No. 662,772. Patented Nov. 27, 1900.

J. DARLING.

ELECTRIC MOTOR.

(Application filed Sept. 1, 1900.)

(No Model.)

Fig. 1.

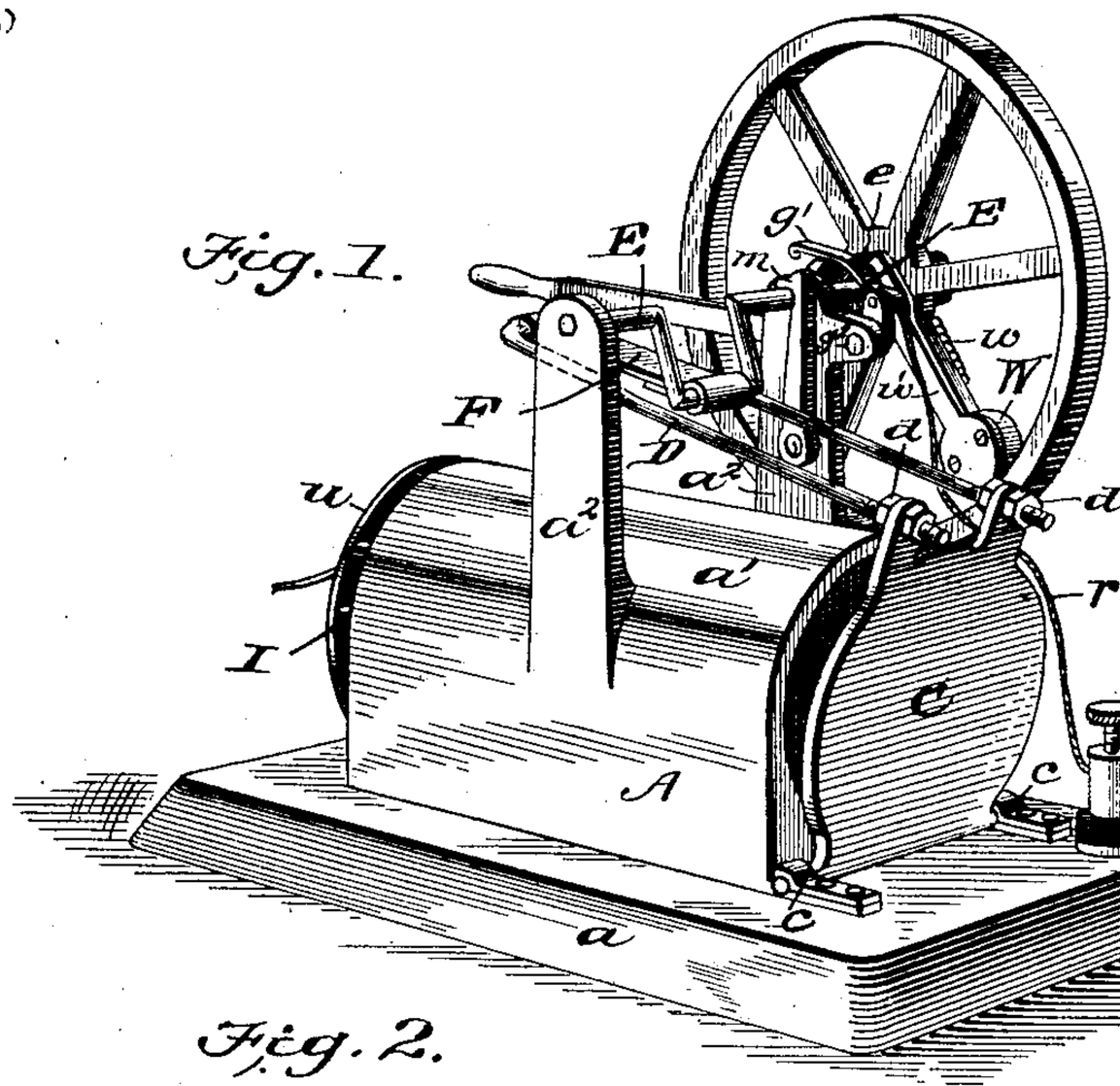

Fig. 2.

Fig. 3.

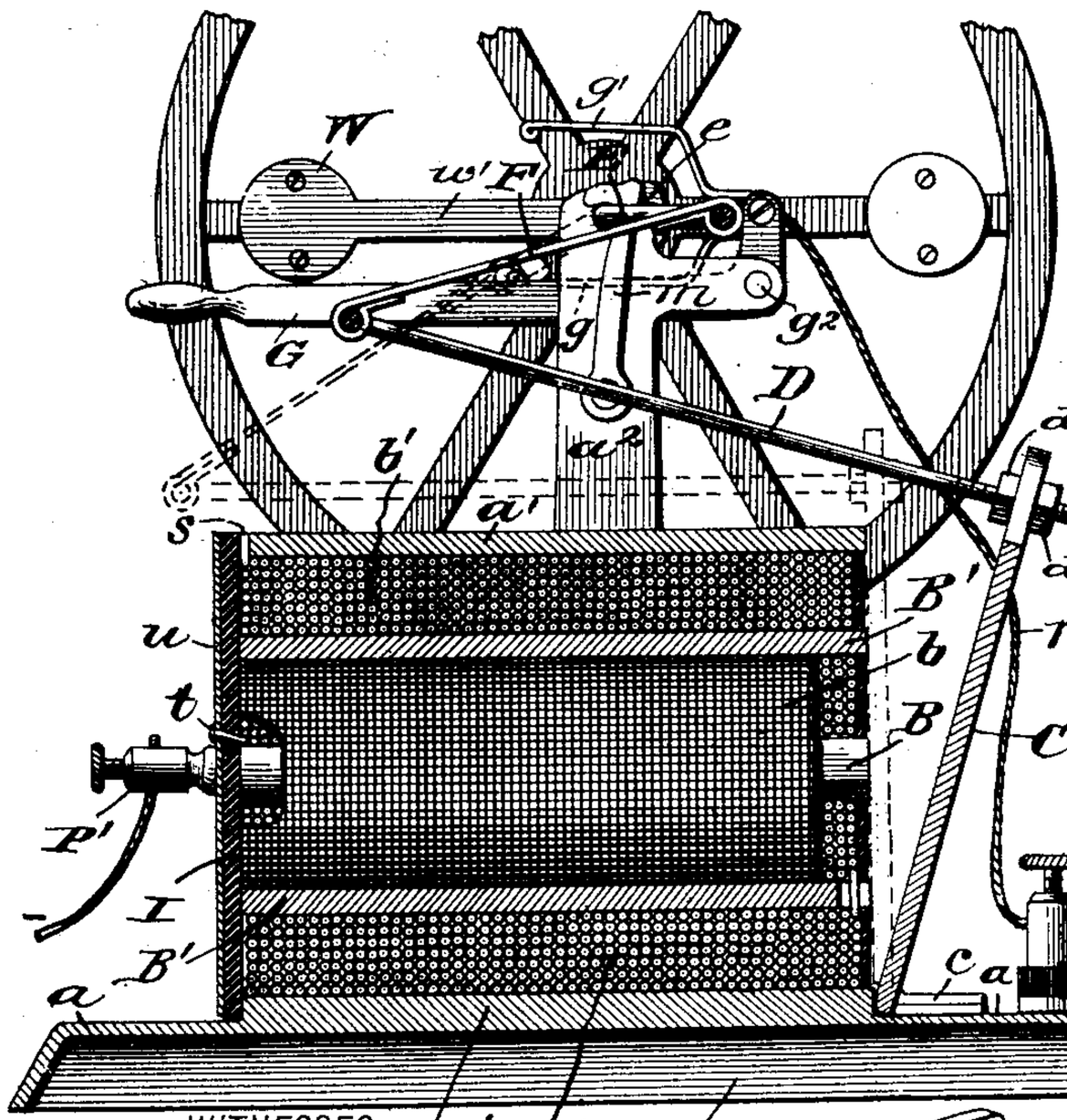

Fig. 4.

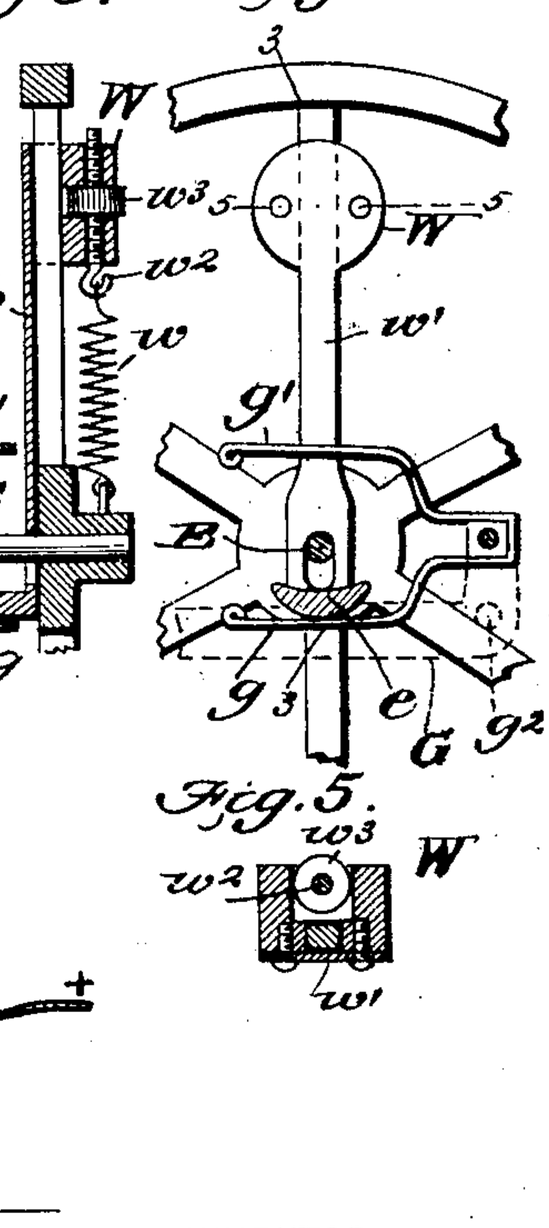

Fig. 5.

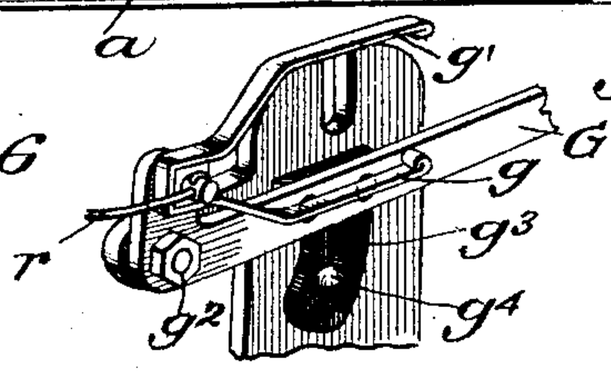

Fig. 6

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JOSEPH DARLING, OF CHICORA, PENNSYLVANIA.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 662,772, dated November 27, 1900.

Application filed September 1, 1900. Serial No. 28,774. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH DARLING, of Chicora, in the county of Butler and State of Pennsylvania, have invented a new and useful Improvement in Electric Motors, of which the following is a specification.

My invention is in the nature of a simple and effective electric motor of that type in which the oscillation of an armature in front of the pole of the electromagnet is converted into rotary motion by means of a connecting-rod and a crank-shaft arranged above and at right angles to the longitudinal axis of the electromagnet.

My invention consists in the peculiar construction and arrangement of parts operating on this principle, which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of the motor. Fig. 2 is a vertical longitudinal section through the electromagnet, and Figs. 3, 4, 5, and 6 are details of the commutator and automatic speed-regulator.

In the drawings, A represents the iron frame of the motor, which may be cast in one piece, as shown; and it consists of a base *a*, a horizontal cylindrical jacket *a'*, and upright pillars a^2 a^2, which latter carry the bearings for the crank-shaft. The jacket *a'* forms a housing for the electromagnet and also forms a part of the magnet, as will be hereinafter explained. The electromagnet while not broadly new in construction differs from the ordinary electromagnet and has a special value and produces a distinct organization and new result in the combination in which it is employed in my motor. It consists of a central iron core B, a winding of insulated wire *b* around the same, forming an inner helix, an iron sleeve B' surrounding this inner helix, and an outer helix *b'*, formed by the winding of the same wire *b* outside of the sleeve B', all of which is inclosed in the outer iron jacket *a'*, which forms part of the framework and also adds to the magnetic quality of the electromagnet. The special value of this form of electromagnet is not only to greatly increase its magnetic attraction, but it has a special correlation to the armature C when the latter is arranged as in my invention, which I will now describe. This armature of soft iron rocks on its lower edge in a seat formed on the top of the base about an axis that is directly against the end of the electromagnet, this armature being formed at its lower edge with lugs or bearings which are retained by a detachable plate *c*, bolted or screwed to the base *a*. The armature C tilts or vibrates about the rocking axis below, and the upper end of the said armature is connected to the crank-shaft, as will be hereinafter described.

The peculiar value and correlated effect between the compound electromagnet (having a double helix, with the iron sleeve B' and external jacket *a'*) and the armature C, whose rocking axis is always in the vertical plane of the end of the electromagnet, are as follows: It is well known that the attractive energy of an electromagnet on its armature increases with the diminution of distance between the armature and poles of the magnet. Now with the armature pivoted against the end of the electromagnet it feels first the attractive energy of the electromagnet in the lower part of the jacket *a'*, against which it practically rests, and then, owing to the angle of divergence, the attractive energy of the lower part of sleeve B' is next felt, and, following this, the core B, the upper part of sleeve B', and the upper part of socket *a'* in succession exert their maximum effect with an increasing force. It will thus be seen that the armature has at all times some part of its body in the range of maximum attraction of some part of the electromagnet, even when thrown back to its remote position, and this gives to the armature a greatly-increased motive power, the result being due to the combined effect of the structural character of the magnet and the relation of the armature thereto.

For transferring the motion and power of the armature to the crank-shaft the armature at its upper end is rigidly connected to an arm D, which extends at right angles to the plane of the armature and above the electromagnet in substantially horizontal position to a point near the opposite end of the electromagnet.

In the uprights or pillars a^2 a^2 is journaled the crank-shaft E, whose cranked middle portion is connected by a pitman F to the end of arm D most remote from the armature. This

arm D is formed of a bent rod doubled on itself, with its middle portion connected to the pitman and its two ends screw-threaded and extended through the top of the armature and provided with screw-nuts *d d* on opposite sides of the armature. This makes a rigid connection of the arm D to the armature C, so that the armature-plate C is braced against twisting from its true plane and also affords an important means of adjustment by which the connection between the armature C and pitman F may be shortened to take up wear, thus avoiding all looseness and rattling noise and also insuring the close approach of the armature to the poles of the magnet. As the arm D extends from the armature to the opposite end of the electromagnet, it passes beneath the crank-shaft E at right angles to it, and through the agency of the pitman F the thrust and pull of the armature are delivered to the crank-shaft from the opposite side to that on which the armature is arranged, the armature C and arm D acting as one right-angular rigid piece.

The crank-shaft E is provided with a commutator for alternately throwing the current through the motor and interrupting it, and said crank-shaft has also a fly-wheel and automatic governor, which I will now proceed to describe. G *g g'* represent an insulated two-pronged brush or switch, between whose branches *g* and *g'* the shaft E passes. This shaft revolves with a contact *e*, which as the shaft revolves is brought intermittently into contact with one or the other prong *g* or *g'* of the switch to send a current intermittently through the coil of the electromagnet just after the armature has receded to its most remote point.

The path of the electric circuit is best seen in Fig. 2, in which P is a binding-post mounted on an insulating-base and connected to one pole of the battery. This binding-post is connected by wire *r* with the two-pronged switch *g g'*.

The outer coil *b'* of the magnet is connected at *s* to the outer metal jacket *a'* and the metal standards a^2. The inner coil *b* is connected at *t* to an external plate *u*, the binding-post P', and the other pole of the battery. I is a plate of insulation between the end of the electromagnet-case *a'* and the outer plate *u*. The path of the electric current then is as follows: from binding-post P, wire *r* to switch *g*, revolving contact *e*, shaft E, standard a^2 and external jacket *a'*, thence by wire *s* to helix *b'*, to helix *b*, wire *t* to plate *u*, binding-post P', and the other pole of the battery.

In running in one direction the rotation of the contact *e* alternately makes and breaks the circuit through the branch *g* of the switch. To reverse the motor, the lever G is deflected, so as to throw branch *g* of the switch out of range of contact *e* on the shaft and bring branch *g'* into range of contact with *e*. The two branches *g g'* move together about the pivotal center g^2, and the adjusting-arm G has a slotted non-conducting plate g^3, playing over a pin g^4, which serves to regulate the throw of the arm and determines the approach of the branches *g g'* toward the contact *e*.

To regulate the speed of the motor automatically, a weight W is arranged to slide radially on one of the spokes of the fly-wheel, is drawn toward the center by a helical spring *w*, and is thrown away from the center by centrifugal action. This weight is connected to a radial slide *w'*, and this in turn bears on its inner end the contact *e*, which rotates with the crank-shaft. When the speed gets excessive, the centrifugal action throws weight W outwardly, and this through slide *w'* pulls the contact *e* away from the branches of the switch, so that a shorter electrical contact is made and a lesser amount of current is admitted to the electromagnet or the current cut off entirely until the speed falls, after which the spring *w*, drawing the weight W toward the center, again causes the slide *w'* to restore the contact *e* to its former range of revolution and rubbing-contact with the switch-prong *g* or *g'*, as the case may be. To regulate the sensitiveness of this governor, the tension of the spring may be adjusted by a screw-threaded stem w^2 and thumb-nut w^3.

For facility and economy of construction one of the standards a^2 is simply bored to receive one end of the crank-shaft, while the other standard has an open seat and has a hooked arm *m*, which may be thrown over the shaft to retain it in its bearing or be thrown back to allow the shaft to be lifted out laterally.

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

1. In an electric motor, the combination with an electromagnet; of an armature having a rocking axis directly at the pole of the said magnet, an arm rigidly attached to the other end of the armature and extending at right angles to a point near the opposite end of the electromagnet, a crank-shaft arranged at right angles to the electromagnet above said arm, and a connecting-rod arranged on the opposite side of the crank-shaft from the armature and connecting the crank-shaft to the extended armature-arm substantially as described.

2. In an electric motor, the combination with an electromagnet; of an armature having a rocking axis directly at the pole of said magnet, an arm rigidly attached to the swinging end of the armature and provided with adjusting-nuts as described and extending to a point near the opposite end of the magnet, a crank-shaft at right angles to the electromagnet, and a pitman arranged on the opposite side of the crank-shaft from the armature and connecting the armature-arm to the crank-shaft substantially as described.

3. The combination with the electromagnet, and the armature having a rocking axis against the end of the said magnet; of an

arm composed of a bent rod having its two ends screw-threaded and separately connected by nuts to the swinging end of the armature and a crank-shaft arranged at right angles to the electromagnet, and a pitman arranged on the opposite side of the crank-shaft from the armature and connecting the armature to the crank-shaft substantially as described.

4. In an electric motor, the combination with the rotary shaft; of a reversing-switch having two branches embracing said shaft, a rotating contact moving with the said shaft and arranged between the two branches of the switch and a centrifugal governor attached to and automatically adjusting said rotating contact for a longer or shorter contact with the branches of the switch substantially as described.

5. In an electric motor, the combination with the rotary shaft; of a reversing-switch having two branches embracing said shaft, and a lever-handle for adjusting said switch, a rotating contact moving with said shaft and arranged between the two branches of the switch, a radially-sliding bar connected to the rotating contact and bearing a weight at its outer end, and a spring and means for adjusting it, said spring being connected to the weight and arranged to draw it against centrifugal action substantially as described.

6. In an electric motor, a revolving shaft, a brush-arm or switch at right angles thereto, a rotating and sliding contact between the brush and the shaft, and a centrifugal governor arranged to throw the rotating contact away from the brush and toward the center of the shaft as described.

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