

(No Model.)

M. G. FARMER.
ELECTRO MAGNET.

No. 351,256.

Patented Oct. 19, 1886.

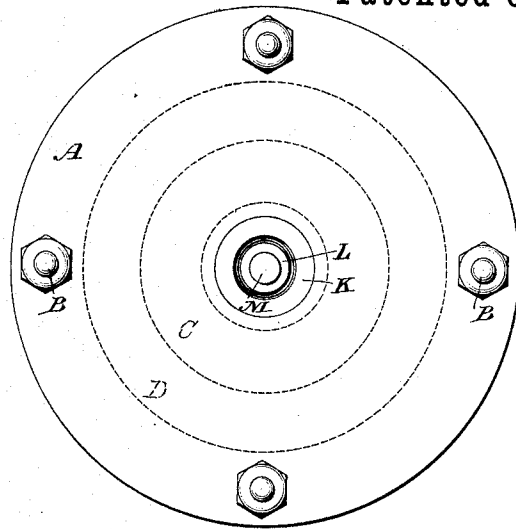


Fig. 2.

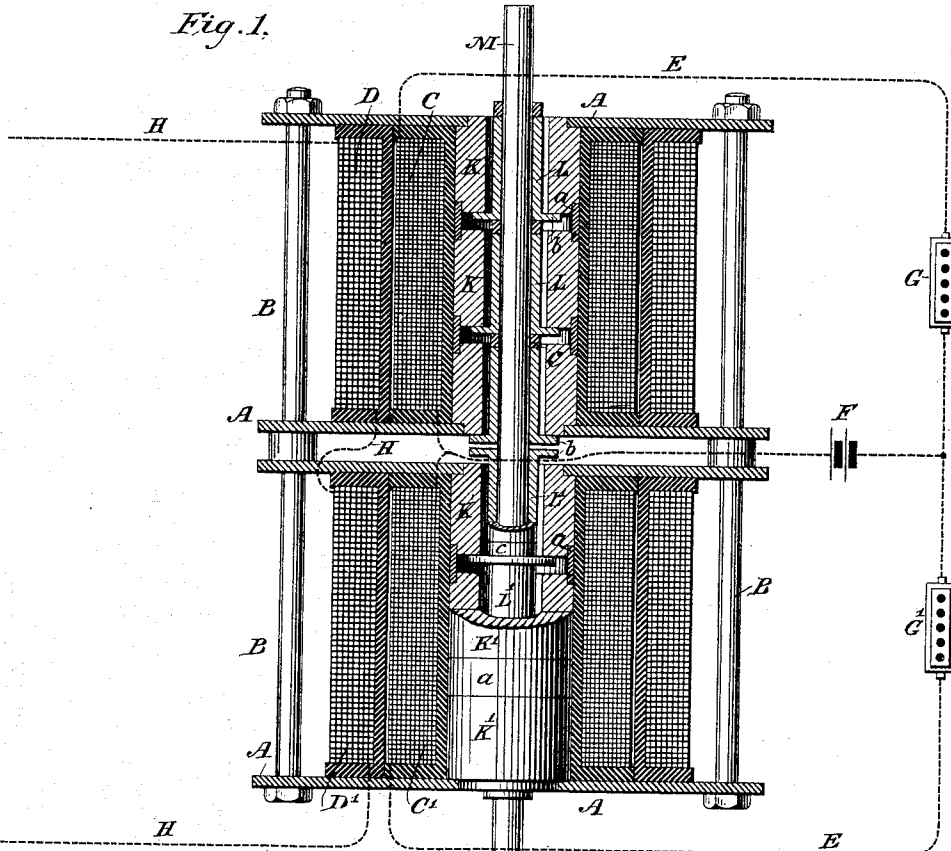


Fig. 1.

Witnesses

Geo. W. Breck.
Carrie C. Ashley

Inventor

Moses G. Farmer
By his Attorneys
Duncan, Curtis & Page.

UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF NEW YORK, N. Y.

ELECTRO-MAGNET.

SPECIFICATION forming part of Letters Patent No. 351,256, dated October 19, 1886.

Application filed June 11, 1886. Serial No. 204,836. (No model.)

To all whom it may concern:

Be it known that I, MOSES G. FARMER, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electro-Magnets, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention is an improvement in that class of electro-magnets which are distinguished by a helix and movable core, and which are commonly known as "axial" magnets.

15 The chief object of this invention is to produce a very sensitive magnet of this general character, and at the same time one of great power, by means of which a comparatively feeble current may be caused to exert a strong attractive force.

20 The device by means of which my invention is carried out may be generally described in the following manner: There are two helices, placed in line in close proximity to each other. Each helix is compound, consisting, really, of two independent coils, which I shall designate as the "main" and "local" coils or helices, since they are connected in independent circuits, as will be more fully hereinafter explained. Within the local helices are sectional iron cores, tubular, and fixed at short distances apart. The movable portion of the core consists of a number of iron cylinders carried by a brass rod, the cylinders being arranged one in each stationary core-section and formed with a flange that extends into the space between two adjacent sections. The local coils or helices are included in a local circuit in which there is sufficient current to impart polarity to the cores. While the main coils are in the main or working circuit the local circuit is constantly closed, and the other is made and broken, as may be desired. The direction of winding of the local coils or helices is such as to cause the stationary core-sections of each helix to repel the movable cores within them and to attract those in the adjacent sections. The main coils are so wound that a current flowing through them adds its strength to the current in one local coil and neutralizes that in the other, according to the direction of the

current in the main circuit, from which it follows that the armatures may be moved in either direction and their movement utilized for various purposes by directing through the main coils a current in the proper direction. 55

The details of the construction of this device are illustrated in the accompanying drawings, in which—

Figure 1 is a vertical central section of my improved electro-magnet, showing the circuit-connections; and Fig. 2 is a top plan view of the same. 60

The helices are supported between heads or plates A A, forming part of a frame, in conjunction with the bars B B, and are in line with each other and a short distance apart. Each helix is composed of two coils, as C D C' D'. The inner helices, C C', are in a branched local circuit, E, containing a battery, F, and a rheostat, G or G', in each branch, by means of which the resistances of the two branches may be varied. The outer helices, D D', are in the main or operating circuit H. 65

The inner helices, C C', surround stationary tubular cores composed of the soft-iron sections K K', which are formed with a shoulder at each end and held apart by the interposed brass or non-magnetic rings *a*. The heads A A serve to hold the core firmly together. 75 Within the tubular sectional cores are the series of armatures L L', carried by a brass rod or tube, M. The armatures L L' are short tubes of soft iron formed with flanges *b*, or in any other manner, so as to contain a greater mass of iron at that end which is nearest to the end of the next adjacent tubular stationary core-section. The armatures are of a diameter to fit loosely within the sections K K', and are separated from each other by interposed rings of non-magnetic metal *c*. They are secured to the rod or tube M, and the sections K K' placed over them in building up the core, so that the heads or flanges *b* will be contained in the spaces between the sections K and permit the rod or tube M to have a longitudinal movement of limited extent through the helices. 80 85 90 95

I face the armatures L L' with brass or a non-magnetic substance, in order to prevent adhesion from residual magnetism in case of contact with the stationary core-sections, and 100

they are made quite light in comparison with the cores K K'. The object is to impart to the rod or tube N a limited movement in either direction by closing the circuit through the coils D D'. This movement may be utilized for a great many purposes. For example, the instrument may be used in conjunction with proper contacts as a polarized relay, or it may be used for opening and closing a valve or ringing a gong, or for any other like purpose, and it is particularly adapted for operating any such instrument where the expenditure of considerable force is necessary, and where the current to produce it is comparatively weak. In order to accomplish this the inner coils are wound on the current directed through them in such manner as to impart to the ends of the stationary core-sections in one helix polarities opposite to those in the corresponding ends of the sections in the other helix. The same current magnetizes the inner or movable sections, and by reason of their relative positions it imparts to both stationary and movable sections the same polarity at their corresponding or adjacent ends. One end of each movable section being larger than the other, and being also nearer to one of the adjacent stationary sections than its smaller end to the other, such larger ends are attracted by the adjacent stationary sections and repelled by those surrounding them. These forces which, by reason of the closed local circuit, are constantly exerted upon the movable armatures are opposite and normally should be equal. To secure this the proper balance is made by adjusting the rheostats G.

The coils D D' are so wound that a current flowing through the main circuit H will circulate around the two cores in the same direction. A current impulse of given direction, therefore, in the circuit H will assist the local current in one of the helices, C, and neutralize its effect in the other, so that the movement imparted to the armatures and their supporting rod or tube will be toward that helix in which the current is neutralized.

The two coils of the helix may be wound in

other well-known ways than concentrically, as shown in the drawings. The specific construction of the armatures and cores may also be very much varied, and I do not limit myself to the precise form shown.

What I claim is—

1. An electro-magnet consisting of two co-operating helices, each composed of two parts or coils, in combination with stationary sectional cores and a series of connected armatures movable therein, as set forth.
2. An electro-magnet consisting of two co-operating compound helices, in combination with stationary sectional cores and a series of armatures secured to a rod or tube and movable within the core-sections, as set forth.
3. The combination of two co-operating helices, each composed of a main and local coil, stationary sectional cores contained in said helices, and a series of armatures secured to a rod or tube, one armature in each core-section, so as to form a compound polarized magnet when energized by a current in the local coils, as set forth.
4. The combination of two co-operating helices, each consisting of a main and local coil, stationary sectional cores contained in the helices, the sections being separated by short spaces and magnetically insulated, and a series of cylindrical armatures secured to a rod or tube, and formed with a greater mass of iron at one end, and movable within the core-sections, as set forth.
5. The combination of two co-operating helices, each consisting of a main and local coil, stationary sectional cores contained in the helices, the sections being separated by short spaces and magnetically insulated, and a series of cylindrical armatures secured to a rod or tube, and formed with flanges extending into the spaces between the core-sections, as and for the purpose set forth.

MOSES G. FARMER.

Witnesses:

TIMOTHY DAME,
M. F. KEEFE.