(No Model.) 2 Sheets—Sheet 1

M. J. WIGHTMAN.

ALTERNATING CURRENT MOTOR.

No. 562,686. Patented June 23, 1896.

Fig. 1

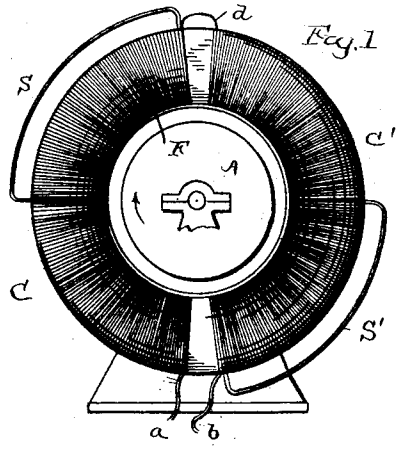


Fig. 2.

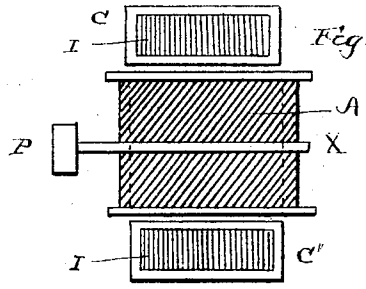


Fig. 3.

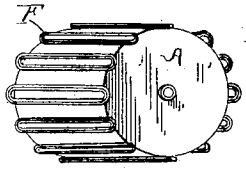


Fig. 4.

Fig. 5

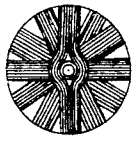


Fig. 6.

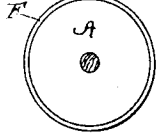


Fig. 7

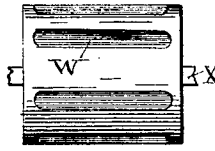


Fig. 8.

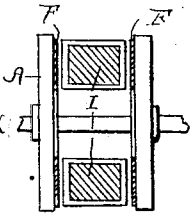


Fig. 9.

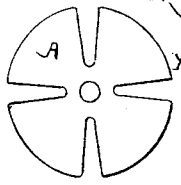


Fig. 10.

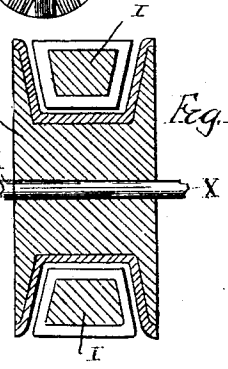
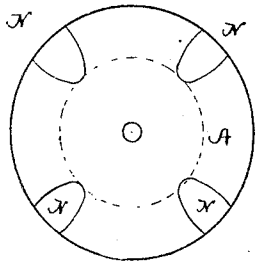


Fig. 11.



Witnesses
Ina R. Steward
Jno. A. Cabell

Inventor
MERLE J. WIGHTMAN

By his Attorneys
Townsend & Townsend

(No Model.)

2 Sheets—Sheet 2.

M. J. WIGHTMAN.

ALTERNATING CURRENT MOTOR.

No. 562,686. Patented June 23, 1896.

Fig. 12.

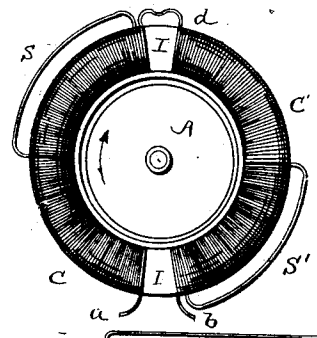
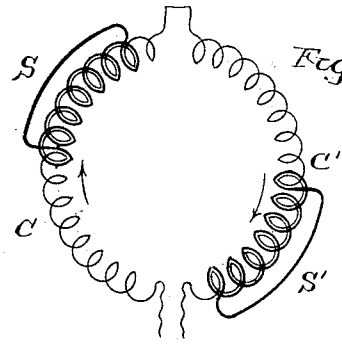


Fig. 13.



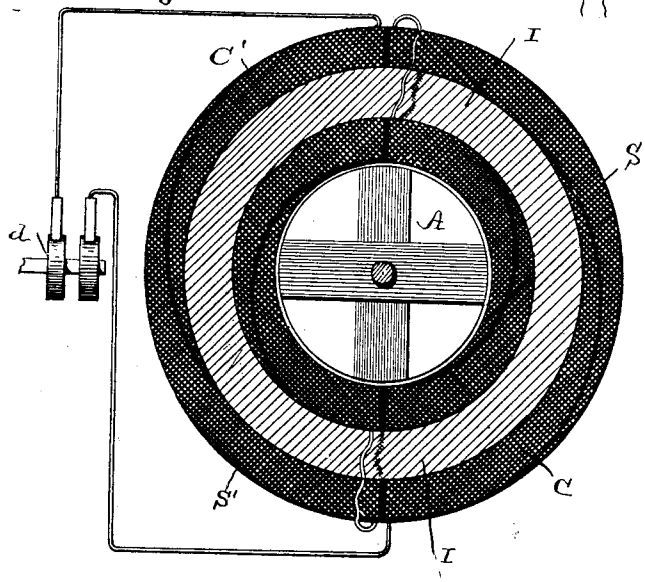


Fig. 16.

Fig. 14.

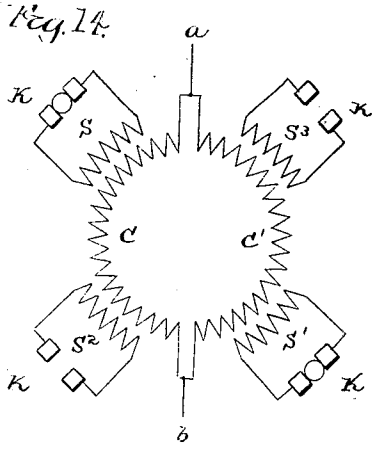
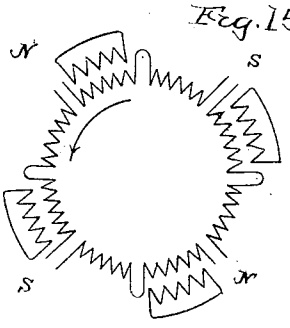


Fig. 15.



Witnesses
Ira R. Steward
Wm. A. Copel

Inventor
MERLE J. WIGHTMAN

By his Attorneys
Townsend & Townsend

UNITED STATES PATENT OFFICE.

MERLE J. WIGHTMAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ALTERNATING-CURRENT MOTOR.

SPECIFICATION forming part of Letters Patent No. 562,686, dated June 23, 1896.

Application filed July 26, 1888. Serial No. 281,126. (No model.)

To all whom it may concern:

Be it known that I, MERLE J. WIGHTMAN, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Alternating-Current Motors, of which the following is a specification.

This invention relates to alternating-current electric motors; and it consists of an alternating-current coil surrounding a magnet-core and having at some portion of its length a closed-circuit conductor, which is the seat of induced currents that operate to produce a lag of the alternations of the field in the portion of field adjacent to said conductor, in combination with a suitable armature which is placed within the magnetic field of the inductor and is adapted to be the seat of induced currents developed by the modified or unretarded portion of the inductor, the attraction of such currents by the currents of the field at the retarded portion producing a movement of the structure, one or both elements of which may be properly mounted so as to be capable of revolution.

My invention consists, further, of a motor having a field-magnet of substantially endless form carrying an alternating-current coil or coils wound to produce two or more poles, closed induced circuits, one or more, applied to definite points of said field-magnet, and an armature within the field of said magnet, as will be hereinafter described.

My invention consists also in the special forms and combinations of apparatus which will be described in connection with the accompanying drawings, and then more specifically stated in the claims.

In the accompanying drawings, Figures 1 and 2 are views of a motor embodying the principle of my present invention. Fig. 3 is a suitable construction of armature for the same; Figs. 4, 5, 6, 7, and 8, modifications thereof. Fig. 9 is a detail of the armature; Figs. 10 and 11, still another form of armature possessing the same advantages. Fig. 12 elucidates the principle of the action of the apparatus. Figs. 13, 14, and 15 are diagrams of circuits which may be used. Fig. 16 is another construction shown in section.

In Figs. 1 and 2, I I is a ring-core surrounded by coils of insulated wire. These coils are wound, as one of the preferred modes, so as to tend to produce polarity at opposite ends of a diameter. The current entering at *a*, Fig. 1, would pass around one half of the ring to the left and reverse at point *d*, to return by the other half of the ring on the right and the exit *b*. This winding is arranged to be connected to an alternating current from any source and to be traversed by such current.

A portion of the winding has parallel to it or interwound therewith a short-circuited conductor or coil indicated at S, as covering about one-quarter of the ring, and at S′ another similar conductor, diametrically opposing S in the instance shown. This leaves portions C C′ of the alternating-current winding without any parallel short-circuited coil. A good proportioning is had by placing four layers of wire on the ring at C and two layers of the same winding on that portion of the ring-core which is adjacent to it, and which the short-circuited winding S, of which latter there would be an equivalent two layers short-circuited. The portion C′ would similarly have four layers, while two layers of the alternating circuit would underlie or overlie two layers of the short-circuited coil S′.

With the arrangement thus constituted motion may be at once produced by mounting near the structure and parallel to the plane of the ring a disk of iron mounted upon a pivot, or, as shown in the figure, by mounting in the interior of the ring an iron body preferably surrounded with a facing or sheet of copper F, in which induction-currents can be developed. The passage of alternating currents supplied through the terminals *a b* results in a rapid revolution of the armature-body A (placed on a suitably-supported shaft) and gives power to the motor-pulley P for use. The armature itself may be constructed in very many ways. It may be a body of iron, laminated or not, with closed-circuit coils placed upon its face, as at F, Fig. 3, or it may have recesses, as in Fig. 4, for the reception of such closed coils.

The ring structure I I, Figs. 1 and 2, should of course be made of laminations or of iron wire.

The armature A may be also wound, as in

Fig. 5, with closed coils passing over its ends and forming a longitudinal winding similar to that of a Siemens armature, but each coil closed upon itself, or, as in Figs. 6 and 7, the body A of the armature may be of iron and the outer shell F of copper, with windows or openings cut therein. This gives a tendency to synchronism of the rates of revolution with the speed of the alternations given to the current which feeds the coils of the apparatus, the relation of the speed and the alternations being dependent in such case, on account of the fact that the windows or openings in the copper facing form virtually magnetic poles or polar projections on the armature. In fact, the iron itself might come up through the spaces or windows provided at W. The armature may also be constructed of a disk or ring, as at A A', Fig. 8, placed laterally to the magnet-ring I I and faced with copper or closed conductor-coils at F F, where presented to the ring. The armature could even be a sheet of copper, either complete or with cut-away notches, as shown in Fig. 9, but the action will be more feeble in such cases.

About the best form of armature which can be employed for obtaining the maximum results is that shown in Figs. 10 and 11, where the magnetized ring I I is suitably mounted so as to lie in a sort of groove in the poles of armature A, and which latter can revolve free of the ring I I. The face of the armature or pole thereon is covered with copper conductors where presented to the ring and forms a number of closed circuits. Here nearly all of the magnetizing force or influence of the iron ring is caught or shaded by the armature and utilized for the production of power. The edges of the armature may be cut away, as in the other cases, with notches, as in Fig. 11, or otherwise provided with poles which tend to the synchronizing of the structure with the rate of alternations in the circuit. This can be done by notching the edge of the armature-core at N N N N more or less deeply.

Fig. 12 is a diagram substantially identical with Fig. 1, only showing the circuits a little more clearly. Fig. 13 shows the circuits separated for clearness. In these figures the direction of revolution will be as indicated by the arrows, the motion being from that portion of the winding which has no short-circuited underlying or parallel conductor.

Manifestly many modifications may be introduced into the windings, &c., without producing substantial alterations in the results accomplished.

In Fig. 14 the winding C C' of the ring is shown connected as two coils in multiple between A and B, and tending, as before, to magnetize the ring alternately north and south at opposite points of the diameter. The closed-circuit coils S S' S^2 S^3 S^4 are in two sets diametrically placed, as shown, and overlying the winding C C'. The coils S S', &c., are provided with short-circuiting plugs or switches K K K K, whereby either the coils S S' may be short-circuited, or the coils S^2 S^3 instead. Rotation of the armature will take place in one direction when circuits S S' are closed, and in the reverse direction when S^2 S^3 are closed. The winding may be such as to produce a number of polar points on the ring. For example, in Fig. 15 a current of a definite direction is sent through the magnetizing-coils tending to produce polarities at the points N S N S, respectively, there being in this case four magnetizing-coils fed by the alternating current, over a portion of each of which is applied the short-circuited winding. In this case the action will be the same, but the actions will take place at four positions on the ring.

It is unessential in what way the winding be laid on or connected up, whether in series or in parallel, or in any other combination, provided that coils comparatively free of short-circuited or parallel windings are succeeded by coils or portions of coils which are provided with or which are adjacent to coils or circuits which are short-circuited around the core or ring, the motion of the armature being always from that portion not provided with short-circuiting coils toward that portion which is provided with short-circuited coils. The theory of the action is the same as that put forth in a prior application before referred to, the closed circuits S, &c., becoming the seat of induced currents of considerable self-induction, thereby producing a modification or lag in the alternations of field over, or in proximity to, which they lie, so that there will be in effect two sets of alternations of inductive field produced by the operation of the alternating currents in the exciting-coils, one set being set up directly by said currents while the other, which is in a portion of field adjoining the first and within the modifying influence of the closed circuits, will come in with a lag or with a phase of alternation displaced from the first set. The lag or difference of phase may be even so great that when an inductive field of one polarity exists in one part of the field of the ring under the action of the alternating-current coils unmodified a field of the opposite polarity may exist over or in proximity to those portions of the inductor which have their actions retarded or modified by the closed circuits. Thus, for instance, while the current is flowing in one direction in the alternating exciting-coils, the induced currents in the closed circuit S, &c., may flow in the opposite direction. Under these conditions the unmodified or slightly-modified alternations set up in the armature currents or polarities which will be of the proper sign to be attracted by the retarded or lagging alternations of inductive influence set up over or in proximity to the closed-circuit conductor S, &c., thus producing rotation of the inductor or armature, or both. From some points of view also repulsive actions may be considered as set up in a manner to cause rotations

of the armature. The action is also simply explained on the theory that there exists a constant tendency of the induced currents in the armature to place themselves in parallel or close relation to the short-circuited currents.

In Fig. 16 there is shown a modified arrangement of the winding. In this the active alternating-current coils C C′ begin deeply at one end and taper off as they pass around the ring, but as they diminish in depth or extent the closed-circuit windings S S′ increase in amount in going around the ring. Each coil beginning at the diametrical line of division passes but part way around to the same line, being entirely replaced at the opposite end of the circumference by the closed-circuit conductor. The operation is substantially the same as before, the closed circuit acting as modifiers of parts of the inductive field produced by the coils C, &c., so as to give at parts of the fields of induction upon the armature a set of alternations displaced in phase from those produced at other parts of the circumference. This is but one of the modifications which comes within the scope of the present invention.

While I have set forth a theory of electrical action in the structure shown, I do not limit myself necessarily to a structure which can operate on the natural principles indicated only, but mean to claim, broadly, any structure in which the parts are assembled and combined in a manner similar to that set forth and shown to produce polarities and fields of inductive action and closed circuits in the relations described.

What I claim as my invention is—

1. In an alternating-current motor in which an effective rotation is produced by parallel circuits formed upon a ring-core, and one of which is closed on itself, an armature A, and an interposed copper conductor F, substantially as described.

2. An alternating-current motor provided with coils tending to establish opposite magnetic polarities at different points of a ring in combination with a set of closed circuits in inductive relation to the magnetizing-coils, and means whereby the one or the other of said inductive circuits may be closed or opened for governing the direction of rotation of the armature, substantially as described.

3. In an alternating-current motor, a field-magnet consisting of a ring-core having coils connected to a source of alternating current and wound about the core in succession and in a manner to produce poles alternately north and south, and closed-circuit coils wound upon alternate ones of said successive coils, in combination with an armature mounted to rotate on an axis coincident with the axis of the field-magnet substantially as set forth.

4. In an alternating-current motor, a field-magnet consisting of a ring-core having coils connected to a source of alternating current and wound about the core in succession and tapering at one end to a single turn in combination with closed-circuit coils wound upon said successive coils and tapered outwardly to fit the latter, and an armature mounted in the center of the field-magnet, substantially as set forth.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 19th day of July, A. D. 1888.

M. J. WIGHTMAN.

Witnesses:
J. W. GIBBONEY,
A. L. ROHRER.