroke and assist to start it on its return, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses, this 12th day of February, 1884.

CHARLES J. VAN DEPOELE.

Witnesses:
AARON K. STILES,
EVERELL D. STILES.