B. G. NOBLE.

Improvement in Magneto-Electric Battery for Firing Fuses, etc.

No. 124,216. Patented March 5, 1872.

Fig: 1.

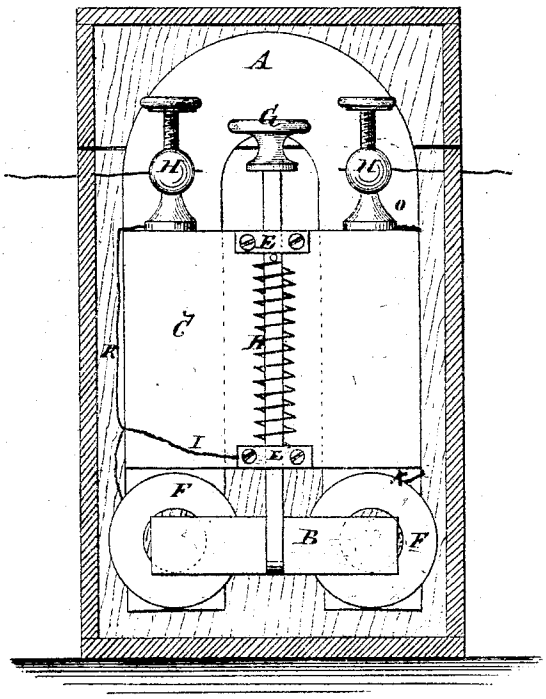


Fig: 2.

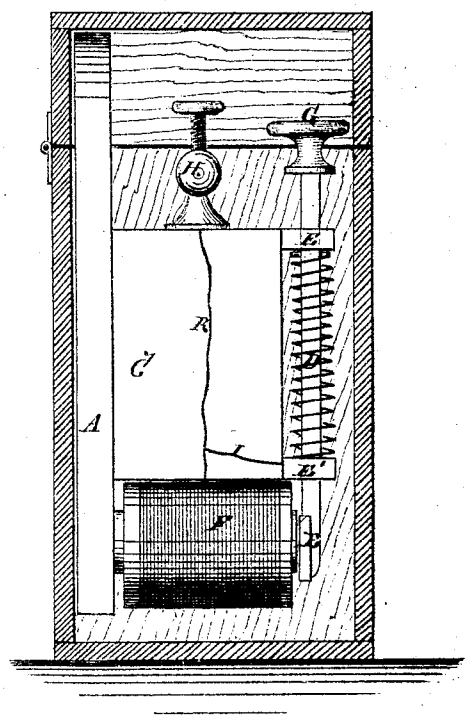
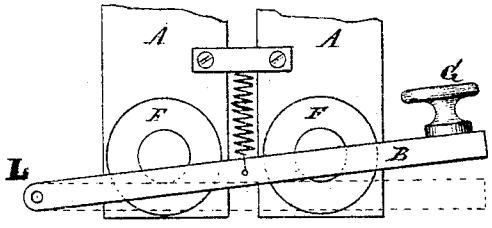


Fig: 3.



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IMPROVEMENT IN MAGNETO-ELECTRIC BATTERIES FOR FIRING FUSES, &c.

Specification forming part of Letters Patent No. 124,216, dated March 5, 1872.

To all whom it may concern:

Be it known that I, BUTLER G. NOBLE, of Brooklyn, in the county of Kings, in the State of New York, have invented a new and useful Magneto-Electric Battery; and I do hereby declare that the following is a clear, full, and exact description of the same, reference being had to the annexed drawing making a part of this specification, like letters being used to indicate corresponding parts in the several figures.

The nature of my invention consists in a novel device for the development at will of a single wave or impulse of the magneto-electric current, of great force and intensity, and its adaptation to the ignition of electric fuses for exploding mines, blasting, firing ordnance, and other purposes. Machines for the development of this form of electricity are of great variety and well known. They consist, substantially, of soft-iron armatures or keepers, surrounded by helices of insulated wire, properly mounted, and revolved or vibrated in close proximity to the poles of a permanent magnet. The electric current is thus induced in the wire of the helices, and, by the agency of breaks and proper wire connections, directed and utilized. This current consists of a succession of distinct waves or impulses, more or less frequent, according to the rapidity of the rotatory or vibratory motion. By an arrangement of breaks and commutators well known, the current of alternate direct and inverse waves may be led off in one direction, but is still wanting in continuity, and even rapid motion does not produce an uninterrupted flow. The induction of the current depends, primarily, on the inherent attractive force of the magnet, and the value of this force being inversely as the square of the distance, the best results are attainable only by the closest proximity of armature and magnet-poles. The utmost nicety of adjustment and delicacy of construction are therefore requisite; hence, this form of machine is not adapted to general use for blasting purposes or the rough usage of the field. A blow, a jar, the shrinking or swelling of wood used in mounting, or the expansion or contraction of metals may derange the adjustment or overcome the minute between-space of magnet and armature, and thus destroy the action of the machine. My invention is designed to obviate these objections, to secure certainty of action, and greatly to enhance the available dynamic value of the magneto-electric force.

To enable others skilled in the art to make and use my invention, I will proceed to describe the construction and operation of the same.

Figure 1 of the drawing represents a front elevation of my magneto-battery, inclosed in a wooden case, which latter is shown in section. Fig. 2 is a side view of the same.

A is a permanent steel magnet of the U-form, constructed and charged in the usual manner, and placed in a vertical position. F F are two spools or helices, constructed and wound in the manner well known, inclosing cores of soft iron. These spools are attached to the respective poles of the magnet by their soft-iron cores, which are fitted closely, and permanently fixed by screws or other means. B is a sliding keeper or armature of iron, which lies in close contact across the soft-iron cores of the spools, as shown in Figs. 1 and 2. It is attached at its center to a brass sliding rod, D, which is surmounted by a knob, G. C is a block of wood or other non-conducting material attached to the face of the magnet. E E′ are two brass guides, attached to the block C at the points shown, through which the rod D moves freely. A spiral spring interposed between the guides E E′ surrounds the rod D. H H are two binding-cups for the reception of leading wires. The two spools hereinbefore described are wound with insulated wire in the same direction. When they are fixed by their soft iron cores to the magnet, the wire of the two helices is made continuous by joining together an end of each between the spools. One terminus of the wire is then soldered to the magnet, as shown at K, Fig. 1. The other, I, is soldered to the lower brass guide, E′, and thus, by the rod D, is connected to the sliding keeper B. The binding-cups H H are then connected, respectively, one to the magnet O, the other to the sliding keeper, through its attachments, the guides E E′ and sliding rod D, by R and I. There should be no metallic connection between the magnet and the keeper, except as above described. The battery thus constructed is inclosed securely in a box, so arranged that the knob and binding-cups are accessible for use. I prefer a magnet of the compound form, consisting of several plates

secured together. The soft-iron cores should project a short distance above the spools, to secure certain contact with the sliding keeper. I do not confine myself to any particular form for this keeper. I prefer a thin rectangular piece of soft iron, of sufficient length to cover the cores of both spools, and whose width is about equal to the diameter of the cores.

The operation of the battery is as follows: The keeper being in contact with the soft-iron cores, the circuit is closed. On striking the knob G quickly down, the keeper slides from the iron cores, the circuit is broken at the instant of the maximum development of the induced current through the helices, and a single wave or impulse of great force and intensity is discharged through the binding-cups and their attached leading wires. When the knob is released the spiral spring retracts, replacing the keeper and producing a current of much lower intensity, and in an inverse direction.

In adapting the magneto-battery to the purpose of blasting or exploding mines, I use what are known as "electric fuses." These fuses are of various forms, but consist substantantially of a receptacle of wood or other material, containing a small quantity of explosive matter; also, a separate priming of fulminate or other substance sensitive to a current of intense electricity, which is interposed between the interior ends of two small wires with which the fuse is provided. The mine or blast-hole being charged with gunpowder or other explosive agent, the fuse is placed therein, with its attached insulated wires lying on the surface. The blast is then prepared by tamping in the usual manner. The battery being placed at a safe distance, an insulated wire of small size is led out from one of the binding-cups and connected to one of the fuse-wires. The other fuse-wire is attached to a short piece of bare copper wire, the end of which is thrust into moist ground. The earth circuit is completed by connecting the other binding-cup with the ground beneath by a short wire. To fire a number of blasts simultaneously, the leading wire from one binding-cup is placed in communication with a corresponding number of short branches of insulated wire, each attached to a fuse placed within the blast-hole. Their junction is effected by twisting the bare wires tightly together and around the main wire. The ground wires of the series of fuses may be separately thrust into the moist earth, or, for greater certainty, may be collected into one, twisted together and used as a single earth connection, the earth circuit being completed in the usual way at the battery. By this arrangement a single discharge from the magneto-battery will fire a large number of blasts simultaneously. The magneto-electric current as thus developed and employed is well adapted to the purposes above indicated. It has intensity sufficient to pass through long wires, yet does not "jump" or leave metallic conductors. Low insulation is sufficient to hold it, and, as ground circuit is always sure, one wire, and that of small size only, is required. Fig. 3 shows another arrangement which I have contemplated. The keeper is made longer, one end being pivoted, as shown at L, and the other end provided with a knob, G. The connections are the same as in the other form described. The current is developed and discharged on pushing the knob down quickly. A spiral spring, as shown, replaces the keeper upon the iron cores. The dotted lines show its position at the point of separation. I have also contemplated a combination together of several batteries as one, so arranged and connected as to make a simultaneous discharge of all, through common leading wires. In the arrangement and combination hereinbefore described, the soft-iron cores of the helices are kept permanently charged by induction from the steel magnet to which they are fixed, so that they act practically as the poles of the magnet itself. The sliding keeper serves as an armature, always in position except at the instant of use, so that the virtue of the magnet remains unimpaired. By the actual contact of sliding keeper and soft-iron cores the maximum force of the magnet is available. The electric force generated by proximity is diminished rapidly by a slight separation of magnet and keeper, so that at a distance of one fiftieth of an inch four-fifths of the magnetic force is said to be lost. The employment of the magneto-electric machine as an exploder for blasts or mines has hitherto been successful by the combination of a large number of magnets and moving armatures in close proximity, and the firing of a large number simultaneously has been effected only by such arrangements. Such machines require accurate adjustment, the best workmanship, and are very expensive, and liable to get out of repair. My invention is simple in construction, not liable to derangement, and comparatively cheap. The discharge of a single wave or impulse of great force and intensity produced with my battery, by the sudden removal of the armature from the magnetic poles with which it is in actual contact, is more effective for the simultaneous firing of a large number of electric fuses, than the most rapid succession of waves of less intensity produced by other modes.

I am aware that about the time of the discovery that electric currents could be obtained from a magnet, some forty years ago, coiled keepers or armatures of soft iron, in contact with the poles of a permanent magnet, were used for the production of the spark, but it would seem that this device was not applied to any useful purpose, except the exhibition of the phenomena of sparks and shocks. I do not claim such an arrangement.

It is well known that any violence at the poles of a permanent steel magnet, such as filing, striking, or rubbing tends materially to destroy its attractive force, and that this is especially the case with magnets of a small size.

It is obvious, therefore, that the use of a sliding-coil keeper in actual contact with the poles of a permanent steel magnet would cause its rapid deterioration, and in time render it useless. In my arrangement no coiled keeper is employed. The rubbing and sliding incident to the separation and replacement of the plain keeper is confined to the soft-iron cores of the helices instead of the poles of the manget itself; and, as the magnetism of the cores is induced by the permanent magnet, its attractive force is increased, rather than diminished, by frequent use.

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

1. The magneto-battery herein described, constructed and operated substantially as herein set forth.

2. The combination of iron-cored helices fixed to the poles of a magnet, with a sliding keeper, constructed and used substantially as and for the purpose herein set forth.

BUTLER G. NOBLE.

Witnesses:
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