3 Sheets--Sheet 1.

MOSES G. FARMER.

Improvement in Electro-Magnetic Engines.

No. 126,628. Patented May 14, 1872.

Fig. 1

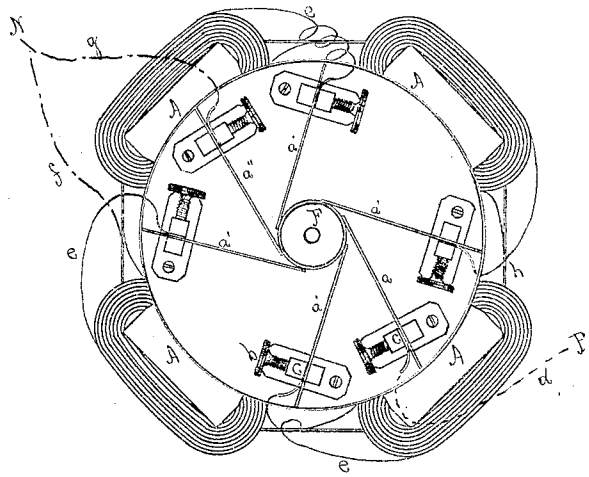
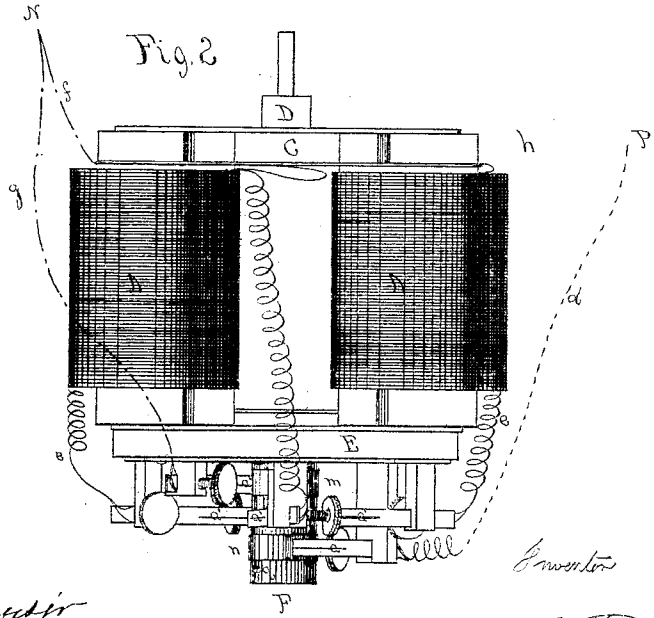


Fig. 2



Witnesses

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3 Sheets--Sheet 2.

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Fig. 3

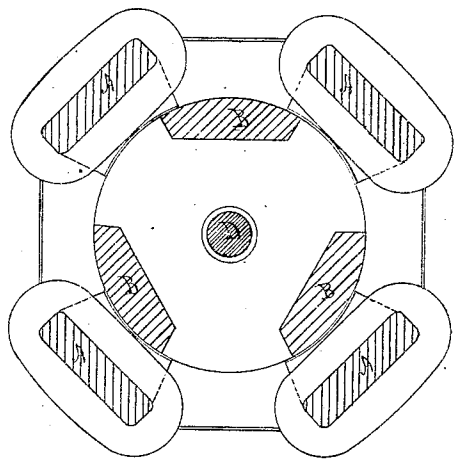
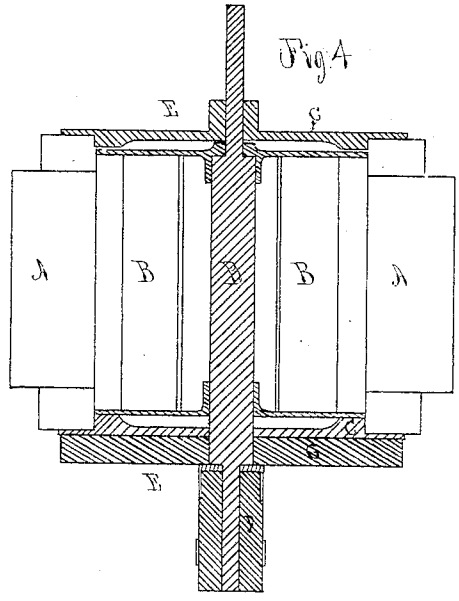


Fig. 4



Witnesses

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3 Sheets--Sheet 3.

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Fig.5

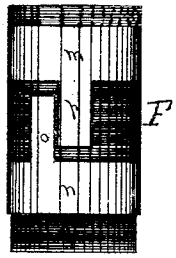


Fig.7

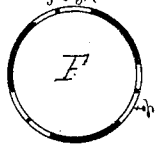


Fig.6.

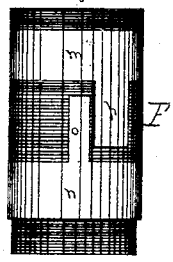


Fig.9

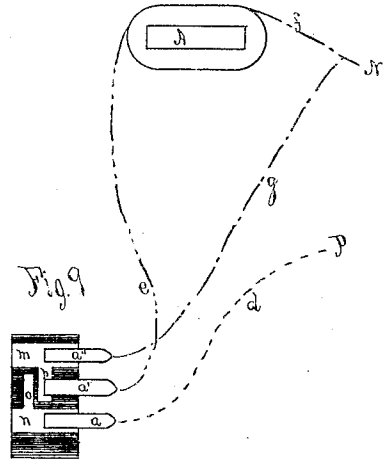
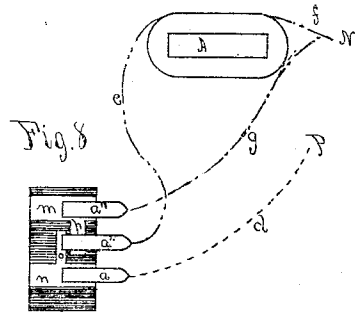


Fig.8



Witnesses:

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UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

IMPROVEMENT IN ELECTRO-MAGNETIC ENGINES.

Specification forming part of Letters Patent No. 126,628, dated May 14, 1872.

Specification of an Improvement in Electro-Magnetic Engines, invented by MOSES G. FARMER, of Salem, in the county of Essex, Commonwealth of Massachusetts.

The nature of my invention consists in an improved manner of constructing an electro-magnetic engine so as to prevent the formation of the induction-spark, which is generally produced when connection with the electro-magnets of the engine and the galvanic battery exciting the same is interrupted, by providing means for connecting the extremities of the helix of each electro-magnet just before connection with the battery is broken. It also consists in the manner of adjusting the circuit-changer or commutator so that the current can be broken and closed at any part of the stroke of the engine, and thus admit of its velocity being increased or diminished at will.

My invention is based upon the discovery that if the extremities of the helix of an electro-magnet be connected just before the galvanic current circulating in the same is interrupted, the extra current due to the inductive action of the magnetized core does not give rise to a spark at the point where contact is broken, but subsides gradually until the residual magnetism is discharged. It is applicable to electro-magnetic engines of every form, but, as best explaining and illustrating my improved construction, I have selected an engine of the rotary form.

Description of the Accompanying Drawing.

Figure 1, Sheet 1, is an end view of a rotary engine embodying my invention. Fig. 2 is a plan view of the same. Fig. 3, Sheet 2, is a sectional view in the line *x x*, Fig. 2, and shows the magnets and the armatures. Fig. 4, Sheet 2, is a sectional view in the line *y y*, Fig. 2. Figs. 5 and 6, Sheet 3, are plan views of the commutator. Fig. 7, Sheet 3, a sectional view of the same; and Figs. 8 and 9, Sheet 3, diagrams illustrating the manner of connecting the helices and the arrangement of the circuits, and show the course of the current both when the circuit is closed and when it is broken.

Though I am aware that electro-magnetic engines of the rotary form are well known, I will, nevertheless, for the purpose of more fully explaining my invention, proceed to describe the construction and operation of a machine of this description.

A series of electro-magnets (I have shown four, A A A A) are fixed at equal distances from each other in plates C C, and have their ends or poles bent inward, as shown in dotted lines in Fig. 3, Sheet 2. A shaft, D, rotates in bearings in the centers of the plates C C, and has a series of armatures, unequal in number to the electro-magnets, (I have shown three, B B B,) secured to it at equal distances from each other by the plates G G. The number of electro-magnets and armatures being unequal, their respective positions in relation to each other are different, as shown in Fig. 3, Sheet 2, for when one armature is nearly opposite an electro-magnet the next armature will be a little further from the next succeeding magnet, and the remaining armature will be intermediate between the two other magnets. If, then, one of the electro-magnets be excited, and the current be cut off from the others, it will attract the armature nearest to it, and cause the shaft to rotate until the attracted armature is brought directly opposite the attracting magnet, but if, just before this happens, the current be cut off from the attracting magnet and directed to the next succeeding magnet, this, in turn, attracts the armature nearest to it, and so continues the rotation of the shaft, and thus, by magnetizing each of the magnets in turn, a continuous rotary motion is imparted to the shaft. This successive magnetization is effected automatically by what is known as a circuit-changer or commutator, which is placed upon the extremity of the shaft D. It consists of a cylinder, F, of hard rubber, ivory, or some other suitable non-conducting substance, and has inserted therein a ring, *n*, of metal, provided with tongues *o*, equal in number to the armatures, and forming part of the surface of the cylinder, and dividing it into insulating and conducting spaces. A spring, *a*, supported by a projection from the plate E, rests at one end upon the ring *n*, and is connected at the other end to a wire, *d*, passing to one pole of a galvanic battery. A series of similar springs, similarly supported, each of which is connected by a wire to one of the electro-magnets, respectively bear at their extremities upon the alternate conducting and insulating surfaces of the cyl-

inder F, but are so arranged that only one of them rests upon a conducting-surface at the same time. All of the electro-magnets are connected by a wire, *f*, which is connected to the other pole of the battery, and, consequently, the rotation of the shaft, by bringing a conducting-surface in turn in contact with a spring connected with one of the magnets, causes the current to pass successively to each of the magnets, and thus magnetizes them.

I will now proceed to explain in what manner I have improved the construction of this form of engine according to the principles of my invention.

Upon the commutator F I place another ring of metal, *m*, provided in the same manner as the ring *n*, with a series of tongues, *p*, wider than the tongues *o*, but equal in number and lying parallel with them. Upon this ring *m* bears another spring, *a''*, supported in the same manner as the springs *a' a' a' a'*, and connected with a wire, *g*, which is attached to the wire *f* connecting the magnets, and consequently with the extremities of the helices next to the negative pole of the battery. The other springs *a' a' a' a'* connected to the electro-magnets bear upon the wide tongues *p*, as well as upon the narrow tongues *o*, and since said tongues are separated by only a narrow insulating-strip, each of said springs comes in contact with a wide tongue before it leaves contact with another tongue, and consequently the extremities of such helix are united just before its connection with the battery is broken. This will be more fully understood by reference to diagrams on Sheet 3 of the drawing. Fig. 8 shows the circuit-changer when the circuit is closed, and Fig. 9 when the circuit is broken. In the first-named position of the circuit-changer the current passes from the positive pole *p* by wire *d*, spring *a*, to ring *n;* thence by tongue *o* to spring *a';* and thence by the wire *e* to the magnet, and through it to the battery by the wire *f*. In the other position of the commutator the extremities of the helix are united through wire *e*, spring *a*, tongue *p*, ring *m*, spring *a''*, and wire *g*. By thus connecting the extremities of each magnet the magnetic energy stored therein is not wasted by conversion into light and heat in the form of a spark when connection with the battery is broken, but is utilized in prolonging the attractive force exerted upon the armature until the extra current subsides, which subsidence will be gradual while the ends of the coil are connected, and consequently the efficiency of the engine is increased and the cost of working the same diminished; and, moreover, the formation of a spark being prevented, the destruction of the commutator by the combustion of the metallic portion is obviated.

I have ascertained by experiment that the electro-magnets discharge their magnetism when the extremities of the helices are united in a longer time than it takes for them to acquire their magnetism, and consequently the tongues *p* are made wider than the tongues *o;* and I also make the conducting-surface of the circuit-changer bear such proportion to its entire surface as will insure the magnetization of each magnet to its entire capacity and its complete discharge—therefore obtaining the full working power of the engine.

The disk E, to which the springs *a a' a' a' a' a''* are attached, is not fixed to the shaft D, but can be rotated concentrically with the same, and thus move the springs partly around the commutator; and since the movement of the conducting-tongues *o* and *p* is simultaneous with and corresponds to that of the armatures, it is possible, by altering the relative position of the springs to the tongues, to cause the current to be broken and closed at any point of the stroke.

If the current is closed when an armature is quite near its attracting-magnet the residual magnetism will tend to draw the armature back, and thus retard the movement of the machine; but if, on the contrary, the current is closed when the armature is some distance from the magnet, the residual magnetism will be expended in attracting the armature forward, and consequently the velocity of the machine will be increased.

Claims.

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

1. An electro-magnetic engine, so constructed that the extremities of each of the helices of the electro-magnets of the same are united just before their connection with the battery is broken, in the manner and for the purpose as set forth.

2. The commutator or circuit-changer F, having upon it the rings *m* and *n*, provided, respectively, with the tongues *p* and *o*, as and for the purpose set forth.

3. The combination of the commutator F, the springs *a a' a' a' a' a''*, wires *d e f g*, and electro-magnets A A A A, all arranged as and for the purpose set forth.

4. The combination of the commutator F, the adjustable plate E, and springs *a a' a' a' a' a''* attached thereto, as and for the purpose set forth.

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Witnesses:
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