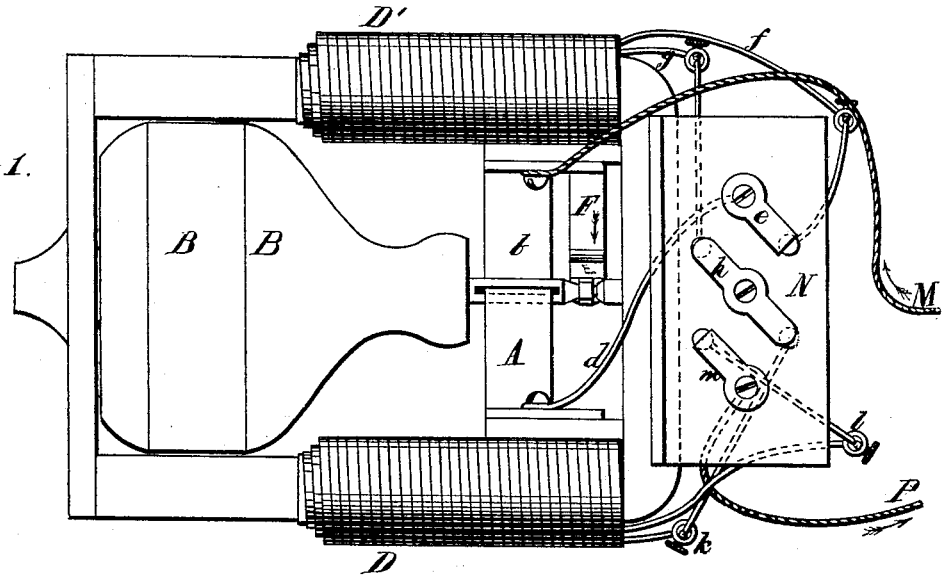
G. F. GREEN.

ELECTRO-MAGNETIC MOTORS.

No. 184,469. Patented Nov. 21, 1876.

Fig. 1.



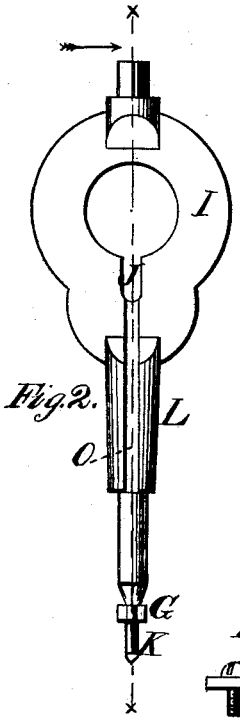


Fig. 2.

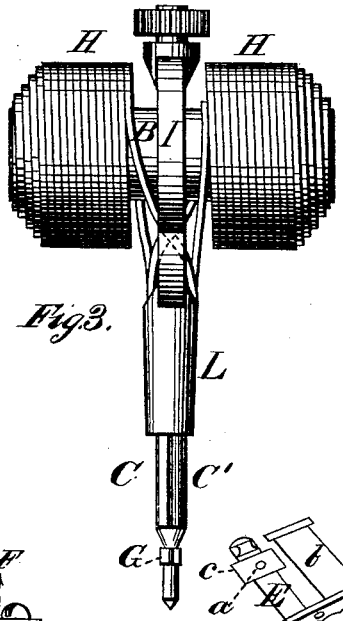


Fig. 3.

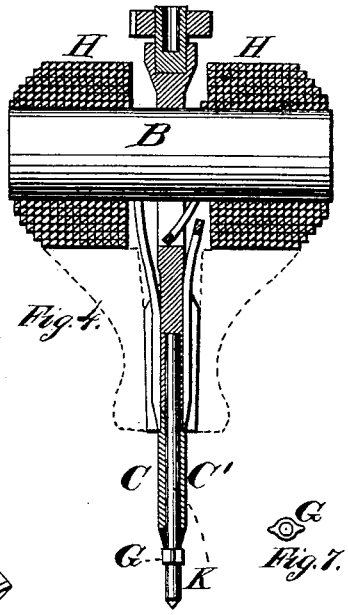


Fig. 4.

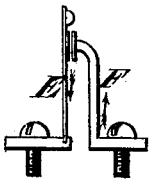


Fig. 5.

Fig. 6.

Fig. 7.

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GEORGE F. GREEN, OF KALAMAZOO, MICHIGAN.

IMPROVEMENT IN ELECTRO-MAGNETIC MOTORS.

Specification forming part of Letters Patent No. **184,469**, dated November 21, 1876; application filed October 28, 1875.

To all whom it may concern:

Be it known that I, GEORGE F. GREEN, of Kalamazoo, Kalamazoo county, and State of Michigan, have invented a new Electro-Motor, of which the following is a specification:

This invention has relation to that class of machines known as "electro-motors;" and the nature of my invention consists in a rotating head carrying a straight electro-magnet, actuated by a peculiar break-piece, this magnet revolving on, and at right angles with, a spindle secured between the legs of a stationary electro-magnet, as will be hereinafter more fully set forth.

In the annexed drawings, Figure 1 is a plan view of the engine complete, in which B designates the rotating head. Fig. 2 indicates the yoke and the spindle in connection, with pivot at one end, and a steel box for bearing and gear secured to the yoke at the opposite end. Fig. 3 is the same yoke, with the electro-magnet and helices attached, but with the balancing-head removed to show the arrangement of the parts more clearly. Fig. 4 is a section of the same, together with the balancing-head, showing the arrangement of the wires along the spindle to the disks or pole-changers C C′. Fig. 5 is an edge view of the break-piece E and conductor F, not in contact, but both bearing contiguous faces of considerable area. Fig. 6 is a perspective view of break-piece E and one of the shifter-pads *b*. Fig. 7 is a detail view of the cam G, which is secured or forged on the spindle near its pivot, whose office is to lift the break-piece E from the conductor F, for the purpose to be presently shown.

In this invention the circuit-breaker E is so arranged as to work in connection with the circuit-shifters, to avoid the destruction or burning of the same heretofore so objectionable in electro-magnetic apparatus.

The rotating head B′, Fig. 1, is composed of two separate helices, one placed on each end of the soft-iron bar B, (shown in Fig. 3,) having an outer and inner end of each helix-wire carried down and soldered to the tubular disk C, the other two ends of the helix-wire carried down and soldered to the opposite disk C′. These helices and wires are generally inclosed in wood, and preferably in the form shown. This covering prevents the hum of rotation and the atmospheric resistance which occur when the magnet is not thus protected. The current flowing through the helices of the rotating head also flows through the outer helices D D′, the same break-piece affecting the inner and outer helices, and working in connection with the disks or pole-changers C C′. These disks are insulated from the spindle, in the usual way, by the introduction of paper or other non-conductor between them and the spindle.

The break-piece E, Fig. 5, is operated by the cam G on the lower end of the spindle, lifting this break-piece from the face F the instant the disks C C′ are in position to reverse the current in the rotating head. The disks or shifters to this engine for reversing the current are the same in principle as those of the well-known "Page electro-motor," and generally shown in works on physics; but the hitherto unavoidable destruction by burning of the disks is prevented by the break-piece E breaking the circuit the instant the current is ready to reverse on the inner helices H H. This break-piece also entirely relieves the engine of magnetism while the rotating head is passing centers, then letting the whole current on as soon as the magnets have passed each other. When the break-piece is lifted by the cam G it checks the flow or current from the battery, causing the battery to suspend action, thus prolonging the life of the battery very considerably. This lifting-check also prevents any liability of the current "short-circuiting," or finding a passage through both shifter-pads A and *b*, in every half-revolution of the spindle, by passing through one or both of the disks C C′. This arrangement also entirely prevents the destruction of these parts by burning which has heretofore been so troublesome, and makes the engine in this respect exceedingly durable.

In building the revolving head of this engine, to which the driving-gear is attached, I insert the piece of round soft iron B half-way through the yoke, Fig. 2, soldering it firmly and at right angles with the axis coinciding with that of the spindle. The helices H H may be made of one wire, like that on the outer or U magnet D D′; but I prefer to wind

on each end of this iron cylinder B separate coils of copper wire H H. Such independent coils appear to give better results than when made of one continuous wire. In winding these two separate coils I connect the ends of both coils to the disks C C′, so that the current divides and runs through both coils in the same direction, co-operating, of course, to make one end of the magnet B positive and the other end negative alternately. The yoke I is made, preferably, of brass, with an opening large enough to admit and secure the cylindrical bar B. A narrow cut, J, is extended from this central opening, through which the wires are passed before securing them to the disks C C′. K, Fig. 4, is a steel spindle, pivoted at one end, and the other inserted in the stem L of the yoke. This stem L is grooved on opposite sides to receive the wires passing to the disks C C′, as shown at O, Fig. 2. At G, on the spindle, is the small double cam shown in detail in Fig. 7. On the opposite or short end of the yoke is placed the main driving-gear, secured to a steel box or bearing inserted in the end of the yoke, as shown in Figs. 3 and 4. The cam G, Fig. 7, is forged solid on the spindle, or otherwise secured, and has two opposite lugs for lifting the break-piece E from the conductor F as the spindle revolves.

The faces of the break-piece and conductor are furnished with flat disks, preferably of silver. These disks having appreciable area, the electric force remains distributed over the same at the moment contact is broken and renewed; hence they are not liable to combustion by such rapid interruption of the current as in case of a point or edge contact, in which the electric force is concentrated to an intensity beyond the capacity of the metal to resist. The disk or face *c* is furnished with a small perforation, *a*, to prevent any atmospheric pressure, and also for ventilation. The shifter-pad *b* is shown in connection with this perforated disk in Fig. 6.

I prefer making the helices of these engines of square wire, as it makes a more compact helix than round wire, bringing the current nearer the axis of force.

In the operation of the engine the current enters the cable M from the battery, passes to the conductor F, then to break-piece E, and to shifter-pad *b;* then through one disk, C, by wires to helices on both ends of the iron cylinder or magnet B simultaneously, and leaves the helices simultaneously by the other wires, and through the other disk, C′, both helices co-operating to increase the magnetic power required. Thence the current enters the shifter-pad A, passes the wire *d*, through the switch *e*, to wire *f*, then to helix D′. It then leaves this helix by wire *g*, passes to switch *h*, wire *k*, to helix D; leaving this helix by wire *l*, passing switch *m*, through cable P, to battery. To reverse the engine the switches *e h m* are simply reversed from the position assumed above, and shown in Fig. 1.

These engines are constructed to develop great power in a small compass, and one having a U-magnet four and a half inches by three and a half, or the size very nearly of the several parts shown in the drawings herewith presented, is sufficiently large to run the ordinary sewing-machine for making all kinds of garments.

I have found, by years of practice, that in order to secure greater power for heavier work, it is not well to increase the size of the engine greatly beyond these dimensions; but it is better to attach to the periphery of the gear on a shaft a number of these machines, thus securing any amount of driving-power.

I propose at some future day to make application for a patent for the combination of a series of these small motors with a large drive-wheel, upon the periphery of which they are arranged to operate.

Having thus described the nature of my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the yoke I and electro-magnet B, substantially as specified.

2. The combination of the yoke I and electro-magnet with the spindle and pole-changers, substantially as described.

3. The switch-board N, having switch-arms *e*, *h*, and *m*, in combination with the helices D D′ and rotating helices H H, substantially as described.

4. The combination, with a U-shaped electro-magnet, of the separate helices H H, in which the current is divided on the spindle, the two parts of the divided current running thence independently to the separate helices on the straight electro-magnet H H, whereby the power of the engine is increased, substantially as described.

5. The yoke or axle I, consisting of spindle K, with cam G, pole-changers C C′, stem L, and head, with driving-wheel, substantially as specified.

6. The break-piece E, in combination with the shifter-pads *a* and *b*, disks C C′, and cam G, substantially as described.

7. The combination, with a U-shaped magnet, of the shifter-pads A and *b*, break-piece E, and conductor F, substantially as specified.

GEORGE F. GREEN.

Witnesses:
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JOHN H. DEAN.