No. 855,513. PATENTED JUNE 4, 1907.

R. P. IRVING.

RECIPROCATING ELECTRIC MOTOR.

APPLICATION FILED NOV. 21, 1906.

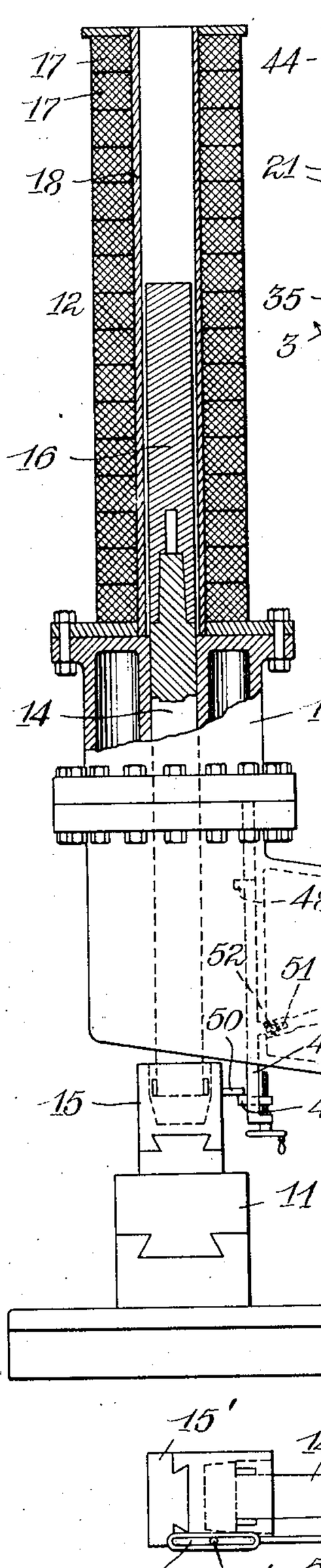


Fig. 1.

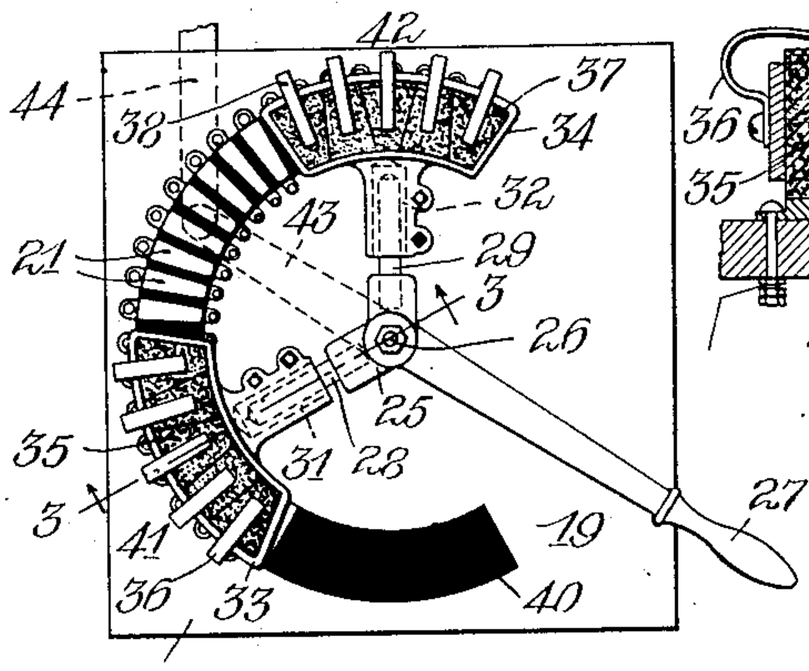


Fig. 2.

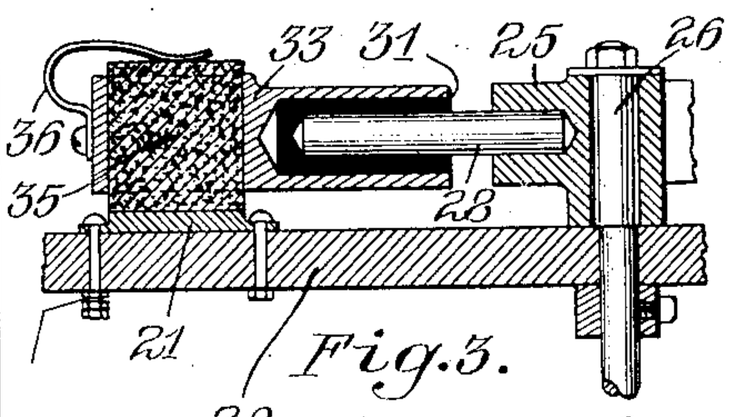
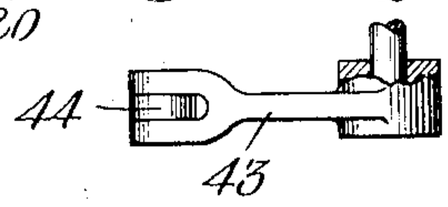


Fig. 3.



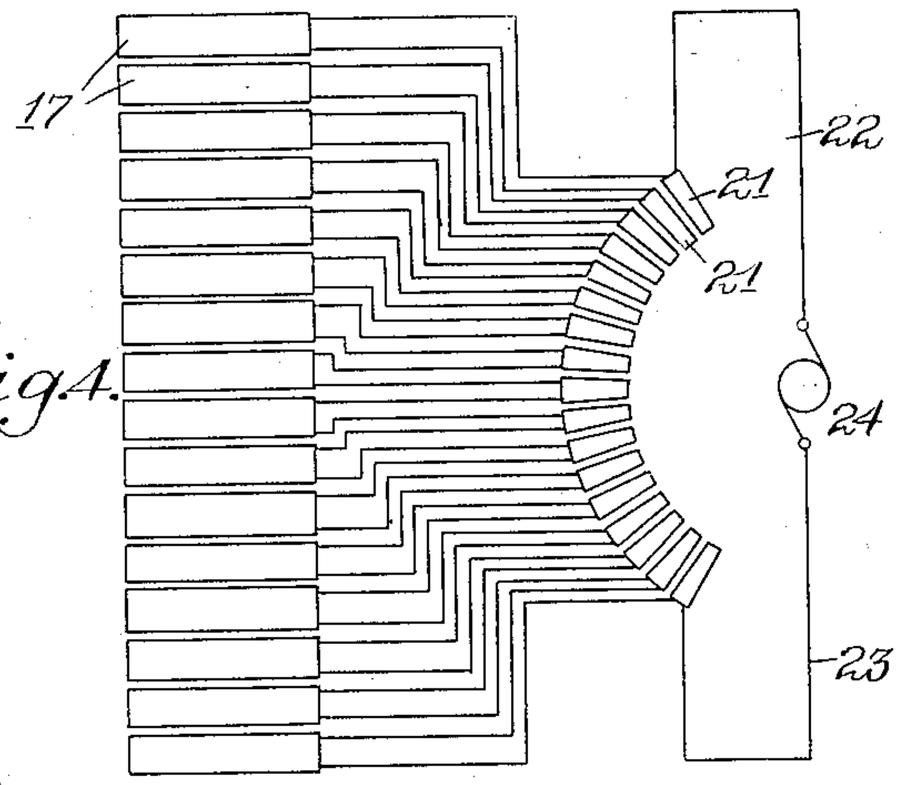
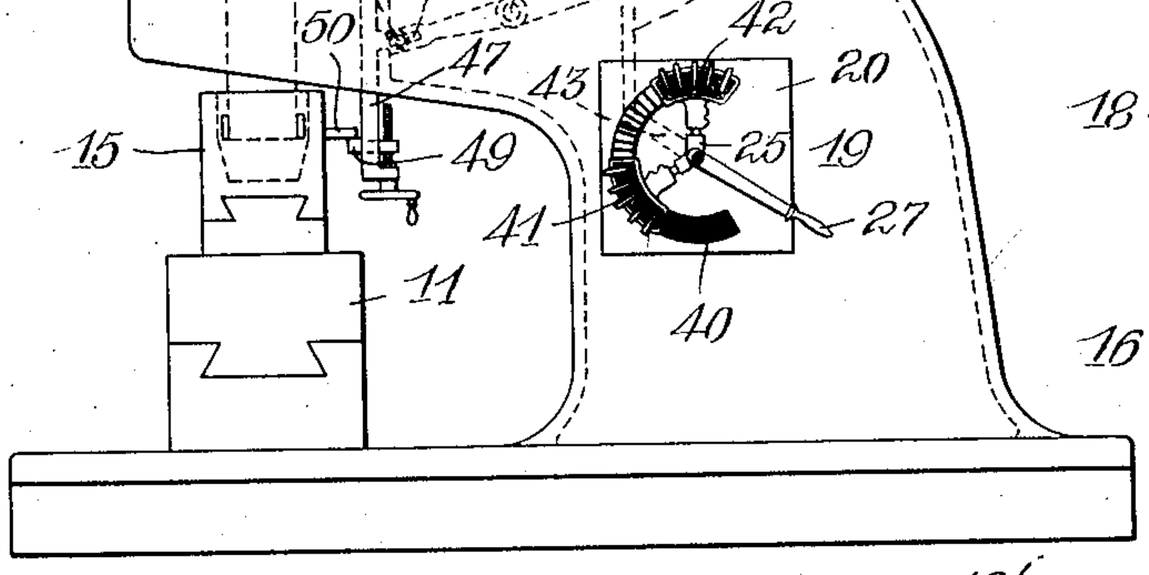


Fig. 4.



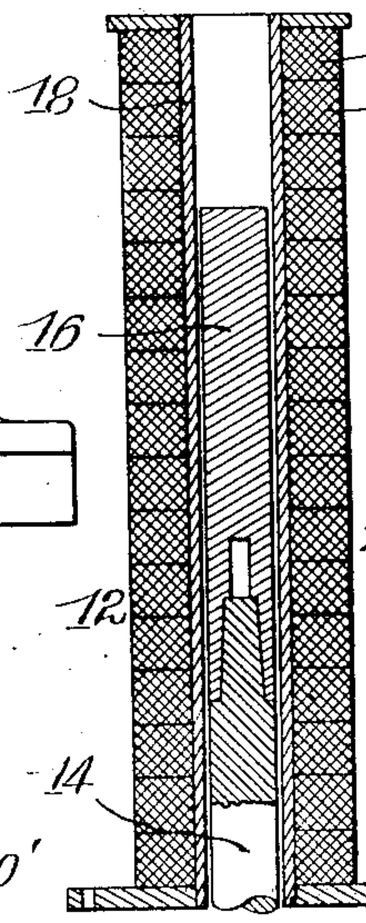


Fig. 5.

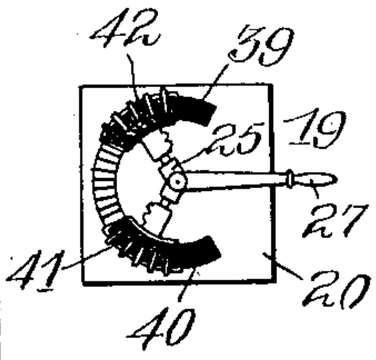


Fig. 6.

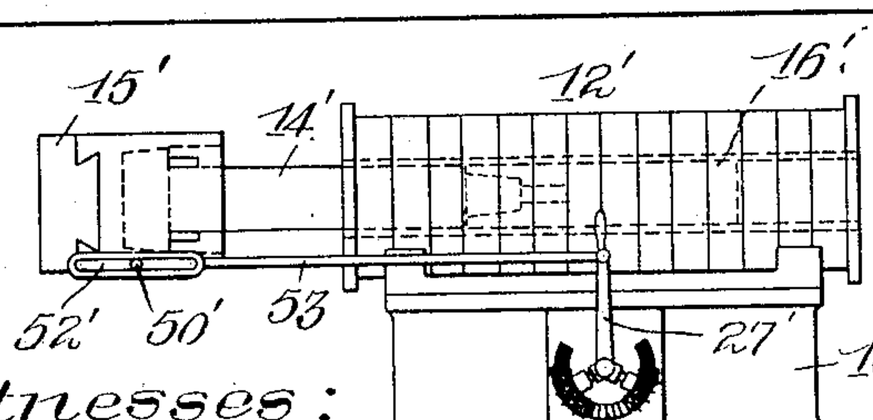


Fig. 7.

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UNITED STATES PATENT OFFICE.

RONALD P. IRVING, OF QUINCY, MASSACHUSETTS.

RECIPROCATING ELECTRIC MOTOR.

No. 855,513. Specification of Letters Patent. Patented June 4, 1907.

Application filed November 21, 1906. Serial No. 344,412.

To all whom it may concern:

Be it known that I, RONALD P. IRVING, a citizen of the United States, residing at Quincy, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Reciprocating Electric Motors, of which the following is a specification.

This invention relates to improvements in reciprocating electric motors, one of the adaptations of which is a hammer herein shown illustrating one specific embodiment of my invention, and the objects are to provide a motor of the character described so constructed and arranged that the reciprocatory member or core is operated positively in both directions, may be stopped at will and held at any desired point in its stroke, and may be operated entirely automatically or may be controlled manually.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the claims thereof.

Referring to the drawings: Figure 1 is a side elevation, partly broken away and partly in section, of a hammer showing one embodiment of my invention. Fig. 2 is an enlarged detail side elevation of the controller. Fig. 3 is an enlarged section, partly in elevation, taken on line 3—3 of Fig. 2 looking in the direction of the arrows on said line. Fig. 4 is a diagram illustrating the system of wiring. Fig. 5 is a detail sectional elevation, partly broken away, of the solenoid, core and plunger, with the core shown in mid-position. Fig. 6 is a detail side elevation of the controller shown in mid-position corresponding to the position of the core shown in Fig. 5. Fig. 7 is a modified form of hammer arranged horizontally.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 10 is a frame of any usual or desired construction having an anvil 11 suitably mounted thereon. A solenoid 12 is mounted on the frame 10, but is separated therefrom by a separator 13 formed of non-magnetic metal, such, for instance, as brass. A plunger 14 formed of non-magnetic metal is slidably mounted in the separator 13 and has fast thereto at its lower end a hammer 15. A core 16, preferably formed of soft iron, is fast to the plunger 14 at its upper end and is adapted to reciprocate within the solenoid 12. The solenoid 12 consists of a plurality of separate helices 17 each of which in itself constitutes a solenoid, said helices being wound around a tube 18. A controller 19 which may be placed at any suitable point is preferably mounted on the frame 10. The controller 19 comprises in its construction a base 20 formed of suitable insulating material, such, for instance, as slate, having mounted thereon a plurality of metal contact plates 21 which are insulated from one another by insulating material placed therebetween.

Each of the helices 17 is connected, respectively, to two of the contact plates 21, in other words, the helices 17 are connected to the contact plates 21 in series. The two of said contact plates which are most remote from each other are connected by wires 22 and 23 to a source of electrical current 24. A rotatable member 25 is fast to a shaft 26, said shaft being journaled on the base 20. The rotatable member 25 is provided with a handle 27 by means of which said member may be rocked on the shaft 26. Two arms 28 and 29 forming a part of the rotatable member 25 are inserted in insulating bushings 31 and 32, respectively. Two brush holders 33 and 34 are mounted on the bushings 31 and 32, respectively, thereby being insulated from each other. A plurality of carbon blocks 35 constituting a brush are slidably mounted in the brush holder 33 and are pressed against the faces of the contact plates 21 by springs 36.

A plurality of carbon blocks 37 constituting a brush are slidably mounted in the brush holder 34 and are held against the faces of the contact plates 21 by springs 38. Two plates 39 and 40 formed of insulating material are arranged with their front faces in alinement with the front faces of the contact plates 21, all of said front faces together with the front faces of the insulating material between said contact plates constituting a continuous surface. The brush 41 which consists of the carbon blocks 35 is adapted to contact with a series of the contact plates 21 and the brush 42 which consists of the carbon blocks 37 is adapted to contact with a series of the contact plates 21.

If the rotatable member 25 together with the brushes 41 and 42 were removed from the shaft 26, the current from the source of electrical current 24 would traverse the entire series of contact plates 21 and the entire series of helices 17, thereby energizing the

solenoid 12 from end to end. If now we put the rotatable member in place, it will be seen that the current will flow along the line of least resistance and that as a consequence when the controller 19 is located in the position shown in Fig. 2, the current will traverse only the upper series of nine helices 17 and from that point will be short circuited by the brush 41 to the lowermost of the contact plates 21. It will be understood, therefore, that said upper series of nine helices will be energized and that the core 16 will be drawn to its uppermost position and held there. If now the rotatable member 25 is moved to its opposite position with the brush 41 entirely in contact with the insulating plate 40, the magnetic field will be correspondingly moved to the lower series of nine of the helices 17, or if the rotatable member 25 is placed in mid-position as shown in Fig. 6, the magnetic field will be correspondingly moved to mid-position and the core 16 will, therefore, be moved to mid-position as shown in Fig. 5. It will be readily understood that by means of the handle 27 the rotatable member 25 may be rocked to and fro, thus positively controlling the movement of the core 16 and when said handle is held stationary said core will be held stationary in a position corresponding to the position of said handle.

The core 16 being connected to the hammer 15 by the plunger 14 formed of non-magnetic metal, said hammer, therefore, is not affected by the magnetism of said core and similarly the separator 13 prevents the frame 10 from being affected by the magnetism of the solenoid 12. An arm 43 fast to the shaft 26 is connected by a link 44 to a lever 45, said lever being pivoted at 46 to the frame 10. A slide 47 guided in suitable ways in the frame 10 has a projection 48 formed thereon and a projection 49 adjustably mounted thereon. A pin or other projection 50 fast to the hammer 15 is adapted to engage the projections 48 and 49 alternately. The lever 45 is slotted at 51 to receive a pin 52 fast to the slide 47.

Assuming that the current is turned on and that the hammer 15 and the core 16 are located in the position shown in Fig. 1, the operator grasps the handle 27 and moves it to the position shown in Fig. 1, the upper series of helices will at once become energized as hereinbefore described and the hammer 15 will be quickly raised to its uppermost position. As said hammer nears its uppermost position the pin 50 strikes the projection 48 and acting through the slide 47, the lever 45, and the link 44 acts to throw the controller 19 away around to the position opposite to that shown in Fig. 1, thereby moving the magnetic field of the solenoid 12 downwardly and consequently causing the hammer 15 to be moved downwardly striking the anvil 11 or work that may be placed thereon. As the hammer 15 moves downwardly, when it has nearly reached its lowest position, the pin 50 strikes the projection 49, thereby acting through the slide 47, the lever 45, and the link 44 to move the controller 19 to the position shown in Fig. 1 and consequently moving the magnetic field of the solenoid 12 upwardly and raising the hammer 15. It will be understood that the operator may at any time during the automatic operation of the apparatus as hereinbefore described, grasp the handle 27 and change the automatic control to manual control by moving said handle up and down or holding said handle in any desired position, whereby the hammer 15 may be held in a position corresponding to the position of said handle.

If desired, the link 44 may be disconnected and the operation thus be made wholly manual.

In Fig. 7 I have illustrated a modified form of hammer in which 12′ is the solenoid mounted on a frame 10′. A controller 19′ is mounted on the frame 10′. A plunger 14′ is slidably mounted within the solenoid 12′ and said plunger has fast thereto at one end a hammer 15′ and at the other end a core 16′. A pin 50′ fast to the hammer 15′ is adapted to play in a slot 52′ formed in a rod 53, said rod being connected to the handle 27′ of the controller 19′. The pin 50′ is adapted to engage the opposite ends of the slot 52′ alternately and thereby automatically actuate the controller 19′.

While I have shown the device of my invention as applied to a hammer it will be evident that the same may be utilized for a great variety of purposes where a reciprocating motor may be employed and I do not desire to limit myself to the present embodiment thereof.

Having thus described my invention what I claim and desire by Letters Patent to secure is:

1. In combination, a solenoid comprising a plurality of helices, a source of electrical current, and means interposed between said source of electrical current and said helices adapted to limit the magnetic field of said solenoid to a predetermined number of helices, said means also adapted to move said magnetic field longitudinally of said solenoid.

2. In combination, a solenoid comprising a plurality of helices, a controller connected to each of said helices, and a source of electrical current connected to said controller, said controller adapted to direct said current to a predetermined number of said helices.

3. In combination, a plurality of helices, a core adapted to reciprocate therethrough, a plurality of contact plates insulated from one another, each of said helices connected, respectively, to two of said contact plates, and two movable brushes each adapted to

contact with a plurality of said contact plates.

4. In combination, a plurality of helices, a core adapted to reciprocate therethrough, a plurality of contact plates insulated from one another, said helices connected to said contact plates in series, a source of electrical current connected to the two of said contact plates which are most remote from each other, and two movable brushes, each adapted to contact with a plurality of said contact plates.

5. In combination, a plurality of helices, a core adapted to reciprocate therethrough, a plurality of contact plates insulated from one another, each of said helices connected, respectively, to two of said contact plates, and two brushes movable in unison across said contact plates.

6. In combination, a solenoid comprising a plurality of helices, a core adapted to reciprocate therethrough, a plurality of contact plates insulated from one another and arranged on an arc of a circle, each of said helices connected, respectively, to two of said contact plates, a rotatable member journaled concentric with said contact plates, and two brushes mounted on said member and insulated therefrom, each of said brushes being adapted to contact with a series of said contact plates.

7. An electrically operated hammer apparatus comprising in its construction a frame, a solenoid comprising a plurality of helices mounted on said frame, a separator formed of non-magnetic material interposed between said solenoid and said frame, a core formed of magnetic material adapted to reciprocate within said solenoid, a plunger formed of non-magnetic material fast to said core, a hammer fast to said plunger, a plurality of contact plates insulated from one another, each of said helices connected, respectively, to two of said contact plates, and two movable brushes each adapted to contact with a plurality of said contact plates, and mechanism operatively connected to said brushes adapted to be actuated by said hammer.

8. An electrically operated hammer apparatus comprising in its construction a frame, a solenoid comprising a plurality of helices mounted on said frame, a separator formed of non-magnetic material interposed between said solenoid and said frame, a core formed of magnetic material adapted to reciprocate within said solenoid, a plunger formed of non-magnetic material fast to said core, a hammer fast to said plunger, a plurality of contact plates insulated from one another, each of said helices connected, respectively, to two of said contact plates, two movable brushes each adapted to contact with a plurality of said contact plates, and mechanism operatively connected to said brushes adapted to be actuated by said hammer.

9. In combination, a solenoid comprising a plurality of helices, a core adapted to reciprocate therethrough, a source of electrical current means interposed between said source of electrical current and said helices adapted to limit the magnetic field of said solenoid to a predetermined number of said helices and mechanism to actuate said means to move said magnetic field longitudinally of said solenoid.

10. In combination, a solenoid comprising a plurality of helices, a core adapted to reciprocate therethrough, a source of electrical current means interposed between said source of electrical current and said helices adapted to limit the magnetic field of said solenoid to a predetermined number of said helices, said core adapted to actuate said means to move said magnetic field longitudinally of said solenoid, said means also adapted to be operated manually.

11. An electrically operated hammer apparatus comprising in its construction a frame, a solenoid comprising a plurality of helices mounted on said frame, a core formed of magnetic material adapted to reciprocate within said solenoid, a plunger of non-magnetic material fast to said core, a plurality of contact plates insulated one from another, each of said helices connected, respectively, to two of said contact plates, two movable brushes each adapted to contact with a plurality of said contact plates, a reciprocatory slide mounted on said frame, said slide provided with two projections extending therefrom, a projection on said hammer adapted to engage said projections alternately, and mechanism operatively connecting said slide and said brushes.

12. An electrically operated hammer apparatus comprising in its construction a frame, a solenoid comprising a plurality of helices mounted on said frame, a core formed of magnetic material adapted to reciprocate within said solenoid, a plunger of non-magnetic material fast to said core, a plurality of contact plates insulated one from another, each of said helices connected, respectively, to two of said contact plates, two movable brushes each adapted to contact with a plurality of said contact plates, a reciprocatory slide mounted on said frame, said slide provided with two projections extending therefrom, one of said projections being adjustable toward the other, a projection on said hammer adapted to engage said first projections alternately, and mechanism operatively connecting said slide and said brushes.

13. An electrically operated hammer apparatus comprising in its construction a frame, a solenoid comprising a plurality of helices mounted on said frame, a separator formed of non-magnetic material interposed between said solenoid and said frame, a core formed of magnetic material adapted to reciprocate within said solenoid, a plunger formed of non-magnetic material fast to said

core, a hammer fast to said plunger, a plurality of contact plates arranged on an arc of a circle, each of said helices connected, respectively, to two of said contact plates, a rotatable member journaled concentric with said contact plates, two brushes mounted on said member and insulated therefrom, each of said brushes being adapted to contact with a series of said contact plates, a handle mounted on said rotatable member, a reciprocatory slide mounted on said frame, said slide provided with two projections extending therefrom, a projection on said hammer adapted to engage said first projections alternately, and mechanism operatively connecting said slide and said rotatable member.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

RONALD P. IRVING.

Witnesses:
LOUIS A. JONES,
ANNIE J. DAILEY.