B. M. DUTTON.

ELECTRIC HAMMER.

APPLICATION FILED FEB. 16, 1909.

962,499.

Patented June 28, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

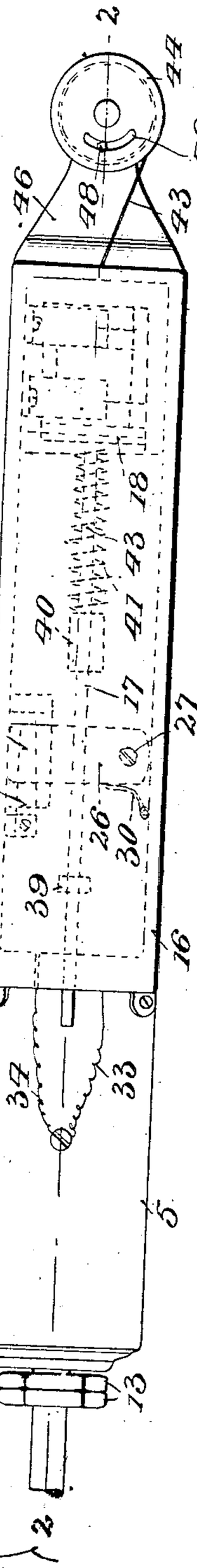
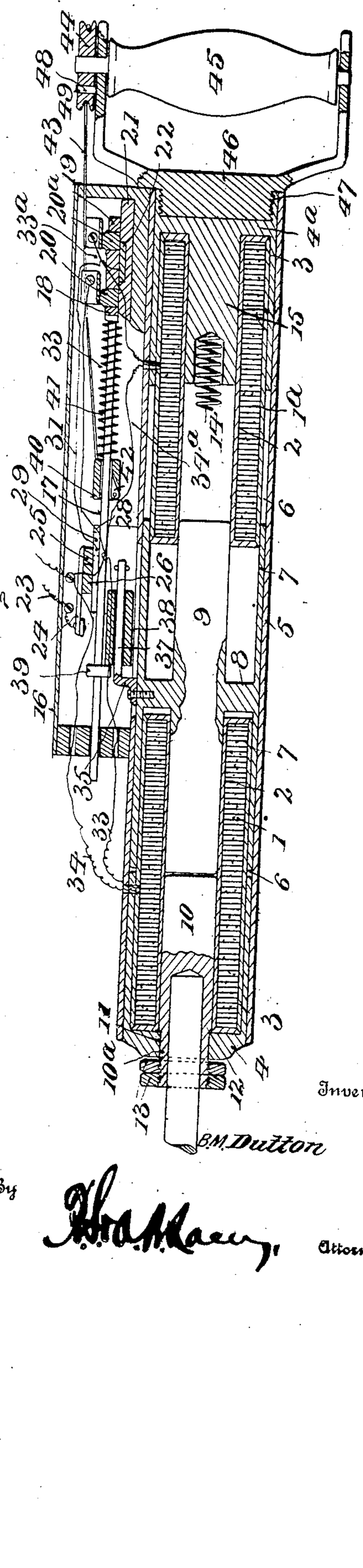


Fig. 2.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

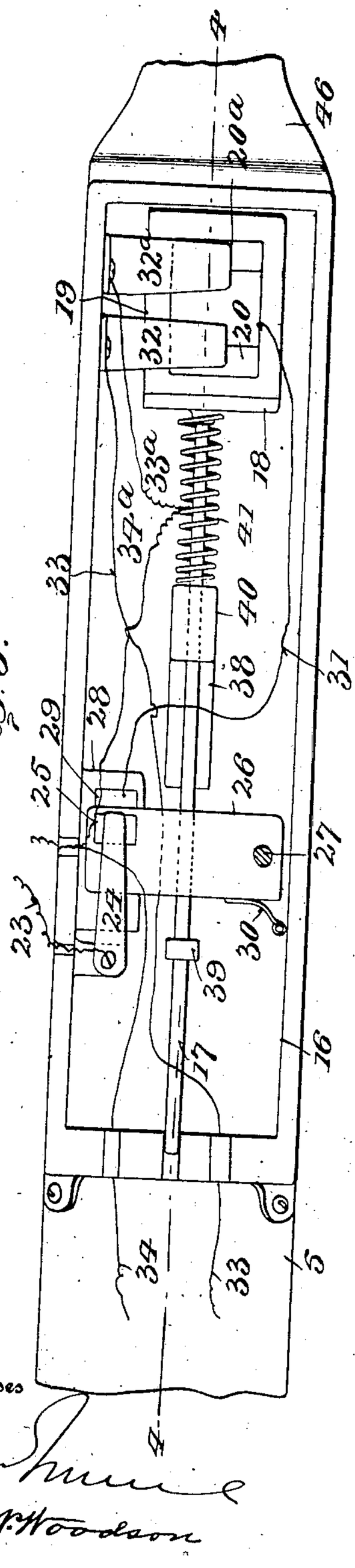
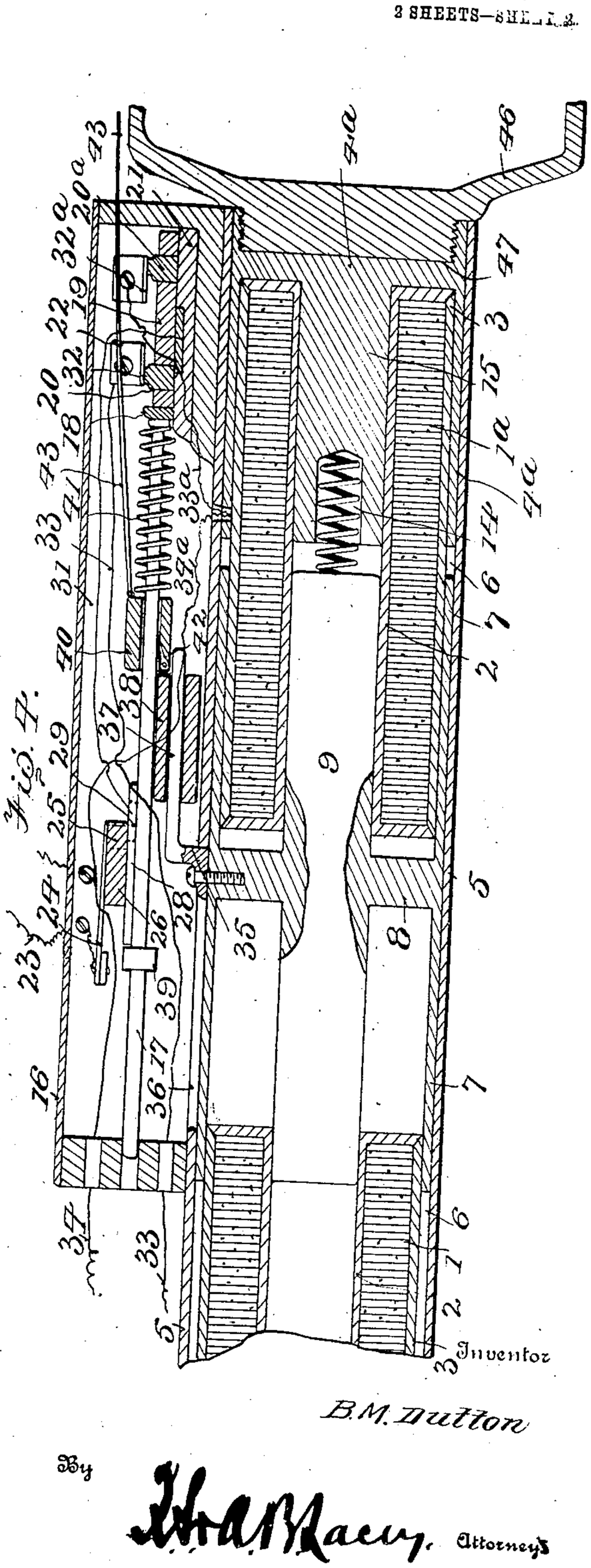


Fig. 4.



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UNITED STATES PATENT OFFICE.

BURTON M. DUTTON, OF RICHMOND, VIRGINIA, ASSIGNOR OF ONE-HALF TO WILLIAM H. OXENHAM, OF RICHMOND, VIRGINIA.

ELECTRIC HAMMER.

962,499. Specification of Letters Patent. Patented June 28, 1910.

Application filed February 16, 1909. Serial No. 478,250.

To all whom it may concern:

Be it known that I, BURTON M. DUTTON, citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Electric Hammers, of which the following is a specification.

This invention comprehends certain new and useful improvements in electric reciprocating motors of that type designed particularly to serve as hammers for use in operating tools, as in riveting, chiseling or the like, and the invention has for its object an improved apparatus of this character which consists essentially of two solenoid coils that are arranged to alternately influence a magnetic core or plunger, so as to effect the reciprocation thereof and impact the same intermittently against the tool, the plunger being of peculiar formation so as to be well guided in its movement and to strike an effective blow.

A further object of the invention is an improved switching mechanism which is actuated by the reciprocating plunger so as to alternately energize the respective solenoids, and which is so constructed that the blow from the plunger is fully imparted before the switch is reversed to effect the retraction of the plunger, thereby making the frequency of reciprocation of the plunger relate directly to the strength of the actuating current and rendering unnecessary delicate adjustment in order to get the switching mechanism into synchronism with the inertia and length of stroke of the plunger. And a still further object of the invention is a switching mechanism that is susceptible of being controlled from the handle of the device, so as to admit of the operator quickly and conveniently starting or stopping the hammer when desired, and also affording means for adjusting the length and frequency of the plunger's stroke.

With these and other objects in view that will more fully appear as the description proceeds, the invention consists in certain constructions and arrangements of the parts that I shall hereinafter fully describe, and then point out the novel features thereof, in the appended claims.

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

Figure 1 is a top plan view of an electric hammer constructed in accordance with my invention; Fig. 2 is a longitudinal section thereof, on the line 2—2 of Fig. 1; Fig. 3 is an enlarged plan view of the switching mechanism; and, Fig. 4 is an enlarged section on the line 4—4 of Fig. 3.

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

This invention consists essentially of two longitudinally alining spaced forward and rear solenoid coils 1 and 1^a which are oppositely wound upon suitable spools 2, the coils being also preferably inclosed in hollow cylindrical jackets 3. At their opposite ends, these coils are fitted into substantially cup-like forward and rear closures 4 and 4^a which are secured rigidly within the opposite ends of a tubular casing 5, the adjacent ends of the solenoids being disposed beyond the extremities of the cup-like closures so as to afford annular guideways 6 between the ends of the jackets 3 and the inner wall of the casing 5. Slidingly mounted in the respective guideways 6 are annular circumferential guide flanges 7 which are oppositely and longitudinally disposed from the marginal portion of an outstanding collar 8 that is formed at an intermediate point on a longitudinal core or plunger 9. The plunger is formed of suitable magnetic substance, and has its opposite ends projected into and slidingly mounted in the adjacent ends of the bores of the spools 2 of the forward and rear solenoids, the plunger being arranged to be alternately influenced by the solenoids, so as to be pulled forwardly and rearwardly thereby and thus caused to reciprocate within the casing. When influenced by and moved forwardly in the forward solenoid 1, the core is arranged to impact against a tool stock 10 which is mounted in the forward end of the corresponding spool for a limited longitudinal movement therein, the forward extremity of the tool stock being reduced, as indicated at 10^a, with the reduced portion extending forwardly through an opening 11 formed in the forward closure 4, the reduced portion providing a forwardly facing shoulder 12 which is arranged to bear against the

closure around the opening, to limit the forward movement of the stock, while the rearward movement thereof is limited by one or more nuts 13 working upon the projecting extremity of the reduced portion. When retracted under the influence of the rear solenoid 1^a, the core is arranged to abut against an expansion spring 14 which serves as a buffer and is carried by an extension 15 projecting into the rear end of the bore of the rear spool from the adjacent closure 4^a.

In order to alternately energize the two solenoid coils, I employ a switching mechanism that is preferably inclosed in a suitable housing 16 provided on the exterior of the casing 5. This switching mechanism consists essentially of a longitudinal switch bar 17 which is mounted for reciprocatory movement in the housing, and which is formed at one end, preferably its rear end, with a cross-head 18 to which is secured a longitudinally disposed substantially flat block 19 of insulating and noncombustible material. Mounted in this block and extending between the inner and outer faces thereof, are two longitudinally spaced metallic contacts 20 and 20^a, the inner faces of the block 19 and the contacts carried thereby being ground to present an even surface which rests against and is movable across the outer surface of a bed 21 also composed of insulating and noncombustible material. A stationary metallic contact 22 is countersunk in this bed and is arranged to have the contact 20 and 20^a alternately engaged therewith by and upon the reciprocation of the switch bar 17, the contact 22 being designed to be in electrical connection with the source of supply of the current during the operation of the device. In the present instance, a feed wire 23 extends from the dynamo or batteries or the like and enters the housing 16, preferably near the forward end thereof, and is electrically connected to a longitudinally extending spring contact finger 24. This contact finger is adapted to rest frictionally against the outer face of a contact 25 that is mounted in one end of a cutoff bar 26 of insulating material, the cutoff bar extending transversely of the housing in proximity to the switch bar 17, for a purpose to be presently disclosed, while the opposite end of the cutoff bar is pivoted, as indicated at 27. The first named end of the cutoff bar is movable between the contact finger 24 and an insulating block 28 having a contact 29 countersunk therein, a spring 30 normally holding the cutoff bar with the opposite faces of the contact 25 in engagement with the finger 24 and the contact 29, so that the current flows from the former to the latter, from which latter it is conducted to the stationary contact 22 by means of a lead 31.

At their outer faces, the metallic contacts 20 and 20^a are preferably disposed beyond the adjacent face of the insulating block 19, and are arrnaged to wipe frictionally across and in continual engagement with two spring contact fingers 32 and 32^a, so as to alternately conduct the current thereto when the said contacts are intermittently engaged with the contact 22 upon the reciprocation of the switch bar 17. From the respective contact fingers 32 and 32^a, the current is designed to be conducted to the forward and rear solenoids 1 and 1^a through the instrumentality of leads 33 and 33^a, confluent leads 34 and 34^a serving to return the current to the source of supply after it has flowed through the coils.

The necessary reciprocation of the switch bar 17 is effected through the instrumentality of an angle arm 35 which is rigidly secured to the collar 8 of the plunger, and which works in a longitudinal slot 36 provided in the casing 5, the extremity of the arm being preferably longitudinally and rearwardly disposed, as indicated at 37, and having a thimble 38 mounted thereon for a limited sliding movement. This thimble acts somewhat as a delayed trip, and is arranged, after the plunger has imparted a stroke, to slide forwardly upon the extremity of the arm and abut against a rigid collar 39 provided on the switch bar 17, thereby moving the latter forwardly to effect the reversal of the contacts 20 and 20^a and the energization of the rear solenoid. The rearward movement of the switch bar 17 is effected through the instrumentality of a sleeve 40 that is normally free to slide thereon and is supported in operative position in the rear of the thimble 38 by an expansion spring 41 encircling the switch bar and interposed between the sleeve and the cross-head 18. The sleeve 40 is provided with a friction lever 42 that, in the normal position of the sleeve, is disposed in the path of the thimble 38 so that the latter abuts thereagainst upon its rearward movement and thus clutches the sleeve to the switch bar, to move the same rearwardly and again reverse the contacts so as to energize the forward solenoid. The forward movement of the sleeve 40, under the influence of the expansion spring 41, is controlled by a flexible connection 43 secured at one end to the sleeve and passing rearwardly through the rear end of the housing, and arranged to be reeled upon a sheave or drum 44. The sheave is adapted to be turned by a handle or grip 45 rotatably mounted in a bifurcated handle frame 46 which screws at its forward end into a threaded socket 47 formed in the rear closure 4^a. In the present instance, the turning of the sleeve 44 is limited by a stop 48 carried by one of the bifurcations of the handle frame 46 and pro-

jecting into a segmental slot 49 formed in the sheave, and thus limiting the extent to which the flexible connection 43 may be reeled upon the drum by turning the handle 45.

In the practical operation of the hammer, when the parts are in the positions illustrated in Fig. 4, it is to be observed that the current flows from the feed wire 23, along the contact finger 24, through the contacts 25 and 29, and then from the latter, through the lead 31 to the stationary contact 22. Inasmuch as in the position shown, the contact 20 is in engagement with the contact 22, the current will flow from the latter to the former, and thence through the spring contact finger 32 and along the corresponding lead 33, so as to effect the energization of the forward solenoid 1. This coil, therefore, exerts a strong pull upon the plunger so as to move the same forwardly in the casing 5 and impact the core against the tool stock, to impart the desired blow to the tool. Attention is particularly directed to the fact that the annular guide flanges 7, in addition to their function of guiding the plunger in its movement, also serve, in conjunction with the core, as armatures for the respective coils, so that the plunger is subjected to an increased magnetic influence, and thus imparts a more effective blow. While the plunger is moving forwardly, the thimble 38 is positioned at the rear end of the longitudinal portion 37 of the arm 35, and after the plunger has completed its stroke, this thimble continues its forward movement, sliding from its inertia forwardly along the arm and abutting against the rigid collar 39 to carry the same and the switch bar 17 forwardly, the sleeve 40 not moving forwardly with the switch bar, but being retained in its normal position by the flexible connection 43 and against the compression of the spring 41. This movement of the switch bar moves the contact 20 out of engagement with the stationary contact 22 and engages the contact 20^a with the latter, whereby the current is conducted off through the spring contact finger 32^a and the lead 33^a to the rear solenoid 1^a, which then exerts a rearward pull upon the plunger to quickly retract the same until the core abuts against the spring 14. The sudden arresting of the rear movement of the plunger, causes the thimble 38 to continue its rearward movement by its inertia, and to slide longitudinally of the arm, the thimble then abutting against the friction lever 42 to clutch the sleeve 40 to the switch bar 17 and move the latter rearwardly through the instrumentality of the former, to again reverse the contacts and energize the forward solenoid 1. The sleeve 40 is returned to its normal position by the spring 41 as soon as the thimble 38 releases the friction lever 42, the sleeve thus moving forwardly to take up the slack of the flexible connection 43 and to assume a position so as to be again ready for operation by the thimble. The foregoing operation is repeated indefinitely so long as the current continues to flow to the stationary contact 22.

Should the operator desire to stop the hammer, it is only necessary to turn the handle 45 to unreel the flexible connection 43 from the drum 44, and thus admit of the sleeve 40 sliding forwardly on the switch bar, through the influence of the expansion spring 41, until the sleeve abuts against the cutoff bar 26 to turn the same forwardly against the action of the spring 30, and disengage the contact 25 from the contact 29 so as to break the circuit. The reversal of the above operation sets the hammer in operation. By turning the grip or handle 45, it will be apparent that when the hammer is in operation, the sleeve 40 may be normally held in different relative positions on the switch bar 17 so as to cause the thimble 38 to operate the sleeve and return the switch bar to its rearward position at a sooner or later period, thus regulating the frequency of the stroke of the plunger, and also the length thereof.

Inasmuch as the inner surface of the block 19 is ground so as to bear evenly upon the bed 21, it will be apparent that all air gaps are obviated, and since the contacts are embedded in insulating the noncombustible material, all possibility of sparking is effectually precluded during the movement of the contacts 20 and 20^a alternately into engagement with the stationary contact 22 upon the reciprocation of the switch bar 17.

From the foregoing description, in connection with the accompanying drawings, it will be apparent that I have provided an improved electric hammer in which the solenoid coils are so arranged as to have a long reach and exert a strong initial pull upon the plunger; in which the switching mechanism is so arranged that the reversal of the current to energize the rear solenoid does not occur until after the blow has been fully imparted; which may be conveniently controlled from the handle to start or stop the device, or regulate the length and frequency of movement of the plunger; which is positive in action; and which possesses certain other advantages that will become at once manifest to those familiar with devices of this character.

Having thus described the invention, what I claim is:

1. An electric reciprocating motor including a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, means for limiting the reciprocatory movement of the plunger in one direction, switching mechanism for alternately ener-

gizing the coils, an arm carried by and reciprocating with the plunger and extending in the direction of reciprocation thereof, and a member mounted for limited sliding movement on the arm and arranged, when the movement of the plunger in said direction is arrested, to slide on the arm in such direction by inertia to actuate the switching mechanism.

2. An electric reciprocating motor including a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, means for limiting the reciprocatory movement of the plunger in both directions, switching mechanism for alternately energizing the coils, an arm carried by and reciprocating with the plunger and disposed in the direction of the reciprocation thereof, and a member mounted for limited sliding movement on the arm and arranged, when the movement of the plunger in either direction is arrested, to slide on the arm in such direction by inertia to actuate the switching mechanism.

3. An electric reciprocating motor including a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and embodying a reciprocatory switch bar movably mounted independently of the plunger, and actuating means carried by and reciprocating with the plunger and coöperating with the switch bar to effect the reciprocation thereof by and upon the reciprocation of the plunger, the actuating means having a limited movement relative to the switch bar.

4. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger, an arm carried by and reciprocating with the plunger and disposed in the direction of the reciprocation thereof, and a member having a limited sliding movement on the arm by inertia and coöperating with the switch bar to effect the reciprocation thereof by and upon the reciprocation of the plunger.

5. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger and provided with a rigid collar, an arm carried by and reciprocating with the plunger and disposed in the direction of reciprocation thereof, a member having a limited sliding movement on the arm by inertia and arranged to impact against the collar to move the switch bar in one direction, and means disposed on the switch bar and coöperating with the member for moving the switch bar in the opposite direction.

6. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger and a member slidably mounted on the switch bar and provided with a clutch, and means carried by the plunger and coöperating with the member to clutch the same to the switch bar to effect the movement thereof to reverse the switch.

7. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including a switch bar and a member slidably mounted on the switch bar, an electric circuit in which said switch mechanism is included, a cut-off bar also included in said circuit and arranged in proximity to the switch bar, the member being spring-pressed toward the cut-off bar to move the same to break the circuit, and means for limiting the movement of the member under the influence of its spring.

8. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger and effecting the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger and a member mounted on the switch bar and having a clutch, an electric circuit in which said switch mechanism is included, a cut-off bar also included in the circuit and arranged in proximity to the switch bar, the member being spring-pressed toward the cut-off bar to move the same to break the circuit, means for controlling the movement of the member under the influence of its spring, and means carried by the plunger and coöperating with the member to clutch the same to the switch bar and move the latter in the opposite direction from the movement of the member under the influence of its spring.

9. An electric reciprocating motor comprising a casing, alining solenoid coils positioned within the casing in longitudinally spaced relation, the casing being formed intermediate of the solenoid coils with a longitudinal slot, a plunger of magnetic mate-

rial mounted in the solenoid coils and arranged to be reciprocated under the influence thereof, a housing secured on the exterior of the casing over the slot, switching mechanism movably mounted in the housing and adapted to alternately energize the solenoid coils, and means carried by and reciprocating with the plunger and operating in the slot and projecting into the housing for actuating the switching mechanism.

10. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism arranged to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger, actuating means carried by and reciprocating with the plunger and coöperating with the switch bar to reciprocate the same by and upon the reciprocation of the plunger, the actuating means having a limited movement relative to the switch bar, and means for regulating the limited movement of the actuating means relative to the switch bar, whereby to regulate the frequency and length of the stroke of the plunger.

11. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism arranged to alternately energize the coils and including a reciprocatory switch bar movably mounted independently of the plunger, actuating means carried by and reciprocating with the plunger and coöperating with the switch bar to reciprocate the same by and upon the reciprocation of the plunger, the actuating means having a limited movement relative to the switch bar, a movable handle, and means controlled by the movable handle for regulating the limited movement of the actuating means relative to the switch bar, whereby to regulate the frequency and length of the stroke of the plunger.

12. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, solenoid coils alternately influencing the plunger to effect the reciprocation thereof, switching mechanism adapted to alternately energize the coils and including relatively stationary and movable members of noncombustible and insulating material, the members having smooth bearing surfaces abutting against each other, a contact sunk in the stationary member flush with the bearing surface thereof, spaced contacts mounted in the movable member flush with the bearing surface thereof, said spaced contacts being electrically connected to the respective solenoid coils, and means for reciprocating the movable member across the stationary member in the direction in which the contacts of the former are spaced apart, to alternately engage said spaced contacts with the contact in the stationary member, the bearing surfaces of the stationary and movable members being smooth and fitting snugly against each other, whereby to obviate air gaps and sparking in the operation of the switch.

13. An electric reciprocating motor comprising a tubular casing, cup-like closures extending across and fitting snugly within the opposite end portions of the casing, longitudinally spaced solenoid coils disposed within the casing, hollow spools on which the coils are wound, cylindrical jackets inclosing the coils, the remote end portions of the solenoid coils fitting snugly within the respective cup-like closures and the adjacent end portions of the solenoid coils projecting inwardly beyond the cup-like closures to provide annular guide ways beyond the closures and between the casing and the inner end portions of the jackets, a plunger of magnetic material slidably mounted within the hollow spools of the solenoid coils and arranged to be reciprocated under the influence of said coils, a collar outstanding from the plunger intermediate of the solenoid coils, and circumferential flanges disposed oppositely from the collar and fitting snugly to the inner walls of the casing and within the corresponding guide ways and movable in the latter upon the reciprocation of the plunger.

14. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, a solenoid coil adapted to influence the plunger to effect the movement thereof in one direction, means for moving the plunger in the opposite direction, switching mechanism adapted to intermittently energize the coil and embodying a reciprocatory switch bar movably mounted independently of the plunger, longitudinally spaced members mounted upon the switch bar, and a member carried by and reciprocating with the plunger and movable between the spaced members and alternately against the same to effect the reciprocation of the switch bar, the member having a limited movement relative to the plunger.

15. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, a solenoid coil adapted to influence the plunger to effect the movement thereof in one direction, means for moving the plunger in the opposite direction, switching mechanism movably mounted independently of the plunger and arranged to intermittently energize the coil, and a member carried by and reciprocating with the plunger, the member having a limited sliding movement relative to the plunger and being adapted when the plunger has completed its movement in one direction, to slide relative

thereto by inertia to effect the movement of the switching mechanism.

16. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, a solenoid coil for influencing the plunger to effect the movement thereof in one direction, means for moving the plunger in the opposite direction, switching mechanism adapted to intermittently energize the coil and including a switch bar movably mounted independently of the plunger and a member carried by and movable relatively to the switch bar and provided with a clutch, and means carried by the plunger and cooperating with the member to clutch the same to the switch bar to effect the movement thereof to reverse the switch.

17. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, a solenoid coil adapted to influence the plunger to effect the movement thereof in one direction, means for moving the plunger in the opposite direction, an electric circuit in which the solenoid is included, a movable cut-off bar provided in said circuit, a member spring-pressed against the cut-off bar to move the same to open the circuit, and means for limiting the movement of the member under the influence of its spring.

18. An electric reciprocating motor comprising a reciprocatory plunger of magnetic material, a solenoid coil adapted to influence the plunger to effect the movement thereof in one direction, means for moving the plunger in the opposite direction, switching mechanism arranged to intermittently energize the coil and including a reciprocatory switch bar movably mounted independently of the plunger, actuating means carried by the plunger and cooperating with the switch bar to reciprocate the same by and upon the reciprocation of the plunger, the actuating means having a limited movement relative to the switch bar, and means for regulating the limited movement of the actuating means relative to the switch bar, whereby to regulate the frequency and length of the stroke of the plunger.

19. An electric reciprocating motor comprising solenoids coils, a reciprocatory plunger projecting into and movable under the influence of the respective coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocatory switch bar, and a sleeve slidably mounted thereon and provided with a clutch, an arm carried by and reciprocating with the plunger, and a thimble having a limited sliding movement on the arm and arranged to actuate the clutch to hold the sleeve on the switch bar and move the latter in one direction.

20. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the respective coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocatory switch bar, a sleeve slidably mounted thereon and provided with a clutch, a spring acting upon the sleeve to move the same along the switch bar in one direction, and means for limiting the movement of the sleeve under the influence of the spring, and means carried by the plunger and cooperating with the sleeve to clutch the same to the switch bar and move the latter in the opposite direction from the direction of movement of the sleeve, under the influence of the spring.

21. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocating switch bar and a sleeve slidingly mounted thereon and provided with a clutch, means carried by the plunger and cooperating with the sleeve for clutching the same to the switch bar to move the latter in one direction, and means for regulating the normal position of the sleeve.

22. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocating switch bar and a spring-pressed sleeve, means carried by the plunger and cooperating with the sleeve, and a member secured to the sleeve to limit the movement thereof under the force of the spring.

23. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocating switch bar and a spring-pressed sleeve, an operative connection between the plunger and the sleeve, a flexible connecting member secured at one end to the sleeve, and a sheave adapted to have the connecting member reeled thereon to limit the movement of the sleeve under the influence of its spring.

24. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocating switch bar and a spring-pressed sleeve, an operative connection between the plunger and the sleeve, a flexible connecting member secured at one end to the sleeve, a sheave adapted to have the connecting member reeled thereon to limit the movement of the sleeve under the force of its spring, and means for turning the sheave.

25. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a reciprocating switch bar and a spring-pressed sleeve, an operative connection between the plunger and the sleeve, a flexible connecting member secured at one end to the sleeve, a sheave adapted to have the connecting member reeled thereon to limit the movement of the sleeve under the force of its spring, and a rotary handle arranged to turn the sheave.

26. An electric reciprocating motor comprising solenoid coils, a reciprocatory plunger projecting into and movable under the influence of the coils, switching mechanism adapted to alternately energize the coils and embodying a switch rod, means for conducting current through the switch, a cutoff bar normally spring-pressed to close the current through the switch, and a sleeve slidably mounted on the switch bar and spring-pressed toward the cutoff bar to move the same and break the circuit, a handle, and means controlled from the handle for regulating the movement of the sleeve under the force of its spring.

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

BURTON M. DUTTON. [L. S.]

Witnesses:
W. H. MITCHELL,
S. W. JETER.