(No Model.)

R. EICKEMEYER.

ELECTRO MAGNETIC AND MAGNETO ELECTRIC MACHINE.

No. 351,904. Patented Nov. 2, 1886.

Fig. 1.

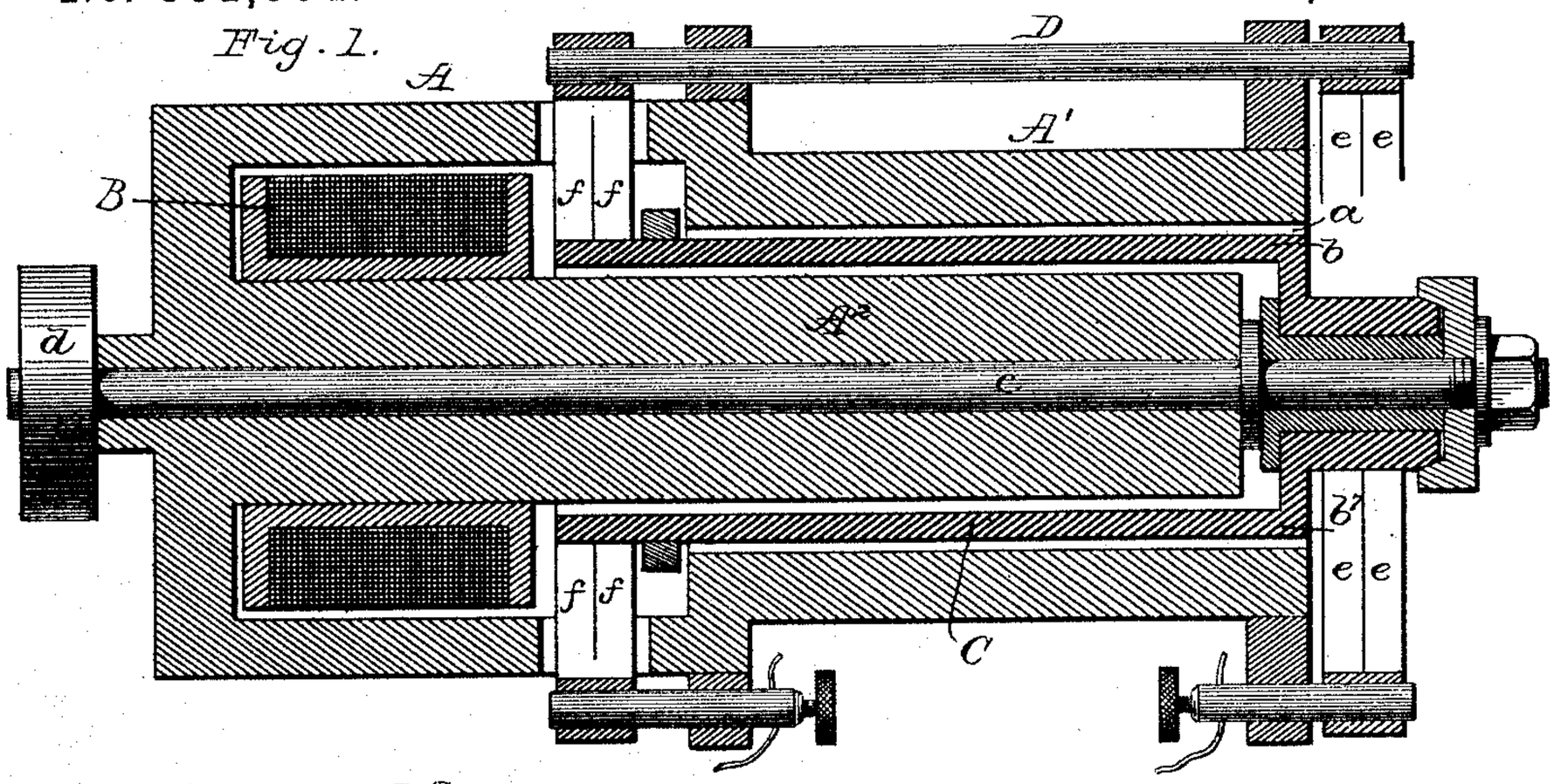


Fig. 3.

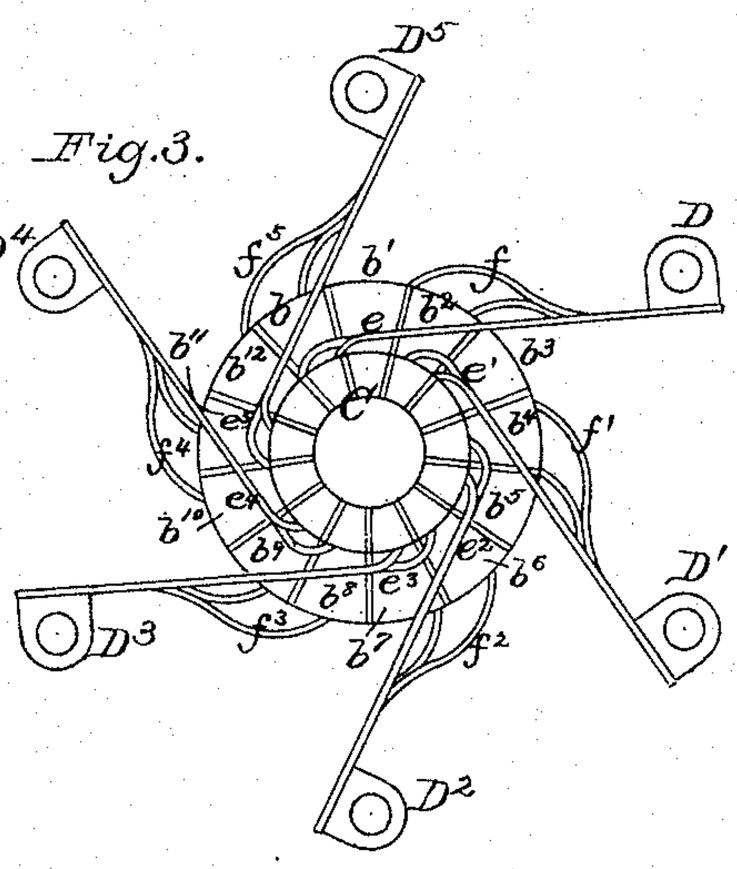


Fig. 2.

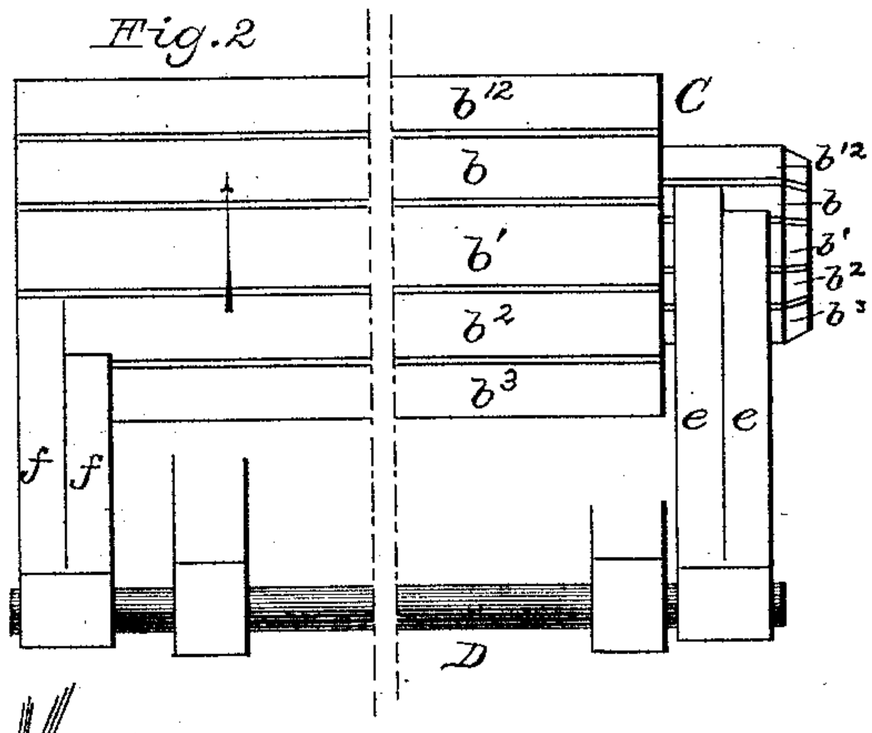
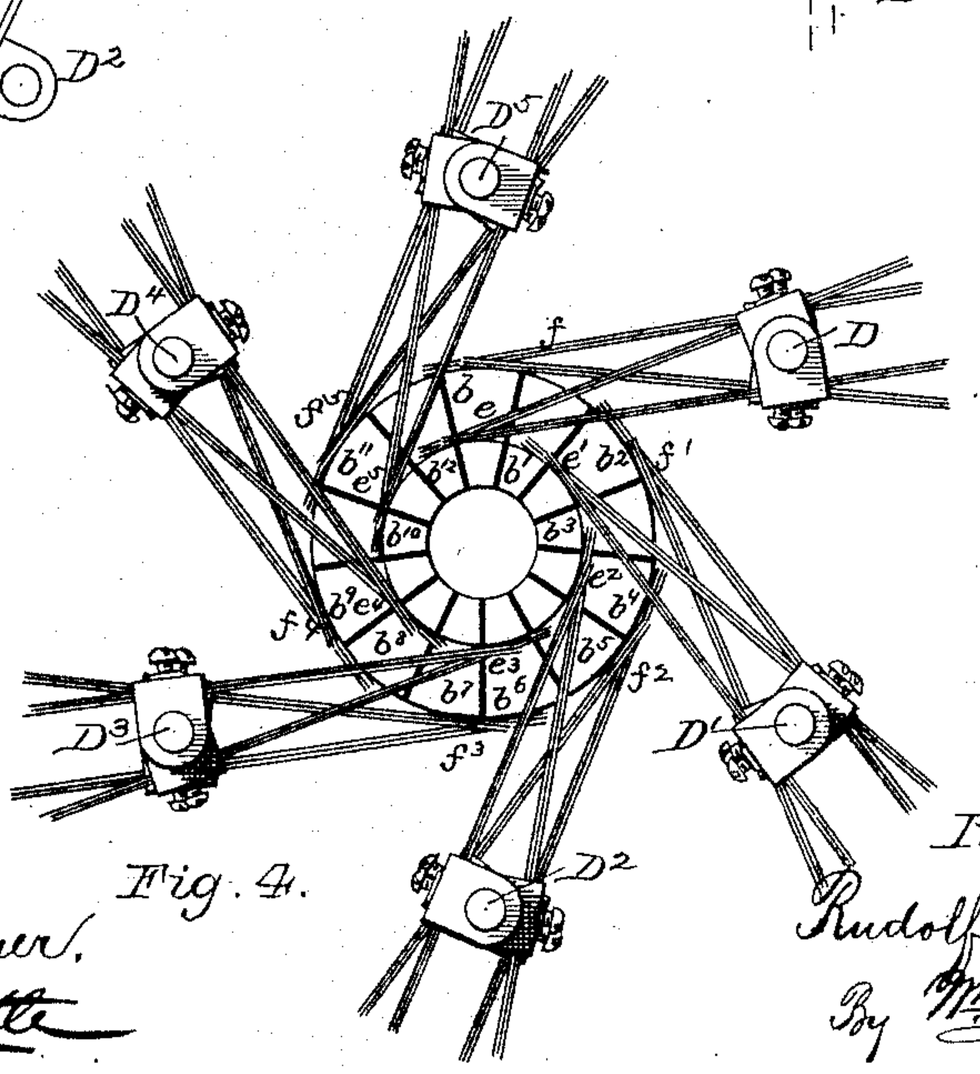


Fig. 4.



Attest:

Philip F. Larner.

Howell Battle

Inventor:

Rudolf Eickemeyer

By Wm. G. Moore

Attorney.

UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

ELECTRO-MAGNETIC AND MAGNETO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 351,904, dated November 2, 1886.

Original application filed November 8, 1882. Serial No. 76,234. Divided and this application filed March 7, 1885. Serial No. 158,033.

(No model.)

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electro-Magnetic and Magneto-Electric Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

It is to be understood that the machine hereinafter particularly described, and illustrated in the drawings, embodies certain features of invention which have been broadly claimed by me in my application for Letters Patent filed November 8, 1882, Serial No. 76,234, and that in my said prior application I have shown and described the machine which is now employed by me for illustrating the subject of this application, which is filed as a division of said original application.

My present improvements relate to what are known as "unipolar machines," and to a particular variety thereof, which were, as I believe, first devised by me, and embody as a characteristic feature an armature or equivalent mechanically active element located within an annular field of magnetic force, and carrying two or more independent electric conductors. Various machines have been constructed by me involving said feature, several of which have been illustrated and described in my said original application. In said machines the several independent conductors are connected in linear series, so as to afford one or more separate electric circuits, according to the number of conductors thus connected in each circuit. In said machines outside electric conductors are employed for coupling the opposite ends of the armature-conductors, and in some cases each of said armature-conductors has at each of its ends a conducting-ring from which a current can be taken continuously, as by means of brushes or other forms of contact-pieces, each of which is always in electrical connection with one particular armature-conductor. In machines embodying the subject of this application the independent armature-conductors are not provided with conducting-rings, and they are not in continuous electrical connection with the brushes or their equivalent, and, instead of having brushes which are limited to service with one armature-conductor, each brush is consecutively common to all of said conductors, and is sequentially in electric contact with all of them at one end thereof. In machines embodying the independent armature-conductors and their conducting-rings it is obvious that to every two of said rings (except those two which serve as the terminals of the machine) there can be an outside conductor for each armature-conductor; but with a brush or equivalent contact-piece which engages sequentially with or is engaged by all of the bars at one end the number of outside conductors must be less than the number of armature-conductors, or, in other words, one and sometimes two or more of the bars at one end must be simultaneously coupled with one and sometimes two or more bars at the opposite end of the armature, and so on throughout the series of conductors—as, for instance, with thirteen armature-conductors and their conducting-rings there would be thirteen outside conductors, including the terminals, whereas in the machine hereinafter described the same number of armature-conductors have six outside conductors, five of which extend from end to end of the machine, and the other, being in two parts, affords the terminals, thus consecutively coupling one end of one and then two armature-conductors with the opposite ends of other armature-conductors, and intermittingly cutting out from the circuit each one of the several armature-conductors, or, in other words, each of said armature-conductors is included within and excluded from the electric linear circuit six times during each revolution of the armature. This particular number of armature-conductors, or of the outside conductors proportionate thereto, in no manner enters into the gist of my invention, which, broadly stated, consists in an armature carrying a series of independent electric conductors coupled by a smaller series of outside conductors, each provided with brushes or contact-pieces engaging with opposite ends of the armature-conductors, whereby a continuous electric circuit is af-

forded which, within the machine, repeatedly traverses the armature-conductors in one direction, and at all portions of its path on said armature always includes one and sometimes more than one of said armature-conductors.

After describing in detail the machine illustrated, the several features of my invention will be specified in the several claims hereunto annexed.

Referring to the drawings, Figure 1 is a horizontal longitudinal section of so much of a machine as is deemed necessary for the purposes of this specification. Fig. 2 is a plan view of the armature and one of its outside conductors detached from the machine. Fig. 3 is a diagram illustrating the arrangement of the outside conductors, their brushes, and the opposite ends of the armature-conductors. Fig. 4 is a reduction of said diagram Fig. 3 into mechanical form.

The electro-magnet A may be indefinitely varied in construction without departure from my invention, so long as an annular field of magnetic force is afforded between inner and outer poles. As here shown, the magnet at A′ has an exterior tubular pole-piece and an interior pole-piece, A^2, and the concentric space *a* between them affords the annular field of force. But one exciting-helix, B, is here shown, housed within the shell of the magnet at the base thereof; but it is to be understood that more than one of said helices may be employed, and that the magnet may be doubled, if desired, and that the interior pole may be rotatory instead of stationary, without departure from my invention, such and still other variations in that connection being fully illustrated in my said original application. The armature C may also be indefinitely varied in construction without departure from my invention, so long as it embodies a series of independent longitudinal electric conductors or bars, *b*, which are caused to revolve within said annular field of force and to continuously cut the magnetic lines in one direction. As here shown, said armature is in the form of a cylindrical shell secured at one end to an armature-shaft, *c*, which is provided at its opposite end with a belt-pulley, *d*, and has its bearings within the inner pole-piece of the magnet.

The armature-bars *b* are insulated from each other and operate as independent electric conductors, and at their outer ends they terminate upon the armature-hub, and at their exposed edges afford contact-surfaces, and at their inner ends similar contact-surfaces are also afforded, which are accessible by way of radial apertures in the shell of the magnet. In some cases these bar-conductors are composed of magnetic metal, so as to render the armature a compound bar-magnet, and in other cases said bars are composed of non-magnetic metal, as fully set forth in my said original application; but these variations do not relate to my present invention.

Referring now to the detached partial plan view, Fig. 2, it will be seen that in this particular instance the bar-conductors are narrower at their outer ends than at their main portions, as an incident of the reduced diameter of the hub as compared to the main body of the armature. Although it is practicable to electrically connect with both ends of an armature which does not have its conducting-bars extended into a hub, as shown, this latter feature is of value, whether at one or both ends of an armature, because of the facility afforded in providing for the connection of the exposed surfaces of said bars with the outside conductors. In this figure but one outside conductor, D, is shown, (to avoid confusion,) and this at one end is provided with a pair of spring-brushes, *e*, which overlie the hub of the armature, and in the particular position shown said two brushes, *e*, are in electric contact with but one of the bars *b*. At the opposite or inner end of said conductor there is another pair of brushes, *f*, which, in like manner, in this particular position are engaged in electric contact with but one of the bar-conductors b^2, leaving between the two bars thus coupled in linear series the bar *b′*; but it will be seen that as the armature revolves in the direction of the arrow the bars *b* and *b′* will next be coupled in linear series with the bars b^2 and b^3, and so on, with this particular conductor, will there be an intermitting coupling, first, of one bar with the opposite end of another bar, leaving out of circuit an intervening bar, and then coupling two bars at one end with two other bars at the opposite end; and it will be obvious that by employing additional similar outside conductors and brushes properly located all of said bars will be similarly coupled and a continuous electric circuit afforded through the machine, traversing the conductors in linear series, although at some portions of its path on the armature said circuit will occupy but one bar, and at other portions two bars.

Referring now to the diagram Fig. 3, the several outside conductors are designated D D′ D^2 D^3 D^4 D^5, and their respective pairs of brushes are designated as *e f*, *e′ f′*, e^2 f^2, e^3 f^3, e^4 f^4, and e^5 f^5, and the bar-conductors *b* are separately indicated, and are thirteen in number. Assuming the armature to be at rest, it will be seen that bar *b* is coupled to bar b^2; bar *b′* is out of circuit; bars b^2 and b^3 are coupled to bar b^4; bars b^4 and b^5 are coupled to bars b^6 and b^7; bars b^6 and b^7 are coupled to bars b^8 and b^9, bars b^8 and b^9 to bars b^{10} and b^{11}, and that bars b^{10} and b^{11} are coupled to bars b^{12} and *b*, thus completing the circuit, which traverses the armature five times, because one of said conductors is in two parts and provided with brushes, thus affording the electric terminals of the machine, as indicated in Fig. 1. From this diagram it will be readily seen that as the armature revolves each brush is progressively engaged electrically by all of the conductors, and that the electric circuit within the machine is continuous and repeatedly traverses

the armature-conductors in one direction, and that said circuit at all portions of its path always includes one or two of the armature-conductors, and also that said conductors are intermittingly connected in linear series, although each conductor is taken into and excluded from the circuit six times during each revolution of the armature.

It will be seen that in Figs. 1 and 2 the brushes *e* and *f* lie flatly upon the contact-surfaces of the conducting-bars, and it is to be understood that the peculiar form of said brushes exhibited in the diagram Fig. 3 was adopted merely in order to more readily illustrate the circuit-contacts than would have been possible had said brushes been shown as practically employed by me, and as I have illustrated them in Fig. 4, wherein corresponding letters of reference have been employed, although the brushes therein occupy positions relatively to particular conducting-bars which differ slightly from those illustrated in the diagram.

It will be seen that portions of the armature-conductors are radial to the axis of the armature, and it is to be understood that conductors which are essentially radial to said axis and are located in an effective magnetic field constitute, in appropriate combinations, the subjects of separate applications for Letters Patent. (See Serial Nos. 202,973 and 203,125.)

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electro-magnetic or magneto-electric machine embodying an armature carrying a series of independent electric conductors, an electric circuit which repeatedly traverses the armature from end to end in one direction, and alternately includes one and more than one of said conductors throughout its path on said armature, substantially as described.

2. In an electro-magnetic or magneto-electric machine, the combination, substantially as hereinbefore described, of a magnet affording an annular field of force, a revolving armature carrying a series of independent electric conductors, and a smaller series of outside stationary conductors provided with contact-pieces, each of which alternately engages electrically with one and then with two of said armature-conductors, whereby said armature-conductors are successively connected singly and in pairs in linear series, and a continuous circuit afforded.

3. In an electro-magnetic or magneto-electric machine, the combination, substantially as hereinbefore described, of an armature embodying a series of independent electric conductors extended into an armature-hub, and a series of outside stationary conductors provided with contact-pieces in successive engagement with said armature-conductors at the hub, for coupling them electrically with other conductors at the opposite end of the armature.

RUDOLF EICKEMEYER.

Witnesses:

PHILIP F. LARNER,

HOWELL BARTLE.