2 Sheets—Sheet 1.

H. J. SMITH.

Magneto-Electric Machine.

No. 201,296. **Patented March 12, 1878.**

Fig. 1.

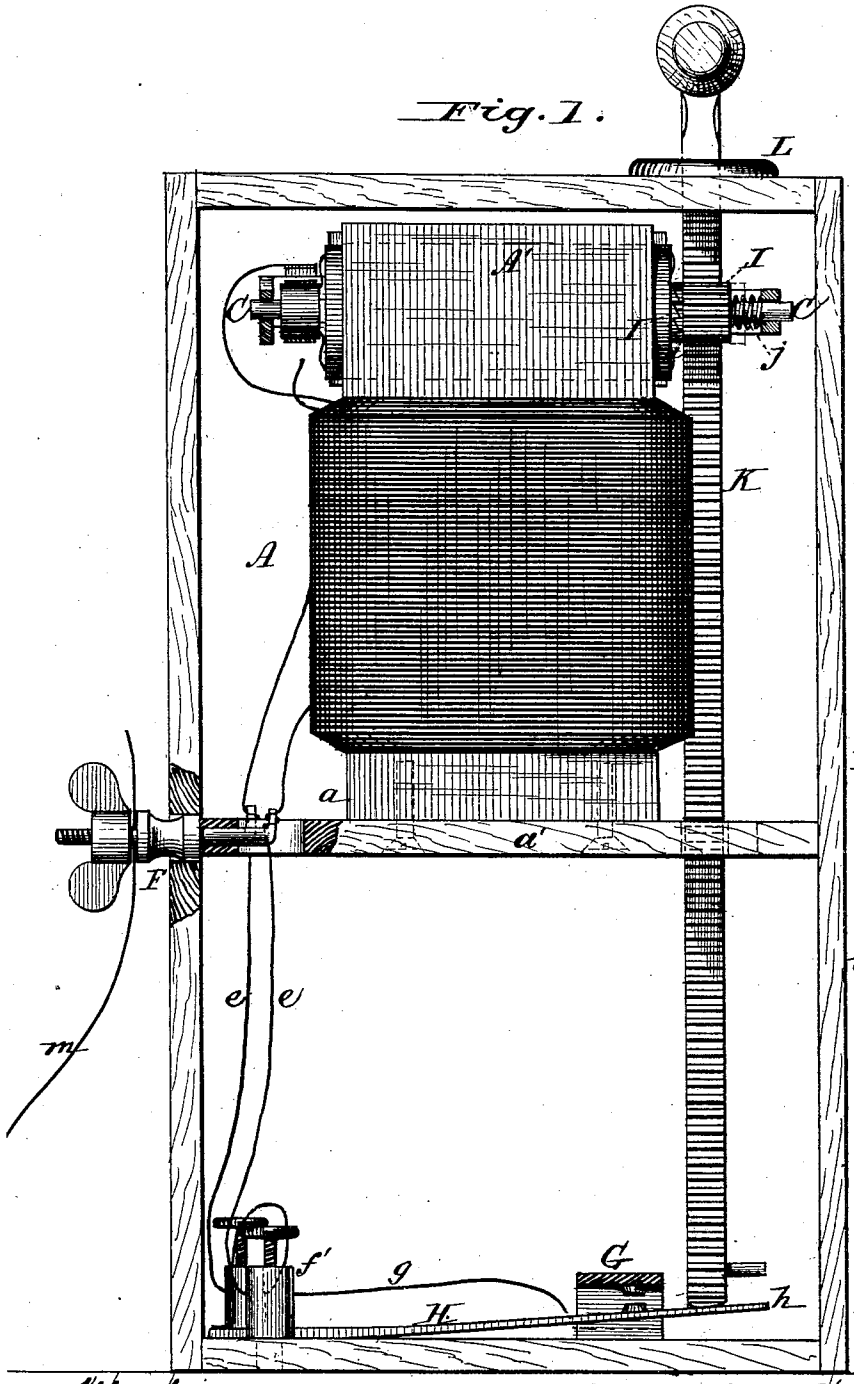
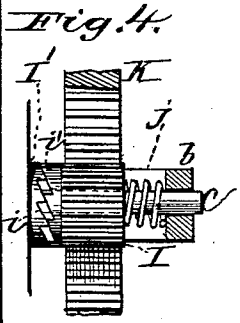


Fig. 4.



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2 Sheets—Sheet 2.

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Fig. 3.

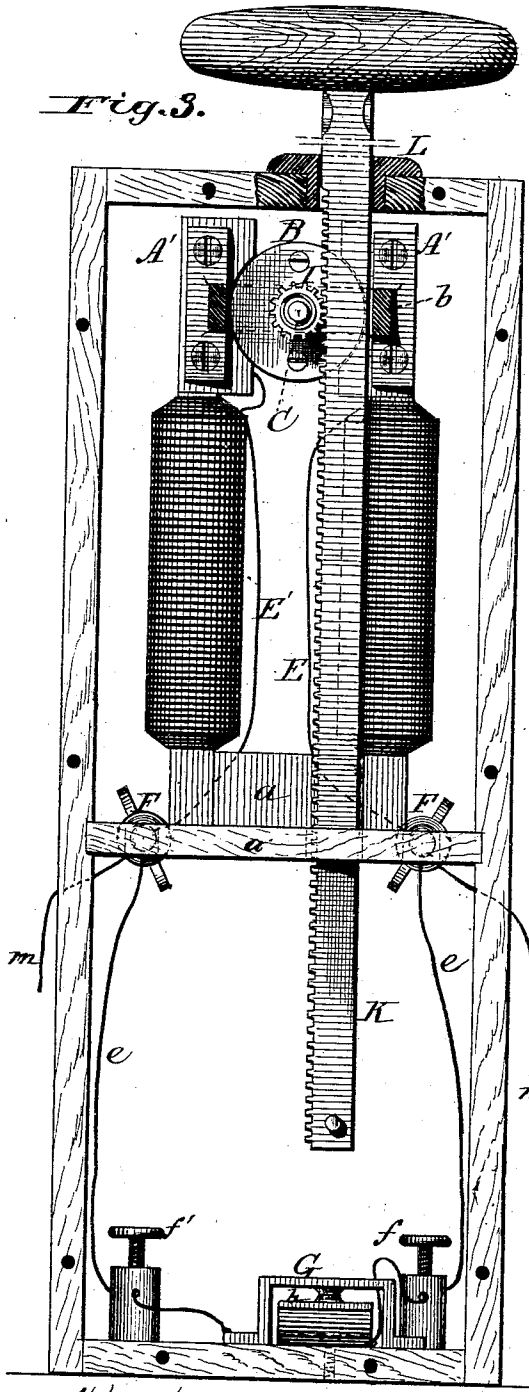
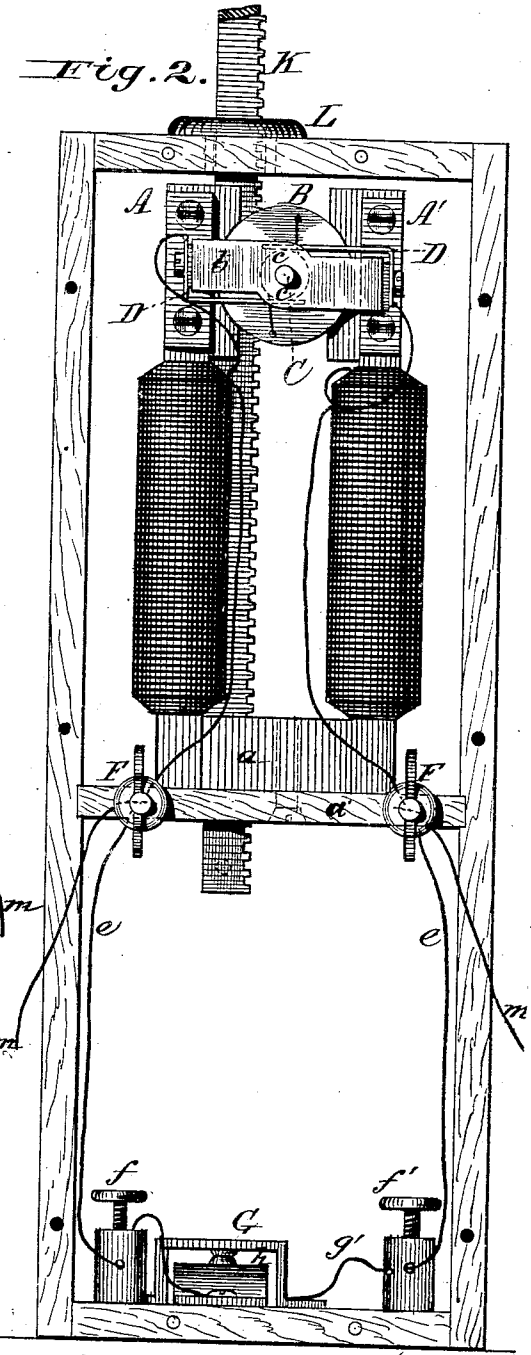


Fig. 2.



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UNITED STATES PATENT OFFICE.

H. JULIUS SMITH, OF MOUNTAIN VIEW, NEW JERSEY.

IMPROVEMENT IN MAGNETO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **201,296**, dated March 12, 1878; application filed January 17, 1878.

To all whom it may concern:

Be it known that I, H. JULIUS SMITH, of Mountain View, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Magneto-Electric Machines, of which the following is a specification:

This invention relates to certain improvements in that class of magneto-electric machines used chiefly for developing an intense current of electricity for firing fuses in blasting or igniting gas-jets, and known as "dynamo-magnetic machines."

It is well known that in a machine of this class the electricity is developed and accumulated in the electro-magnets until a sufficient charge to effect the desired purpose has been obtained, the current being automatically shifted at the proper moment from the condensing-circuit to a circuit through which the effect intended is to be produced.

The intensity of the electric current produced by this and other magneto-electric machines depends upon the rapidity with which the armature is rotated, and the motion has heretofore been obtained by devices giving a uniform motion; but I have found that in order to obtain the best effect, especially in a machine used for firing blast-fuses, the armature should have an accelerated velocity of rotation, its speed increasing from the beginning of its movement to the instant of discharge or shifting of the current from the condensing to the working circuit, and it is important that this shifting should occur promptly at the instant the rotating device has reached the limit of play arranged for its assigned culmination of speed.

The shifting of the current in machines heretofore constructed has been performed by hand and by an automatic switch governed and operated by the electric current, the latter means being preferable; but I have still found such switches rather objectionable in use, owing to the complication of the apparatus and liability to derangement of the parts.

It is the object of my invention to overcome the objections which I have mentioned.

To this end it consists, first, in the combination, with the operating device of the rotary armature of a dynamo-magneto electric machine, of a bridge or switch arranged in the condensing-circuit of said machine and in the path of said operating device, and adapted to be opened by direct impingement of said device thereupon; second, in the combination, with the operating rack-bar of the rotary armature of a dynamo-magneto electric machine, of a shunt or bridge consisting of a spring-bar terminal of the condensing-circuit and a rigid terminal plate, with which said spring-bar is kept in contact by its elasticity, said spring-bar being arranged in the path of the rack-bar, so as to be struck and moved from the rigid terminal by said rack-bar at or near the completion of its armature-operating stroke, whereby the condensing-circuit of the machine is broken by the displacement of the shunt or bridge, and the whole developed current of electricity required to pass to a working circuit for application, substantially as above set forth; third, in the combination, with the rotating armature of a dynamo-magneto electric machine, of a loose pinion arranged upon the arbor of said armature, a rack-bar gearing with said pinion, and a clutch for engaging with and disengaging from said pinion, causing the arbor and armature to revolve therewith when rotated in one direction, but which disengages therefrom and permits said pinion to revolve in the opposite direction independently of the arbor and armature, whereby is secured a rotation of the armature in one direction only, and depolarization of the magnet or magnets prevented.

In the drawing, Figure 1 represents a side elevation of machine constructed with my improvements, a portion of the bracket supporting the armature-bearing being broken away to show the loose pinion and spring-clutch on the armature-arbor. Fig. 2 is a front elevation, the bearing-bracket being broken away to show the commutator. Fig. 3 is a rear view, showing the armature-operating rack and pinion.

The letter A represents an electro-magnet, the base *a* of which is secured to the shelf *a'* of the inclosing-case. The cores of this electro-magnet terminate in enlarged rectangular poles A' A', having curved recesses on their inner faces, between which is arranged the rotary armature B, which is journaled in brack-

ets *b b'*, secured to opposite ends of the poles of the magnet. Said armature consists of a cylinder of soft iron, slotted longitudinally on opposite sides for the reception of the coil of insulated wire *b'*, with which said armature is wrapped.

The armature is arranged to rotate between the curved faces of the poles A' A', and as nearly as possible to the surfaces thereof, which are formed to correspond to the cylindrical shape of the armature.

C is the arbor or shaft of the armature, and upon one end of the shaft or arbor is a commutator of the ordinary construction, consisting of two semi-cylindrical plates, *c c*, of metal, attached to the arbor or shaft of the armature, and suitably insulated from each other and from the armature.

Each plate is connected with one end of the wire with which the armature is surrounded, and on said plates, respectively, the springs D D are made to bear, said springs being respectively connected with the coil-terminals E E of the electro-magnet.

The opposite coil-terminals E' E' are connected to the inner ends of screw-posts F F, and these rear ends of the metal screw-posts are also connected, by wires *e e*, with metal binding-posts *f f'*, located at the bottom wall of the wooden inclosing-case, and from the other metal binding-post, *f'*, a wire, *g'*, leads to and is connected with a bridge or loop, G, also secured to the bottom of the inclosing-case, and spanning the upward curved end *h'* of the spring-bar H, and is in contact therewith, this contact being preserved by the elasticity of the said spring-bar, which thus keeps closed the circuit formed by the wires surrounding the electro-magnet A and the intermediate connections. This circuit I call the "condensing-circuit," for reasons which will presently appear.

Upon the end of the arbor or shaft C of the armature opposite to that upon which the commutator is arranged is mounted a loose pinion, I, upon the inner end edge of which are formed ratchet-teeth *i*, which mesh with the oppositely-inclined teeth *i'* of a clutch, I', firmly secured to the shaft or arbor C. Against the opposite end of the loose pinion I presses a spring, *j*, coiled around the shaft or arbor C and abutting against the bracket *b'*. This spring forces the pinion against the clutch I', and causes the teeth *i'* to mesh with the teeth of the clutch I'. K is a vertically-reciprocating rack-bar moving in a guide, L, arranged in the top of the inclosing-case. The teeth of the rack-bar mesh with the pinion I, and said bar has a length approximately equal to the height of the case of the machine, so that when said bar is fully depressed its lower end strikes and depresses the free end of the spring-bar H, and removes said spring-bar from contact with the bridge or loop G, thus breaking the condensing-circuit; and when said circuit is broken at the point it will flow over a circuit formed by wires connected to the screw-posts F F, and having their outer terminals arranged for applying said current for the purpose desired.

The operation of my invention will be readily understood from the foregoing description. The machine is placed in condition for operation by drawing the rack-bar upward to its limit, this movement being performed without communicating motion to the armature as the loose pinion slips by the clutch I' when rotated by the upward movement of the said bar. Upon the depression of this bar, however, the pinion I engages with the clutch, and the armature thus caused to rotate, by which means induced currents of electricity are generated in opposite directions, and are converted into a continuous current by means of the commutator. The currents are continually augmented in quantity, and also in intensity, by the increasing velocity of rotation of the armature, and are turned, through the springs D, into the electro-magnet coils and connections, which, for this reason, I have termed the "condensing-circuit." When the rack-bar has nearly reached the downward limit of its movement, its lower end strikes upon the free end of the spring-bar H, removing said spring from contact with the bridge or loop G, and breaking the condensing-circuit, upon which, as will be readily understood, the whole current will flow over the working-circuit or circuit of application, which is formed by wires *m m* connected to the screw-posts F F, with which opposite ends of the electro-magnet coils or condensing-circuit are also connected. During its development the current is traversing two circuits, or a main circuit divided through a portion of its length into two unequal parts, of which one, formed by continuation of wire *m m*, is the circuit in which the fuses are situated or interposed, and through this outside circuit there is, during the process of developing the current, a small portion only of the volume of the current passing as the resistance of this circuit is greater. At the same time, through the other or the condensing-circuit, which surrounds the electro-magnet within the machine proper, a portion of the current is passing greater by far than the portion passing at this moment through the outside or fuse circuit, by reason of the much less resistance offered in the short or condensing circuit, which, being broken, the now fully-developed current is obliged to pass through the outside or fuse circuit.

I may add that, in its passage through this latter circuit, it (the current) meets resistance in each fuse of a platinum-wire bridge, which, by that resistance, is heated to redness, or more, thus igniting the priming in the manner ordinarily employed in electrical blasting apparatus.

Although I have in this machine shown a rack or pinion for operating the armature, it is obvious that the result attained can be accomplished by the use of levers, segments of circles, or other well-known devices for produc-

ing intermittent or reciprocating motion. The advantage of this employment of intermittent motion is that, the rack being moved by the exertion of muscular force, the operator can, with very little practice, learn to graduate the force of the stroke by which the rack is driven downward, so as as to increase the rapidity of rotation of the armature from the beginning to the instant when the rack-bar strikes the spring-bar or switch-spring and removes it from contact with the bridge G, which method of rotation I have found to produce the most favorable results. As the rack-bar, to be adjusted for again operating the armature, must be moved in an opposite direction from its operative stroke, a device for disengaging the armature is necessary, in order that it shall not be rotated in reverse directions, the consequence of which would be a depolarization of the magnets, impairing the efficiency of the machine.

Though I have shown a disengaging and engaging tooth-clutch, it is plain the desired end may be reached by any device which causes disengagment of either the pinion from its shaft or the rack from the pinion on the back stroke.

Further, I would say that I do not confine myself to a spring-switch for shifting the current from the condensing-circuit to the working-circuit or circuit of application, as the shifting of said current may be performed by various positively-operating devices actuated by the device which communicates rotary motion to the armature, and arranged in such relation thereto as to effect the shifting of the current at the instant of maximum speed of said armature.

Having now fully described the construction and operation of my invention, I claim—

1. The combination, with the operating device of the rotary armature of a dynamo-magneto electric machine, of a bridge or switch arranged in the condensing-circuit of said machine, and in the path of said operating device, and adapted to be opened by direct impingement of said device thereupon, substantially as and for the purpose set forth.

2. The combination, with the operating rack-bar of the rotary armature of a dynamo-magneto electric machine, of a shunt or bridge consisting of a spring-bar terminal of the condensing-circuit and a rigid terminal plate, with which said spring-bar is kept in contact by its elasticity, said spring-bar being arranged in the path of the rack-bar, so as to be struck and removed from the rigid terminal by said rack-bar at or near the completion of its armature-operating stroke, substantially as described, whereby the condensing-circuit of the machine is broken and the developed current of electricity caused to pass wholly to a working-circuit for application to its intended purpose.

3. The combination, with the rotating armature of a dynamo-magneto electric machine, of a loose pinion arranged upon the arbor of said armature, a rack-bar gearing with said pinion, and a clutch for engaging with and disengaging from said pinion, causing the arbor and armature to revolve therewith when rotated in one direction, but which disengages therefrom and permits said pinion to revolve in the opposite direction independently of the arbor and armature, substantially as described, whereby is secured a rotation of the armature in one direction only, and depolarization of the magnet prevented.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

H. JULIUS SMITH.

Witnesses:
EDWARD GREENE,
JNO. J. COTT.