(No Model.) 3 Sheets—Sheet 1.

H. J. SMITH.

MAGNETO ELECTRIC MACHINE.

No. 534,288. Patented Feb. 19, 1895.

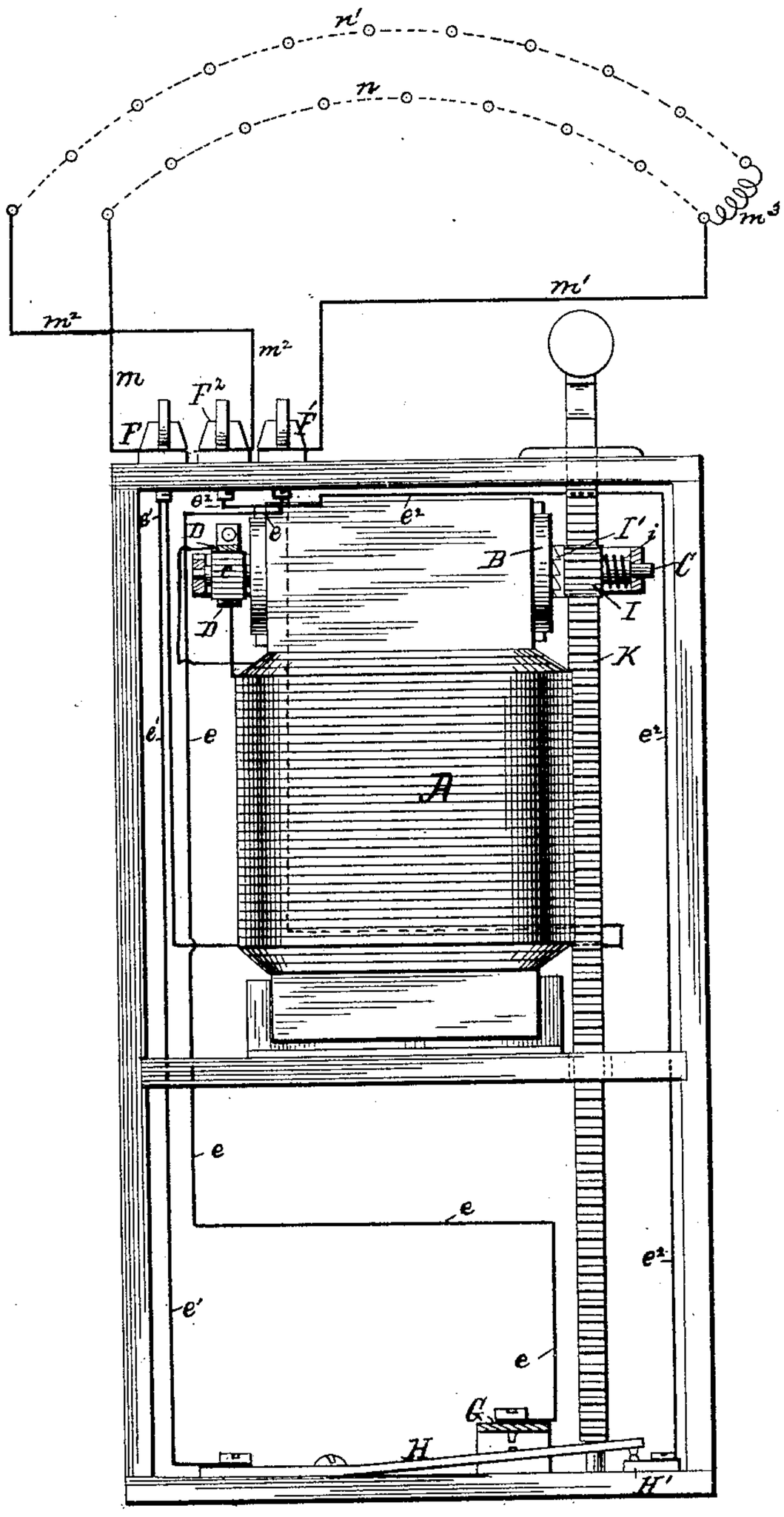

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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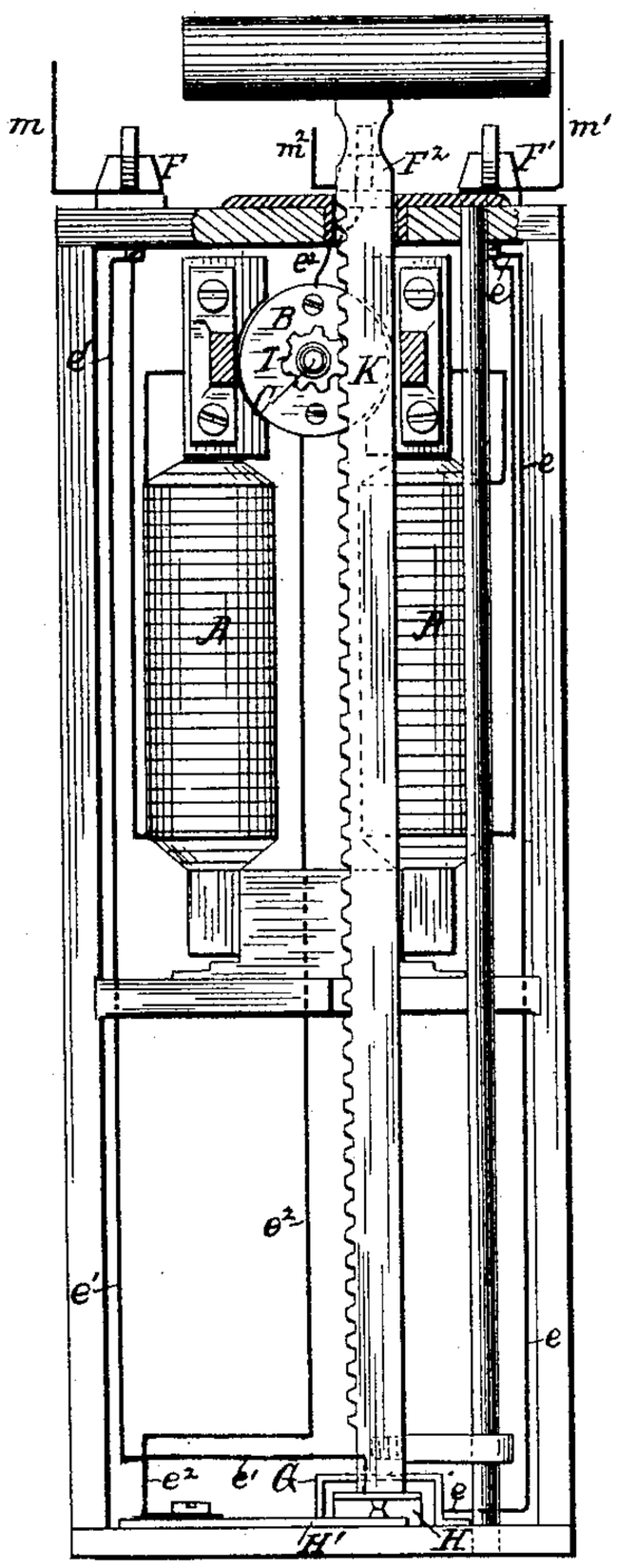

Fig. 2.

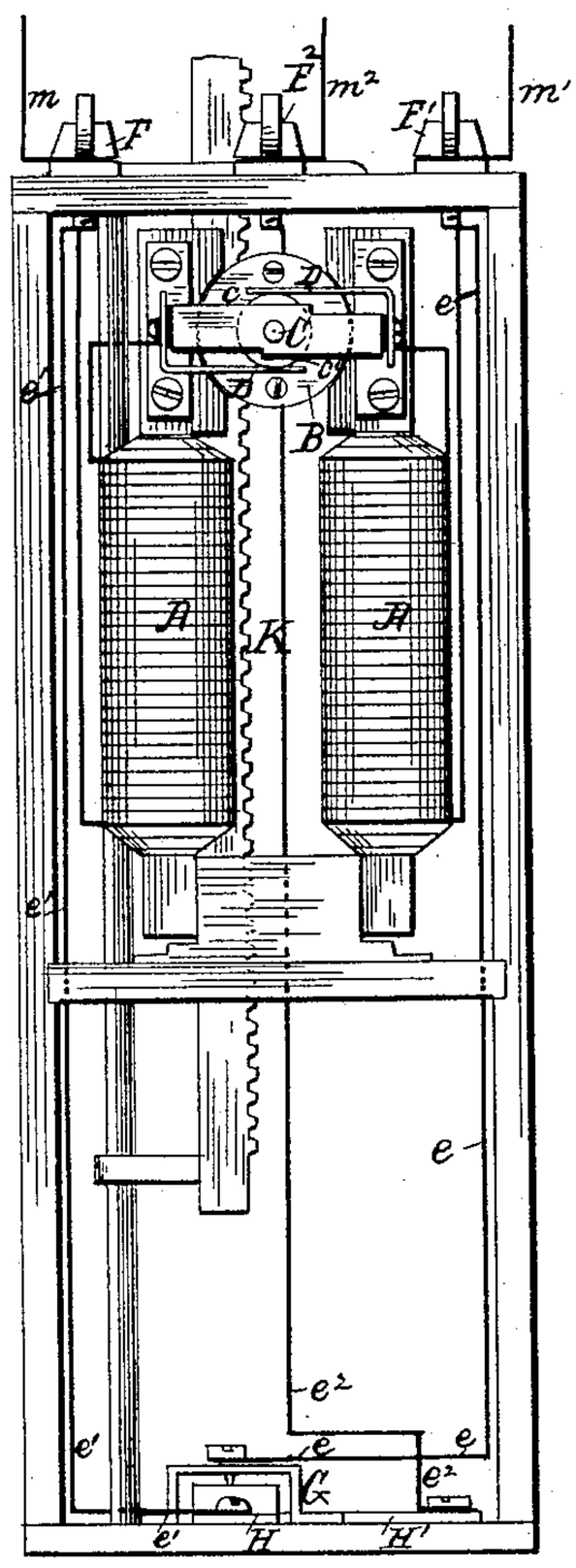

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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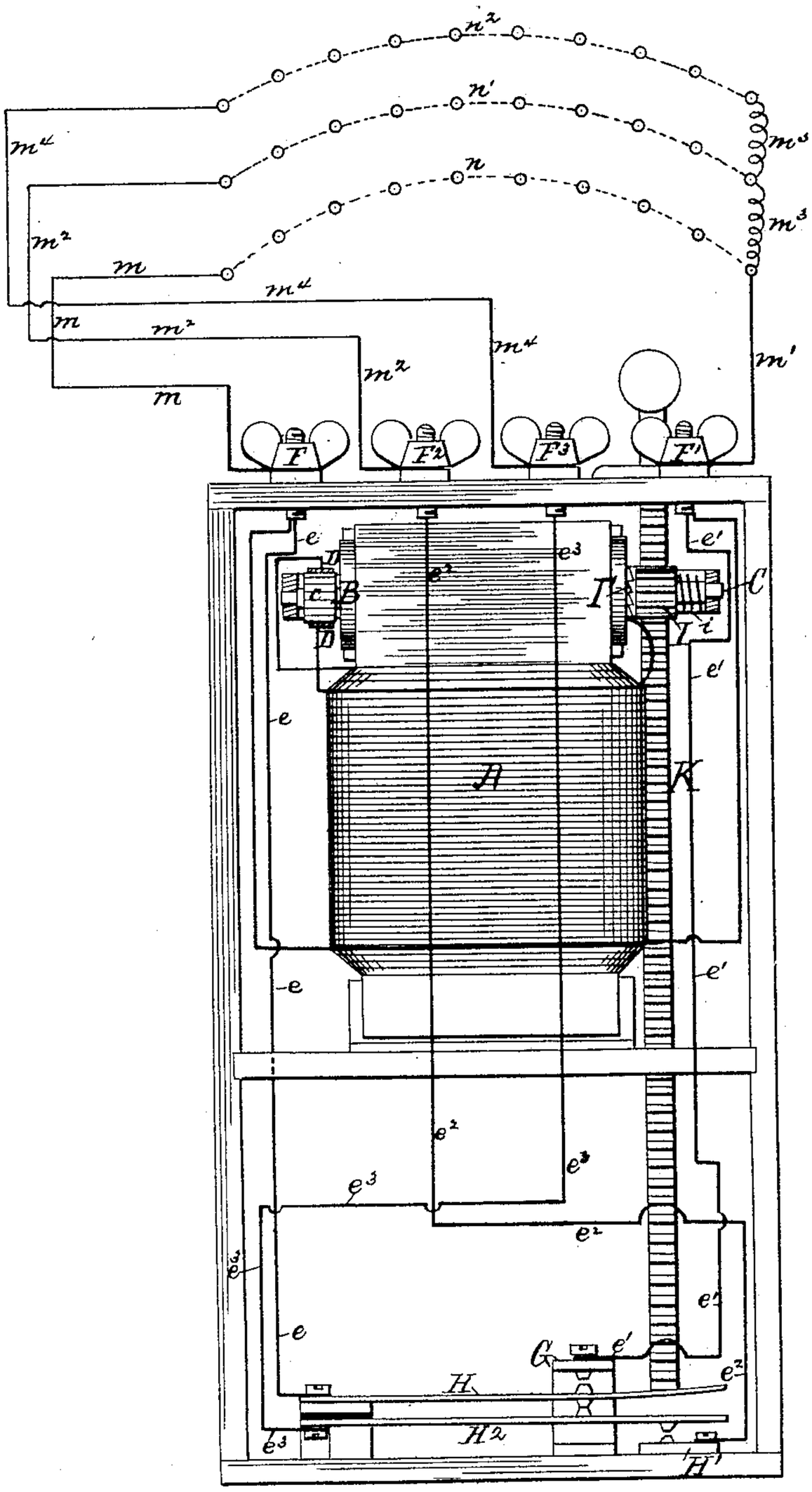

Fig. 4

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UNITED STATES PATENT OFFICE.

HENRY JULIUS SMITH, OF POMPTON LAKES, NEW JERSEY.

MAGNETO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 534,288, dated February 19, 1895.

Application filed June 8, 1894. Serial No. 513,956. (No model.)

To all whom it may concern:

Be it known that I, HENRY JULIUS SMITH, a citizen of the United States, residing at Pompton Lakes, county of Passaic, State of New Jersey, have invented certain new and useful Improvements in Magneto-Electric Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to that class of magneto-electric machines known as dynamo-magnetic machines, and which are used principally to develop an intense electric-current for application in firing fuses in blasting operations and analogous purposes. In machines of this class the electricity is developed by the rapid rotation of the armature and accumulated in the electro-magnets until a charge of adequate volume and intensity to effect the intended purpose has been obtained; and, as such machines are at present constructed, means are provided for automatically shifting the current from the condensing-circuit in the machine to a single outside circuit through which the desired effect is to be produced.

It has been found desirable, in order to obtain the greatest efficiency, especially in the firing of fuses in blasting, to rotate the armature with a velocity which increases from the beginning of its motion to the instant when the developed and accumulated current is shifted from the condensing-circuit to the working-circuit, and to effect this shifting of the current at the instant when the armature has attained the maximum of its rotation. To accomplish this a bridge or switch has been placed in the said condensing-circuit, in the path of the movement of the armature-operating device, and adapted to be opened by direct impingement of said device thereon, at or near the completion of its armature-operating stroke. By this means the fully developed current has been caused to pass to a single outside or working circuit, in which the fuses and their blast-charges are interposed, and to fire the same; but, owing in part to the fact that the energy accumulated in the condensing-circuit is not instantly dissipated when the current is passed therefrom to and traverses the said single working-circuit, and, in part, to the conservation of such energy by a continuance, in a degree, of the generation of the current subsequently to its shift to the said circuit, the current will possess or maintain a potency which will endure at least until the force imparted by the current to the blasting-charges is exhausted.

The object of my present invention is to provide means to utilize this enduring potency of the electric current for purposes of ignition in blasting-operations and analogous uses.

To this end, my invention consists in the combination with the operating-device of the rotary armature of a dynamo-magnetic electric machine, and a switch located, relatively to said armature-operating device, to have mechanical connection established with, and to be actuated by the movement to rotate said armature, of said operating-device, and adapted to pass the developed current from the circuit, in such machine, in which the current is generated and condensed, to an outside or working-circuit, by said mechanical connection of said device with said switch, of an additional switch or switches, or terminal, or terminals, one or more, adapted to successively pass the current from said working-circuit to an additional independent working-circuit or circuits, and located to have electrical contact successively established with the said first switch and with each other, by a continuance of the movement of said armature-operating device, before the potentiality thereby successively imparted to the ignitible devices interposed respectively in the several circuits is therein respectively exhausted.

Figure 1 is a side elevation of a dynamo-magnetic machine containing my invention. Figs. 2 and 3 are respectively end elevations of the opposite ends of the machine; and Fig. 4 is a side elevation of a machine illustrating a modification of my invention.

A is an electro-magnet, between the curved recesses on the inner faces of the poles of which is the armature B, which is journaled by its arbor, C, to rotate in brackets secured to opposite ends of the magnet-poles. Upon one end of the armature-arbor is arranged a commutator of the ordinary construction, consisting of the semi-cylindrical plates *c c'* suitably insulated from each other and the arma-

ture and each connected with one end of the wire with which the armature is wound, and the springs D D bearing respectively on said plates and respectively connected with the magnet-coil terminals. The opposite magnet-coil terminals are connected to screw posts F F′, respectively, and said posts are connected by wires *e*, *e′*, respectively, with a bridge G and spring-terminal H, the said bridge spanning the upward curved end of said spring-terminal, which is in contact with said bridge, and which contact is preserved by the tension of the said spring-terminal when in normal position, as shown. The circuit thus formed by the magnet-coils, wires *e*, *e′* and their described terminals in contact, and which constitutes the condensing-circuit, is thus kept closed. During the development of the current, by the rotation of the armature, the current is, in this machine, traversing two circuits, or, a main circuit divided through a portion of its length into two unequal parts; of which one, constituted by the wires *m*, *m′*, running from the posts F F′, respectively, is an outside or working-circuit in which fuses *n* are interposed; and through this outside circuit only a small portion of the volume of the current passes during its development, as the resistance of this circuit is the greater; while through the described condensing-circuit within the machine the larger portion of the current passes and accumulates, as the resistance of this circuit is the lesser.

In this machine the armature-operating devices comprise a loose-pinion I mounted on an end of the armature-arbor, and adapted, by means of the clutch I′ and spring *i*, when rotated in one direction, to rotate the armature, but to rotate freely in the opposite direction without moving the armature. They also comprise a reciprocatory rack-bar K, which meshes with the said pinion I, and which is of such a length that when it approximates the limit of its movements in the direction to accomplish the rotation of the armature, and the armature has attained its maximum velocity, its end will impinge upon the free extremity of the spring-terminal II, which is, for this purpose, located in the path of the movement of said bar and remove said terminal from contact with said bridge G. By this means the described condensing-circuit is shifted from said condensing-circuit or working-circuit *m*, *m′*, in consequence of the breaking of said condensing-circuit, and fires the fuses *n* in said working-circuit.

I make no claim herein to the combination, in a dynamo-magneto electric machine, of the devices thus far particularly described, as the same has been patented to me under Letters Patent No. 210,296; nor, do I wish to be understood as confining myself in my present invention to the combination with the further devices to be presently herein described of the specific devices hereinbefore particularly described which constitute the generating appliance and a means for shifting the generated current from the circuit in the appliance in which the current is generated and accumulated, to an outside or working-circuit; inasmuch as any known or equivalent appliance may be employed to generate and accumulate the electric current; and the armature may be operated by the use of levers, segments of circles, or other well-known devices for producing intermittent or reciprocating motion, while the shifting of the current from the circuit in which it is generated and condensed to the working-circuit, may be accomplished by any other of the well-known positively operated switch-devices, located in such relation to said armature-operating device as to have mechanical connection established with, and to be actuated by the movement of the armature-operating device to rotate the armature, substantially as described.

At II′, Figs. 1, 2, and 3, I show a terminal, or anvil, which is located relatively to the spring-terminal II, so as to be struck by, and have electrical contact thereby established with it, by the said spring-terminal H, owing to a continuance of the movement of the operating-device K in the direction to rotate the armature, after contact between the bridge-terminal G, of the condensing-circuit, and said spring-terminal II has been broken by the flexure or movement of the terminal II, due to the impingement upon it of said operating-device K. The said terminal II′ is electrically connected to a screw-post F^2 by a wire e^2, and from said post extends a line-wire m^2, which is united to wire *m′* by a wire m^3, thus constituting an additional and independent working-circuit m^2, m^3, *m′*, in which fuses *n′* are interposed.

In Fig. 4 I show a second spring-terminal II^2 interposed between the spring-terminal II and the terminal II′ and suitably insulated, and located relatively to said other terminal so as to be struck by and have electrical contact thereby established with it by the terminal II, owing to the continued movement of the armature-operating device K in the direction to rotate the armature, as hereinbefore set forth, and to subsequently strike, and thereby establish electrical contact with, the terminal II′, owing to the flexure or movement of said terminal II^2 together with that of terminal II due to a further continued movement of the said armature-operating device in the direction to rotate the armature. The said terminal II^2 is electrically connected to a screw-post F^3 by a wire e^3, and from said post extends a line-wire m^4 which is united to wires *m′* m^3 by a wire m^5, thus constituting a further additional independent working-circuit in which fuses n^2 are interposed.

Now it is evident that during the movement of the armature-operating device K, in the direction to rotate the armature, and preferably, as set forth, when the armature thereby approximates the maximum of its velocity, mechanical connection will be effected between the said operating device and the ter-

minal H, thereby shifting the developed current from the circuit in the machine in which it has been generated and accumulated, to the first described working-circuit in which are the fuses *n*, which are thereby fired; and thereafter thereby establishing contact between the terminal H and terminal H^2; or successively establishing contact between terminal H, terminal H^2 and terminal H′, so that the current may pass successively from the condensing-circuit to said first working-circuit firing the fuses *n* therein, and the second described working-circuit, in which are the fuses *n*′ which are thereby fired; or successively from the condensing-circuit to the several described working-circuits, successively firing the fuses *n*, *n*′ and n^2 respectively interposed in said working-circuits; and it is evident that the said several described terminals may be arranged relatively to each other and to the armature-operating device, as shown, that so limited, though appreciable spaces of time will successively elapse between the shift of the current from the condensing-circuit successively to the several described working circuits, that the current, the energy of which in the condensing-circuit, after the current has been initially shifted to the first described working-circuit, is conserved by the continuance of the rotation of the armature, owing to the continued movement in the direction to rotate the armature as described, of the armature-operating device in successively establishing the several described terminal contacts, will successively pass to the several working-circuits before the potentiality imparted by it to the fuses respectively interposed in the several circuits is therein respectively exhausted.

I do not limit myself to switches and terminals in the form shown and described; as it is obvious that any of the well-known terminals or positively operated switching-devices may be employed in place thereof, arranged relatively to the armature-operating device and adapted to be actuated thereby in its movement in the direction to rotate the armature, without variation from the essential nature of my invention.

It is apparent that by means of my invention the potency or energy existing after it has been shifted to and has traversed an initial working-circuit, in the single developed electric-current, and which is conserved, in the circuit in which it is generated and accumulated by a continuance, subsequently to its shift to said initial working-circuit, of the rotation of the armature due to the described continued movement of the armature-operating device, may be utilized to pass to and do effective service in blasting operations in an additional working-circuit, or circuits, successively; and that, thereby, in blasting-operations, several independent working-circuits may be constituted extending, respectively, from the generating-appliance to blasting-charges located at progressively increasing distances from the surface or outward wall of the rock or other material to be dislodged, and that a single electric current may be passed successively over the several circuits, whereby the charges in the holes nearest the outward rock-face may be initially exploded and the outward layer of rock be initially dislodged, and, subsequently, the charges in the holes at progressively increasing distances from the first holes may be successively exploded and successive layers of the rock dislodged.

I make no claim herein to the method of utilizing electricity for purposes of ignition in blasting-operations, which consists in passing an electric-current, from a circuit in which it is generated and accumulated, over a circuit in which ignitible devices are interposed, and subsequently, and before the potentiality successively imparted by the said current to the ignitible devices in the several circuits is therein respectively exhausted, passing the said current over an additional independent circuit, or circuits, one or more, successively, in which additional circuits further ignitible devices are interposed; but I reserve the same herefrom and have made it the subject-matter of claim in a separate application for Letters-Patent, Serial No. 513,957; nor do I make claim herein to the improvement in the art of blasting which is, in part attainable by my present invention, and which consists in locating blast-holes, in the rock, or other material to be dislodged, at progressively increasing distances, successively, from the surface or outward face of the rock-wall; constituting a series of independent electric circuits extending severally from an electrical generator to the blast-holes, respectively, with the fuses or other ignitible devices of the blasting-charges in said several holes interposed in said circuits respectively; and causing a single electric-current to successively traverse said several circuits before the potentiality thereby successively imparted to the blasting-charges interposed in the several circuits is therein respectively exhausted; but I reserve the same herefrom and make it the subject-matter of claim in said separate application for Letters-Patent, Serial No. 513,957.

What I claim as my invention, and desire to secure by Letters Patent, is—

In a dynamo-magneto electric machine, the combination with the armature-operating device, and a switch located, relatively to said armature-operating device, to have mechanical connection established with, and to be actuated by the movement, to rotate said armature, of said operating-device, and adapted to pass the developed current from the circuit in the machine in which the current is generated and condensed to an outside or working circuit, by said mechanical connection of said device with said switch, of an additional switch, or switches, terminal, or terminals, one or more, adapted to successively

pass the current from said first working-circuit to an additional independent working-circuit or circuits, one or more, and located to have electrical contact successively established with the said first switch and with each other, by a continuance of the movement of said armature-operating device, before the potentiality successively imparted by said current to the ignitible devices interposed respectively in the several circuits is therein respectively exhausted, substantially as and for the purpose specified.

H. JULIUS SMITH.

Witnesses:
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