(No Model.)

A. M. FRANKENBERG.

INDUCTION COIL.

No. 426,563. Patented Apr. 29, 1890.

Fig. 1.

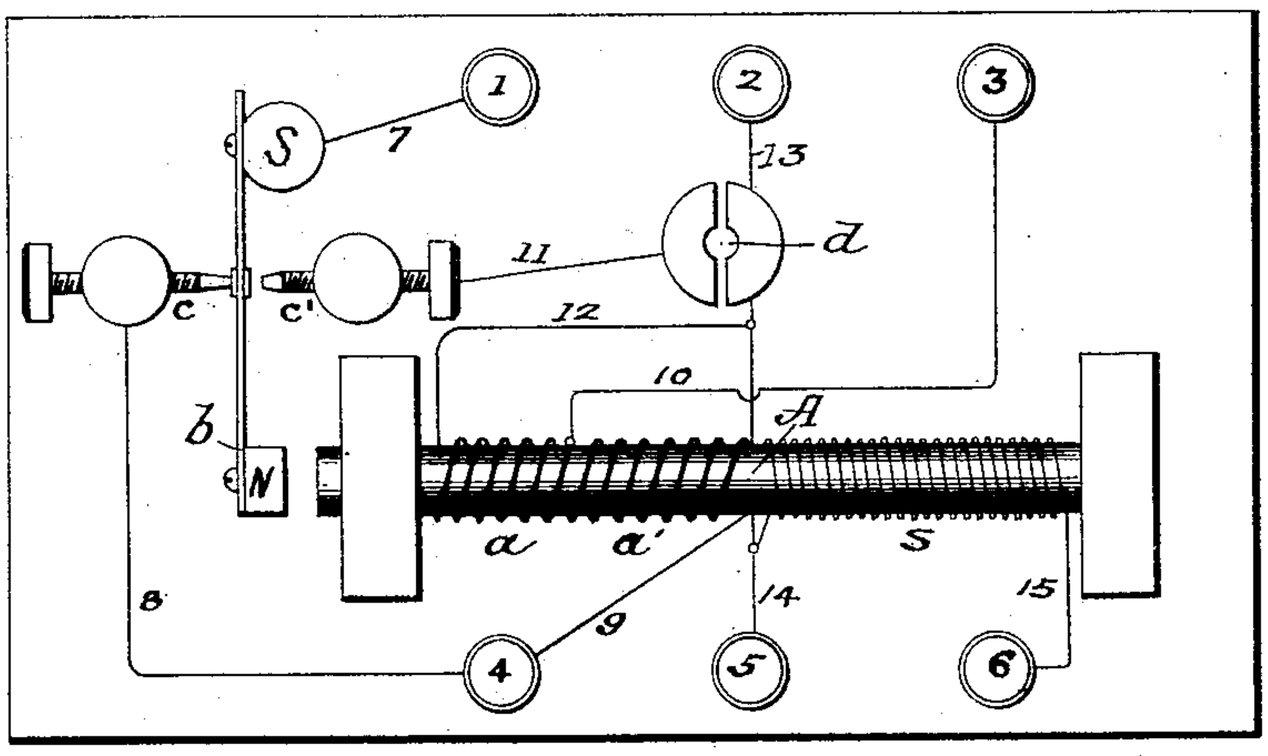


Fig. 2

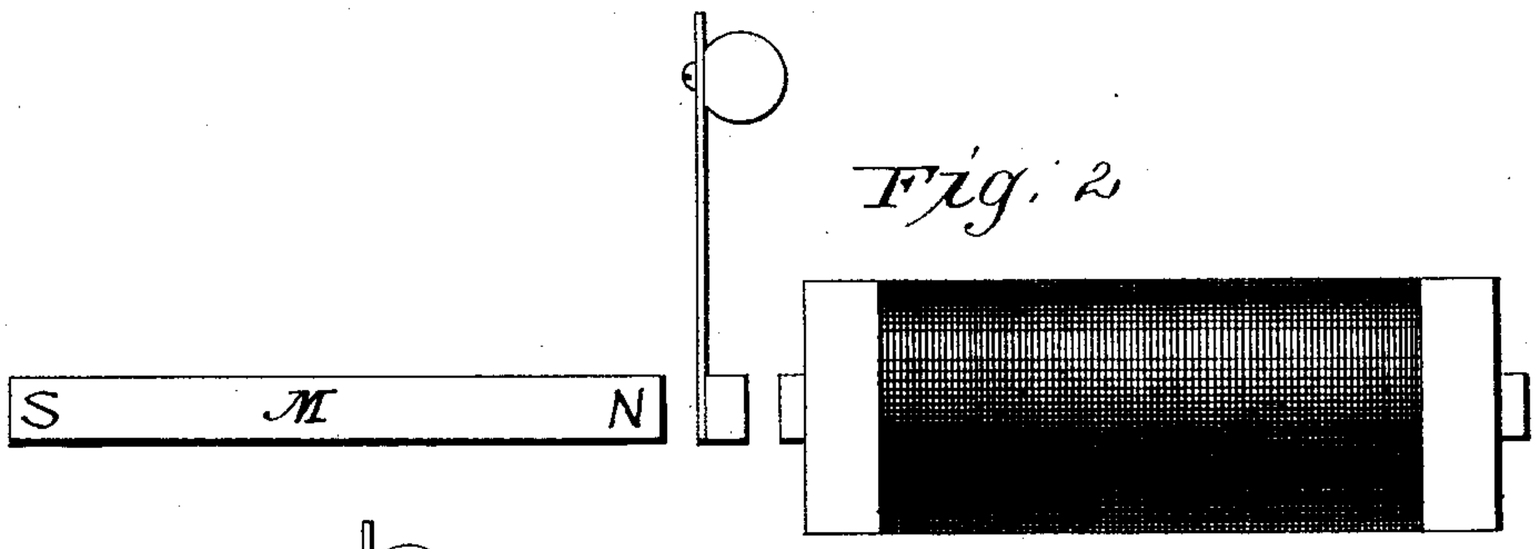
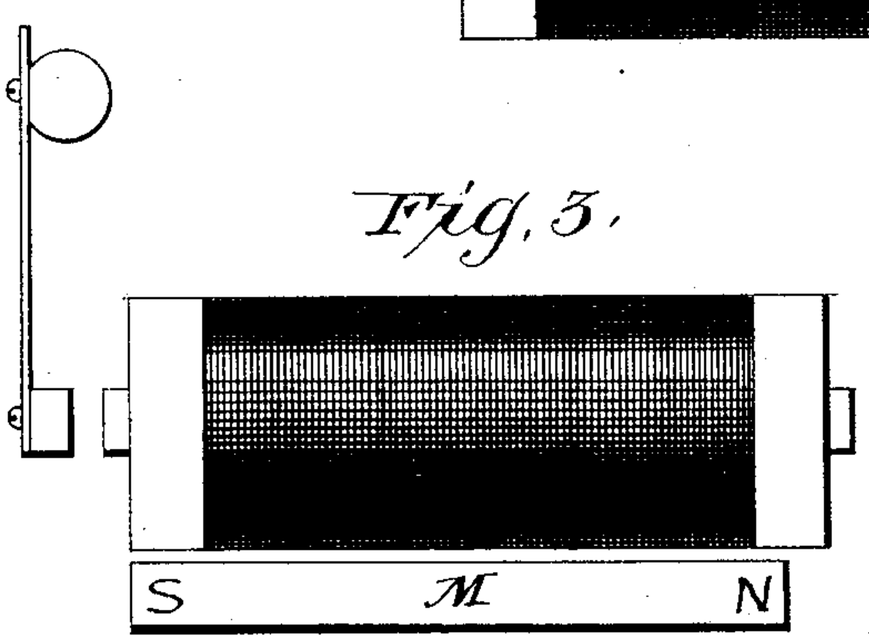


Fig. 3.



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INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 426,563, dated April 29, 1890.

Application filed June 21, 1889. Serial No. 315,090. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY M. FRANKENBERG, a citizen of the United States, residing in Baltimore city, in the State of Maryland, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification.

My invention relates to certain improvements in induction apparatus, and is especially adapted to electro-medical apparatus, though it may be used in connection with signaling apparatus, such, for instance, as is used in train telegraphy.

It is well known that in induction-coils the induced current created in the secondary wire upon the closing of the primary circuit is very weak, not perceptible under ordinary circumstances, while the induced current produced in the same upon the opening of the primary circuit is very strong and in the opposite direction to that of the former. Thus there is a succession of electrical impulses practically in one direction only.

The object of my invention is to produce in induction apparatus equal alternating currents.

Referring to the drawings, Figure 1 represents a general diagrammatical view of the apparatus, and Figs. 2 and 3 are illustrations of the application of a permanent magnet to improve the action of the coil.

A is a core upon which two primary wires *a* and *a'*, of equal thickness and length, are wound together in the same direction.

s is the secondary wire, wound upon the primaries in opposite direction thereto, and its ends are connected to the binding-posts 5 and 6 by the wires 14 and 15.

b is a polarized armature made of steel and magnetized, N indicating its north pole and S its south pole.

c and *c'* are contact-points for the same.

d is a plug-switch, by which the primary wire *a* is connected to the contact-point *c'*. A two-point switch may be used as well.

1, 2, and 3 are binding-posts for the battery, of which the positive pole is connected to post 1 and the negative pole to post 3. The use to which post 2 is put will be explained farther on. 4, 5, and 6 are binding-posts, to which the electrodes are connected for receiving the induced currents. When connected to 4 and 5, the primary induced current alone is received; to 5 and 6, secondary induced current alone, and to 4 and 6 the primary and secondary induced currents are given as one.

The operation of my apparatus is as follows: The contact-point *c* is so adjusted that when the armature is at rest it touches it slightly. If now the battery is connected, the current will pass from binding-post 1, wire 7, armature *b*, contact-point *c*, wires 8 and 9, primary coil *a'*, and wire 10 to binding-post 3. The core of the helix becomes magnetized, its south pole being the one nearest to the armature. The armature *b* is thus attracted, severs its connection with the contact-point *c*, and makes contact with the contact-point *c'*, thereby passing the battery-current from binding-post 1, wire 7, armature *b*, contact-point *c'*, wire 11, switch *d*, wire 12, primary coil *a*, and wire 10 to the binding-post 3. The battery-current in the latter case passes through the primary coil *a* in the opposite direction of that of the primary coil *a'*. Thus the poles of the core become reversed. That nearest the armature now being the north pole, it repels the armature *b*, which is again thrown back on the contact-point *c*, and the same operation is repeated indefinitely. It will be understood that as the battery-current is passed through the primary coils alternately in opposite directions the poles of the coil are alternately reversed. Thus the induced currents are of the same nature. A direct current can also be produced with this apparatus, when desirable, by removing the plug from the switch, thereby disconnecting the primary coil *a* from the contact-point *c'*, the battery-current thus passing only through the primary coil *a'* and in one direction only, as in the ordinary induction apparatus: A much stronger direct current can be given by connecting both primary coils together as one. This is accomplished by removing the battery-wire from the binding-post 3 and connecting it to the binding-post 2. The battery-current then passes from the binding-post 1, wire 7, armature *b*, contact-point *c*, wires 8 and 9, through both primary coils in the same direction, wire 12, switch *d*, and wire 13 to the binding-post 2. The plug should be

removed from the switch in this case, so as to prevent short-circuiting the battery when the armature touches the contact-point c'.

It will be seen that with this apparatus nine qualities of induced currents are produced, as follows:

Alternating current.—Primary alone, secondary alone, primary and secondary combined.

Direct current.—(One primary coil in use,) primary alone, secondary alone, primary and secondary combined.

Direct current.—(Both primary coils in use,) primary alone, secondary alone, primary and secondary combined.

As the armature is a polarized one, it assists its attracting and repelling forces during its vibrations, rendering them very uniform, and consequently a very smooth and steady induced current is produced.

I do not confine myself to a polarized armature, inasmuch as equal results may be obtained by using an ordinary armature polarized inductively by placing a magnet near it. This is illustrated in Fig. 2. The magnet M is a bar-magnet, and is arranged with its north pole adjacent to the armature. In Fig. 3 the magnet M is arranged parallel to the helix, with its south pole nearest to the armature, or, rather, with its poles the same as the poles of the helix when it is charged by the initial current.

It is not absolutely necessary that the armature should be polarized. An ordinary one may be used; but its vibrations are very unreliable and an unsteady induced current is produced.

Having thus described my invention, I claim—

1. The combination, with an induction-coil having two primary circuits through which the current flows alternately in opposite directions and an ordinary unpolarized armature, of a permanent magnet arranged so that the armature will be in the field of force of the magnet, the polarity of the armature end of the coil being opposite that of the presented magnet when the current flows through the primary in one direction and of the same polarity when the current flows in the other direction.

2. The combination, with an induction-coil having the primary circuits a and a', through which the current flows alternately in opposite directions, and an ordinary unpolarized armature, of a permanent magnet arranged so that the armature will be in the field of force of the magnet, the polarity of the armature end of the coil being opposite that of the presented magnet when the current flows through the primary wire a', and of the same polarity when the current flows through wire a.

3. The combination, in an induction-coil, of two primary circuits and a secondary circuit, one and the opposite terminal of each primary circuit joined together to one source of electricity, of two contact-points arranged on opposite sides of a polarized armature and respectively electrically connected with the other terminals of the two primary circuits, of a polarized armature connected to the other source of electricity and vibrating between said contact-points and making contact with them alternately, thereby passing a current of electricity through the primary circuits alternately and in opposite directions to each other, substantially as described.

4. The combination, with an induction-coil having two primary circuits and one secondary wound upon a single core, of an armature for the same, a contact-point located on each side of the armature, one of said points connecting with a terminal of one of said primary circuits and the other of said contacts connecting through a switch with a terminal of the other primary circuit, and a battery-circuit one of whose terminals is the armature and the other the joined opposite terminals of the two primary circuits.

5. The combination, in an induction-coil, of two primary circuits and a secondary circuit, one and the opposite terminal of each primary circuit joined together to one source of electricity, of two contact-points arranged on opposite sides of the armature and respectively electrically connected with the other terminals of the two primary circuits, of an inductively-polarized armature connected to the other source of electricity and vibrating between said contact-points and making contact with them alternately, thereby passing a current through the primary circuits alternately and in opposite directions to each other, substantially as and for the purpose set forth.

6. The combination, with an induction-coil having the primary circuits a and a', through which the current flows alternately and in opposite directions to each other, of a polarized armature, the polarity of which is opposite that of the armature end of the coil when the current flows through the primary circuit a' and of the same polarity when the current flows through the primary circuit a.

In witness whereof I have signed my name in the presence of two subscribing witnesses.

ANTHONY M. FRANKENBERG.

Witnesses:
LOUIS BECKER,
THOS. M. NORRIS.