E. BÜRGIN.

Magneto-Electric and Electro-Magnetic Machine.

No. 206,084. Patented July 16, 1878.

Fig. 1.

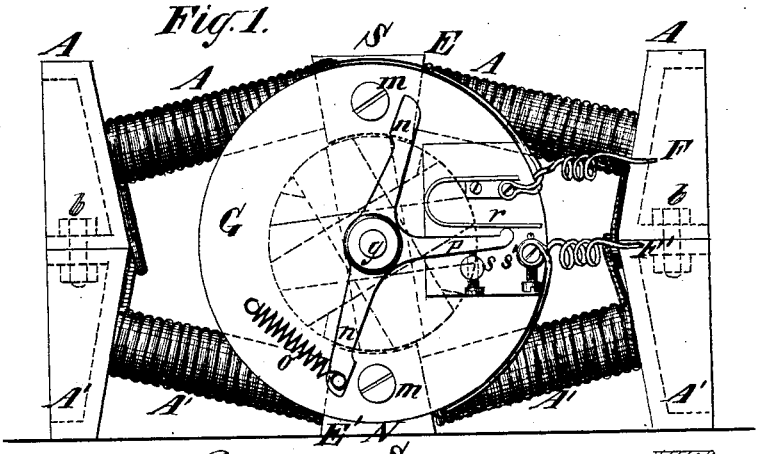



Fig. 2.

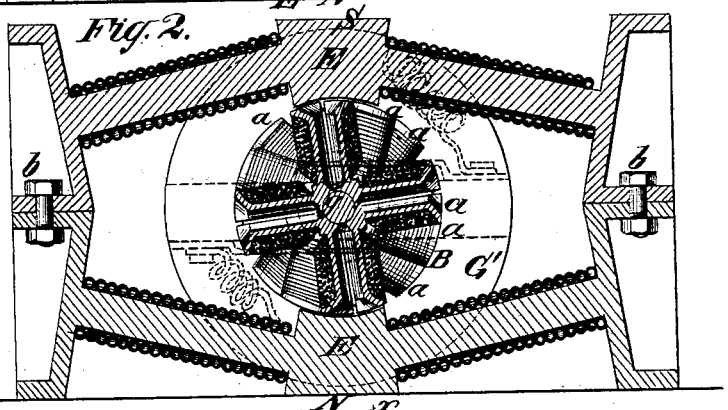
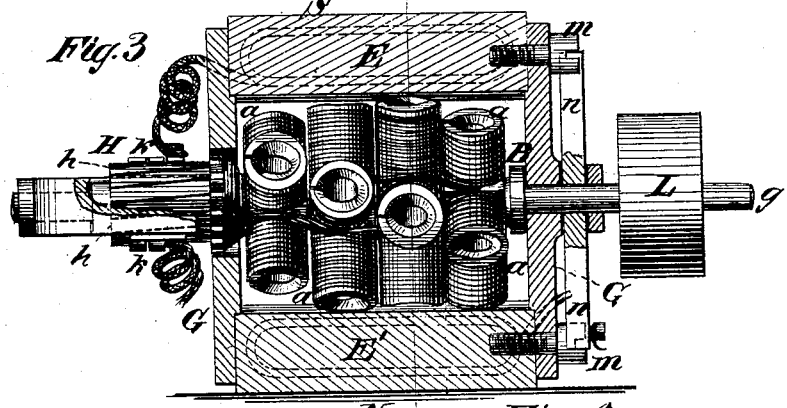
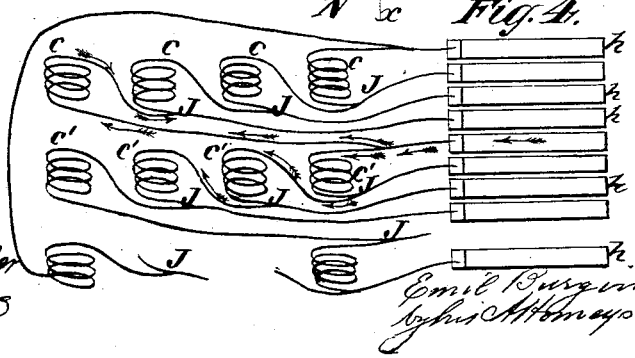



Fig. 3




N x

Fig. 4.

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EMIL BÜRGIN, OF NEW YORK, N. Y.

## IMPROVEMENT IN MAGNETO-ELECTRIC AND ELECTRO-MAGNETIC MACHINES.

Specification forming part of Letters Patent No. **206,084**, dated July 16, 1878; application filed August 28, 1877.

*To all whom it may concern:*

Be it known that I, EMIL BÜRGIN, of the city and State of New York, have invented an Improvement in Magneto-Electric and Electro-Magnetic Machines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification.

This invention relates to magneto-electric machines, which machines may also be used as electro-motive engines; and it consists in improvements in construction of the generative cylinders of such machines; in such a construction of the magnets that the generative-cylinder may be run closer to the magnets than heretofore, thus increasing the effectiveness of the machine; and in an automatic discharging device for firing cartridges, or charges of explosives in mines, torpedoes, submarine blasts, &c.

Figure 1 in the drawing is a side view of a machine constructed in accordance with my invention. Fig. 2 is a vertical longitudinal section of the same on the line *x x* in Fig. 3. Fig. 3 is a partial vertical and central section of the machine, and a side view of the generative cylinder and some of its attachments. Fig. 4 is a diagram illustrating the construction of the generative cylinder, and explaining the arrangement of the elements and their coils, and the connections of the coils with each other and the commutator.

A and A′ are electro-magnets, each of which is formed of a single piece of cast-iron. The said two magnets are attached firmly to each other at *b*, and their coils are wound in such a manner that the poles (indicated by the letters N and S) are in the middle of each magnet, which part of said magnets is enlarged, as shown at E and E′ in Figs. 1, 2, and 3. Said enlarged parts E and E′ have their inner surfaces concave, to fit as closely as is practicable the contour of the generative cylinder B, Figs. 2 and 3, and yet allow the free turning of the said cylinder between them. The said magnets are, moreover, made straight on each side of the middle enlarged parts E and E′, said straight parts being the parts upon which the helices are placed, and the said straight parts of each magnet are inclined toward the corresponding parts of the other magnet in such manner as to act like braces. Each of said straight parts has a terminal enlargement or abutment, said abutments being bolted together at *b*. This construction gives to the conjoined magnets a truss-like effect, by which their middle poles are prevented from being drawn against the cores of the generative cylinder. By this construction I am enabled to place the middle poles so near the cylinder as greatly to increase the efficiency of machines employing magnets with middle poles.

F and F′, Fig. 1, represent the conducting-wires of the main circuit leading off from the coils of the electro-magnets A and A′.

The generative cylinder consists of elements, each of which is a cruciform core, *a*, with a coil on each arm of the cross, said elements being arranged in such manner that the limbs of the cruciform elements form spiral or helical ranks or ranges relatively to their common axis of revolution. The arms of the cores of the said elements *a* are hollow cylinders of soft wrought-iron, expanded at their outer ends, and are slotted on one side to prevent induced currents. They are all attached to a common shaft, *g*, which has its bearings in or supported by the plates G G′, attached to the enlarged portions E and E′ of the magnets A and A′.

Near one end of said shaft *g* is attached to the same a commutator, H, Fig. 3, which consists of a series of insulated conducting-plates, *h*, Figs. 3 and 4, arranged in an insulating-cylinder on the said shaft, obliquely to the axis of said shaft, and metal springs *k*, Fig. 3, connected with the circuit-wire of the coils of the electro-magnets A A′, and pressing upon opposite plates in the insulating-cylinder.

The coils are arranged in such manner that the current, in passing from that plate of the commutator upon which one of the springs presses and through which the current enters the wire of the generative cylinder, passes through each coil in each range or rank of coils in the same direction, beginning in one rank of the coil farthest from said plate, and in the next rank at the coil nearest to said plate; but the current passes through all the ranks of coils between the two plates in contact with the springs *k* on one side of the generative-cylinder in an opposite direction from that in which it passes through the coils on the opposite side of the said cylinder. Hence the effects of attraction on one side of each of

the poles of the electro-magnets and of repulsion on the other side are combined when the machine is used as an electro-motive engine.

The method of winding and connecting the coils is illustrated in Fig. 4, where the plate *h*, with an arrow marked thereon, represents one plate of the commutator in contact with one of the springs *k*, and *c* represents the coils in a rank on one side of said plate, and *c'* represents the coils in a rank on the other side of said plate. The curved arrows represent the course of the current, which is divided into two branches immediately after leaving the plate of the commutator, and passes in different directions through the coils *c* and *c'*, and in returning to the opposite commutator-plate unites again into one current.

By junctions J of the conducting-wires, each of the coils is connected to the next coil in the same rank, and also to a plate in the commutator, and the last coil in any rank is connected with the first coil in the next rank. This arrangement of the coils and their connections with each other and the commutator-plates, and the helical arrangement of the ranks of cores and coils, causes one or more of the elements to be constantly acting at each pole of the magnets A and A', and renders the action of the machine very uniform and continuous.

For producing an electric current, the magnets A and A' are (if not also permanent magnets) temporarily magnetized by a current of electricity passed through their coils.

The magnetism remaining in said magnets will thereafter be sufficient to render the machine operative. The generative cylinder being rotated through power applied to the pulley L, the magnets A A' produce an electric current in the coils of the cylinder, rendering the cores of the rotating elements magnetic, and these passing the poles of the magnets A A' cause an increase in the electricity of the coils of said magnets; and when the electric circuit, of which said coils form a part, is closed the electric current in said coils increases the magnetism of the said magnets. This increases the electric current in the coils of the rotating cylinder, which in turn reacts upon the currents in the coils of the said magnets, this action and reaction continuing and increasing till the maximum effect is reached, and thereafter the machine acts regularly and uniformly.

To use the machine as a motor, it is only necessary to connect the wires F F' with the poles of a suitable battery.

The above-described improvements in generative cylinders and magnets are subject-matter of my English patent dated September 15, 1875, and sealed February 29, 1876.

Upon the outside of the plate G, I attach an automatic device for discharging explosive compounds at a distance. The said device consists of two extensions, *m*, of the poles N and S, which pass out through the said plate G; an oscillating armature, *n*, fitted loosely on the shaft *g*, and provided with a spring, *o*, which, when the machine is not at work, holds said armature away from said extensions *m*; an arm, *p*, extending from said armature to a spring circuit-breaker, *r*; and two stops, *s* and *s'*.

The stops *s s'* are, preferably, furnished with adjusting-screws; but these are not essential. The parts of the exploding device, except the spring *o* and stop *s*, must be made of conducting materials, properly insulated, to conduct a current, as hereinafter described.

For rotating the cylinder of the machine when it is used for exploding charges of explosives, I prefer to use a pulling-cord, a part of which is wound around the shaft, in the place of the pulley L.

To operate the machine for exploding, I connect one of the wires F F' with the stop *s'*, and the other with the spring *r*, as shown in Fig. 1, the said wires leading off to the charge to be exploded, and being there separated to a distance sufficient for the production of a spark, or connected by a small platinum wire, to be heated by its resistance to the passage of the current.

Upon rotating the cylinder B the weak current at first generated in the coils of the magnets A A' passes through the wires F, the spring *r*, and stop *s'*, thus making a short circuit of feeble resistance; but as the power of the generated current approaches its maximum, the ends of the oscillating armature *n* are attracted to the extension *m* of the magnetic poles, the arm *p* forces the spring *r* away from the stop *s*, and the accumulated current then passes through the wires F F' to and from the charge to be exploded, and with the required energy.

I claim—

1. The generative cylinder composed of the soft-iron cores *a*, arranged in helical relation with the shaft *g*, and wound with the coils *c* and *c'*, said coils being connected with each other successively and with the commutator, and the ranks of coils being connected with each other by junctions J, substantially as and for the purpose specified.

2. The conjoined magnets A A', each having its pole in the middle and having its parts on each side of said pole inclined toward corresponding parts in the other magnet, said magnets being united at their extremities to give a mutual bracing or truss-like action to prevent springing against the cores of the generative cylinder, substantially as for the purpose specified.

3. The combination, with the poles N and S, having the extensions *m*, of the oscillating armature *n*, having the projecting arm *p*, the stops *s* and *s'*, and the circuit-breaker *r'*, substantially as and for the purpose set forth.

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