2 Sheets--Sheet 1.

O. HEIKEL.

Magneto-Electric Machines.

No. 155,376. Patented Sept. 29, 1874.

Fig. 1.

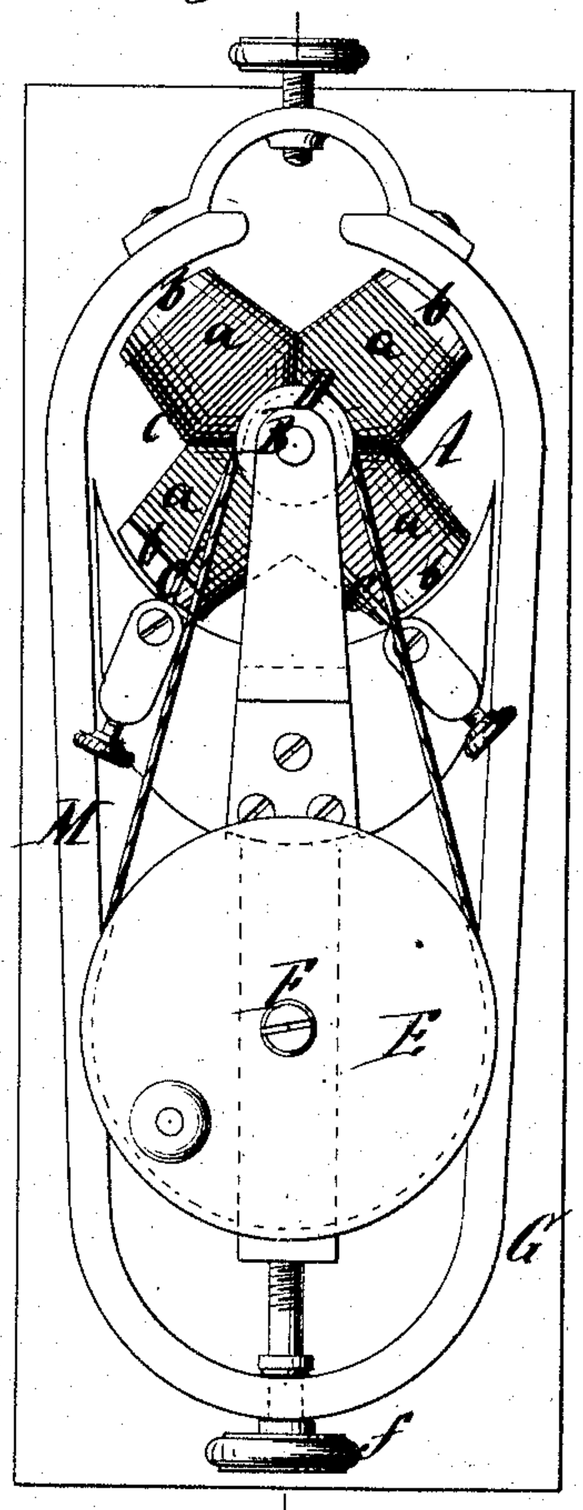


Fig. 2.

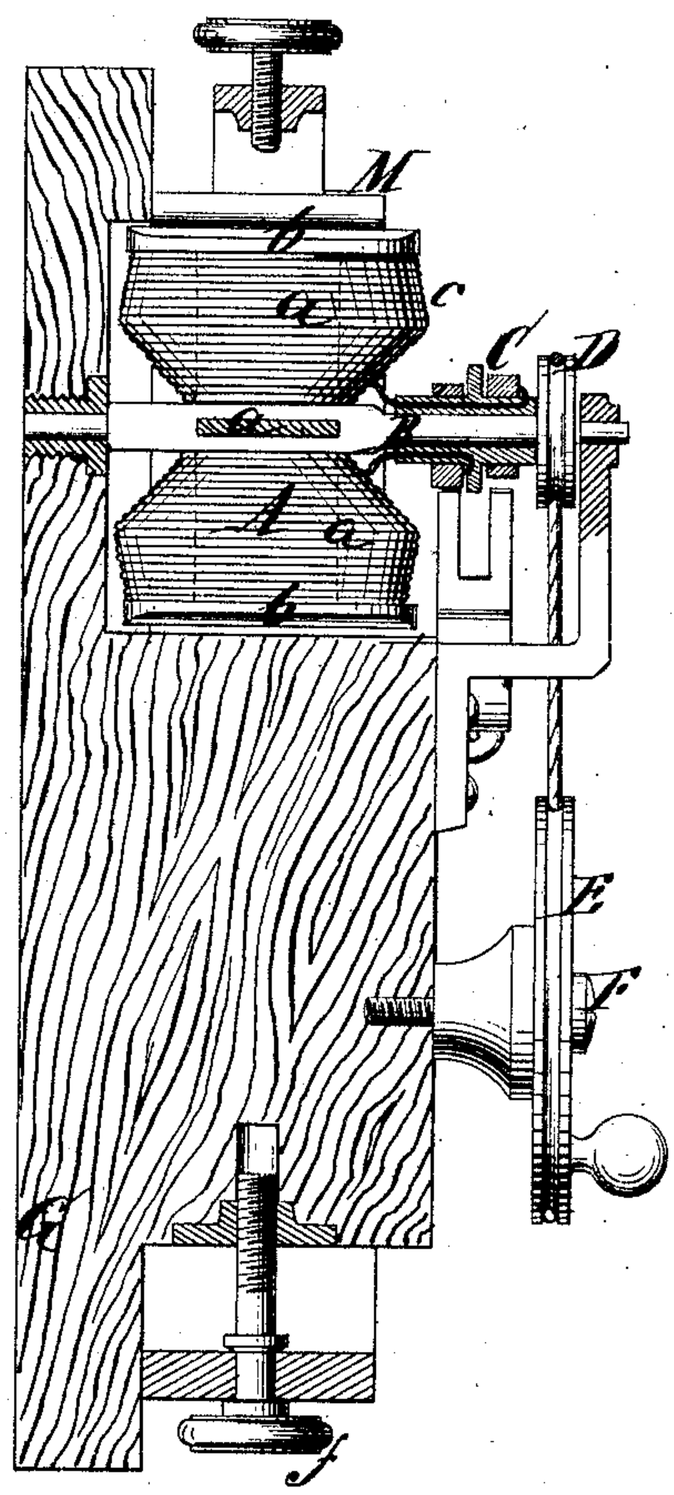
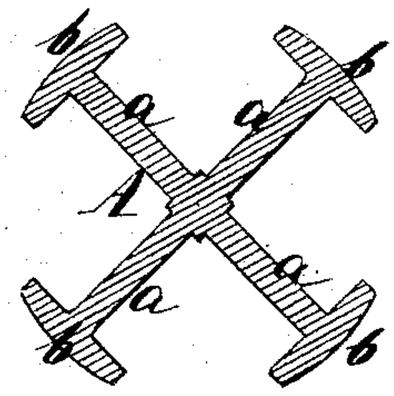


Fig. 3.



Witnesses:
Ernst Bilhuber
Henry Gentner

Inventor:
Otto Heikel
per
Van Santvoord & Hauff
Attys

2 Sheets--Sheet 2.

O. HEIKEL.

Magneto-Electric Machines.

No. 155,376. Patented Sept. 29, 1874.

Fig. 4

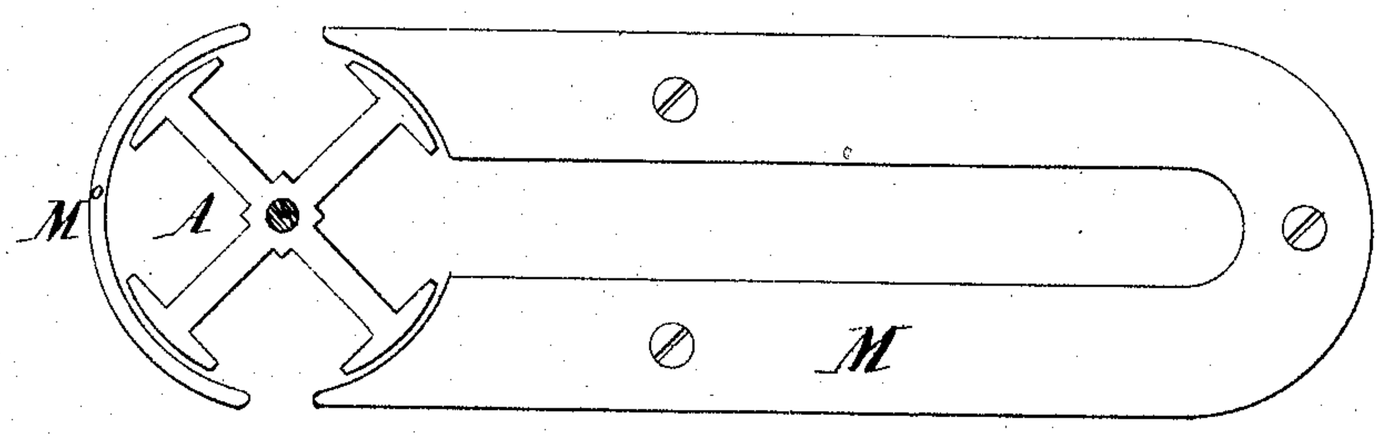


Fig: 5.

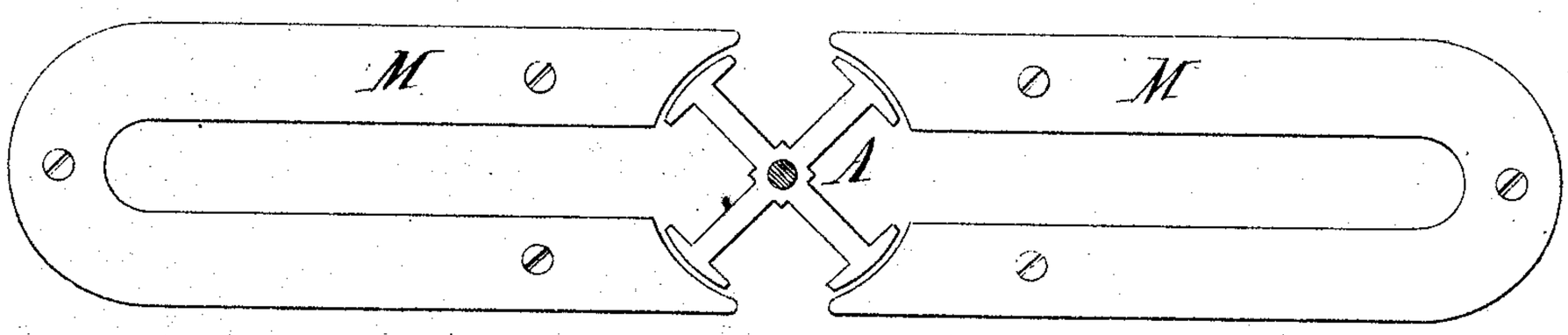


Fig: 6.

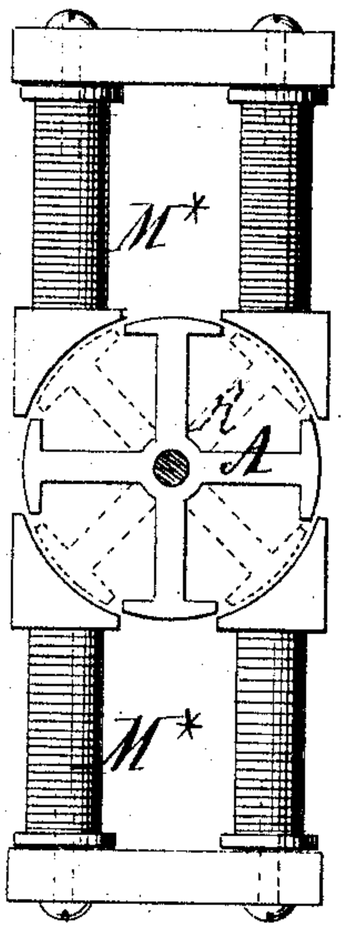


Fig: 7.

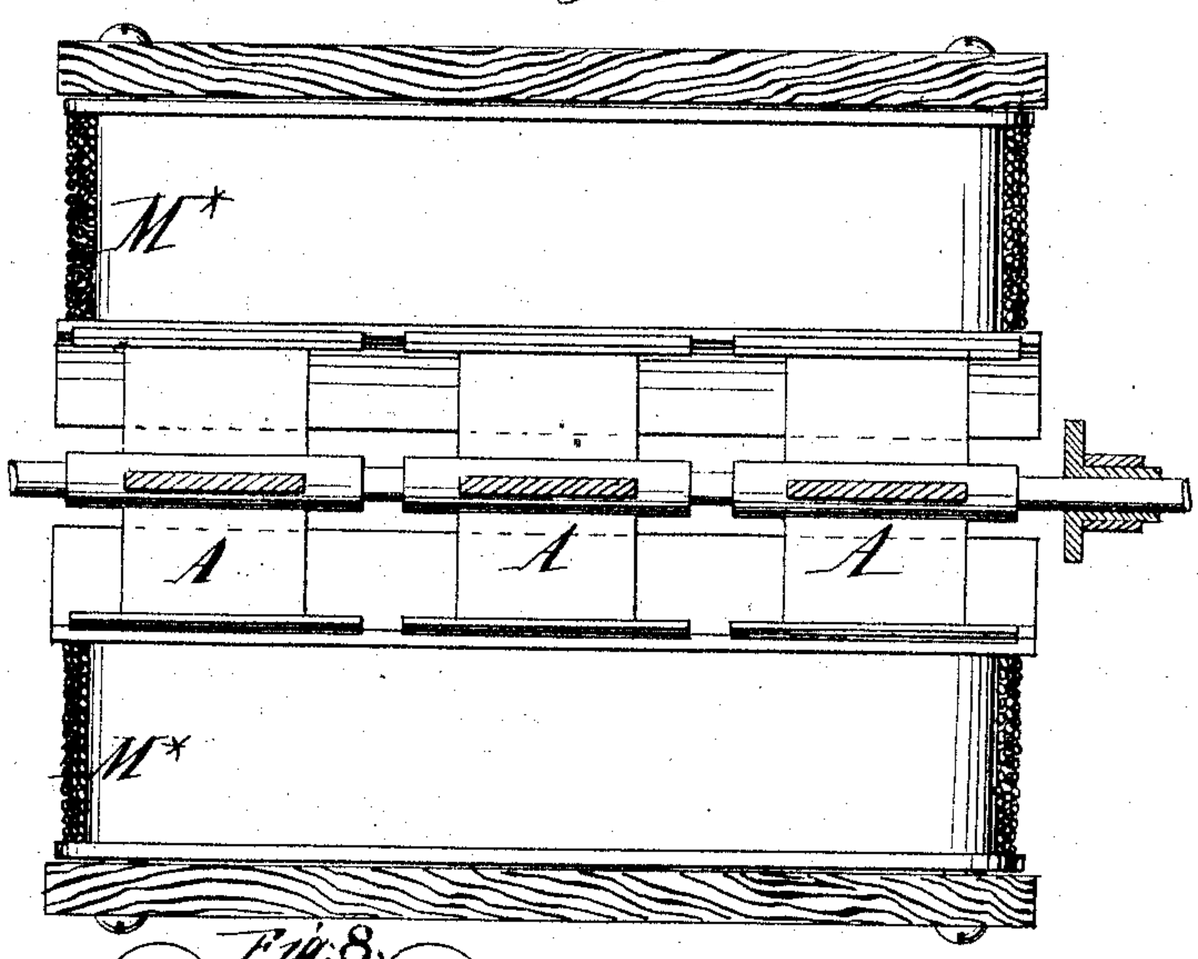
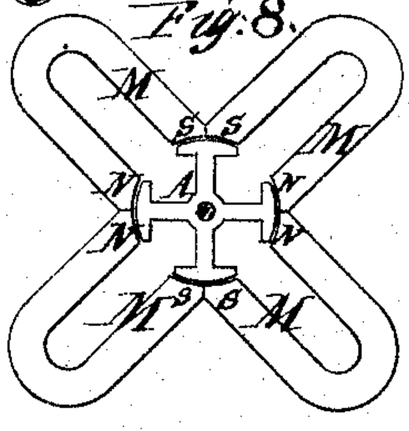


Fig: 8.



Witnesses:
Ernst Bilhuber.
Henry Gentner.

Inventor:
Otto Heikel
per
Van Santvoord & Hauff
Attys

UNITED STATES PATENT OFFICE.

OTTO HEIKEL, OF JERSEY CITY NEW JERSEY.

IMPROVEMENT IN MAGNETO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **155,376**, dated September 29, 1874; application filed November 13, 1873.

To all whom it may concern:

Be it known that I, OTTO HEIKEL, of Finland, now residing in Jersey City, in the county of Hudson and State of New Jersey, have invented an Improvement in Magneto-Electric Machines, of which the following is a specification:

I make use of a stationary magnet and an induction-coil that is revolved by mechanism to produce an electric current for medical and other purposes.

Magnetic motors and engines have been made in which the armatures are revolved by the attraction of electro-magnets, and magneto-electric machines have been constructed in which the induction-coils have been revolved contiguous to permanent or electro magnets.

My present invention relates to a peculiar construction of multi-polar induction-coil in which four or more soft-iron wings surround the central shaft, and upon the whole of these wings or arms the insulated wires are wound, layer by layer in succession, so that the spaces between the wings are gradually filled up. Thereby a very great length of wire is introduced into a small space, and the efficiency of the instrument is greatly promoted, and a powerful instrument made in a small compass. I also adjust the permanent magnet in its position relatively to the revolving induction-coil, so as to vary the intensity of the current.

In the drawing, Figure 1 is a plan of the machine complete. Fig. 2 is a central sectional view. Fig. 3 is a horizontal section of the wings of the induction-coil. Fig. 4 shows such wings in their relation to a permanent magnet of plates. Fig. 5 is a similar view, showing permanent magnets of plates at opposite sides of the induction-coil. Fig. 6 is an end view, and Fig. 7 is a section, of such induction wings or armatures with electro-magnets around them; and Fig. 8 is a plan of the armatures and four permanent magnets.

The metallic arms or wings A are upon a shaft, B, that is set in suitable bearings, and revolved by the wheel E on the gudgeon or center F, and a band to the pulley D. The electro or permanent magnet M is of ordinary construction, except that its poles are curved to be contiguous to a portion of the path described by the revolution of the induction-coil armatures A; and I remark that when an electro-magnet is employed the current is derived from a battery or from the electricity induced in the machine.

With the electro-magnet shown in Figs. 6 and 7 the induction-coils may be numerous, and placed on one shaft, and it is better to position those induction-coils that are connected to the helix of the electro-magnet intermediately, as indicated by dotted lines in Fig. 6.

The commutator or circuit-closer C is composed of two insulated rings upon the shaft B, against which forked springs rest, that are connected with the binding-screws and conducting wires or cords, and the ends of the wires of the induction-coil connect with these respective circuit-closers C, and these disks C are star or cam shaped, so as to close the circuit by contact with the springs, as usual in commutators.

The peculiarity of my induction-coil will be understood upon reference to Figs. 1, 2, and 3. The arms or wings *a a* are at right angles to each other, and terminate as segmental heads *b*. The insulated wire is connected at one of its ends to one of the rings of the circuit-closing disks C; then there is one layer of wire wound out and back upon one arm *a;* then one layer out and back on the opposite arm *a;* and then first one and then the other of the remaining arms is wound; then the operator commences a second layer upon the arm first covered, and applies that second layer to all the arms successively in the original order; then a third layer, and so on, until the entire four arms are filled in, as seen in Figs. 1 and 2. Of course, the coils of wire around one arm lie contiguous to those around the adjacent arms, and assume a conical form outwardly from the base of the arms where they unite with the shaft; but there is only one wire composing the helix of this induction-coil armature. Hence, as this has four arms, it becomes a compound induction-coil, the outer end of the wire being united with the other circuit-closing disk, *c*. This form of induction-coil-revolving armature is very compact and efficient.

In order to vary the intensity of the current or shock, the magnet M is made adjustable in relation to the revolving induction-coil. This

is accomplished by the screw *f*, that passes through the bend of the magnet into a block on the base G. Hence the magnet is held, but its poles can be moved farther from or nearer to the revolving induction-coil, and thereby the intensity of the shock or current is determined.

I claim as my invention—

1. The revolving induction-coil made of the four or more arms or wings, *a*, and heads *b*, upon all of which arms or wings a continuous insulated wire is wound in the successive layers, substantially as and for the purposes set forth.

2. An adjustable magnet applied to and combined with the revolving induction-coil armature, made in the manner before set forth.

OTTO HEIKEL.

Witnesses:

W. HAUFF,

E. F. KASTENHUBER.