(No Model.)

A. D. BLODGETT & J. P. TIRRELL.

ELECTRIC MOTOR.

No. 308,548. Patented Nov. 25, 1884.

Fig. 1.

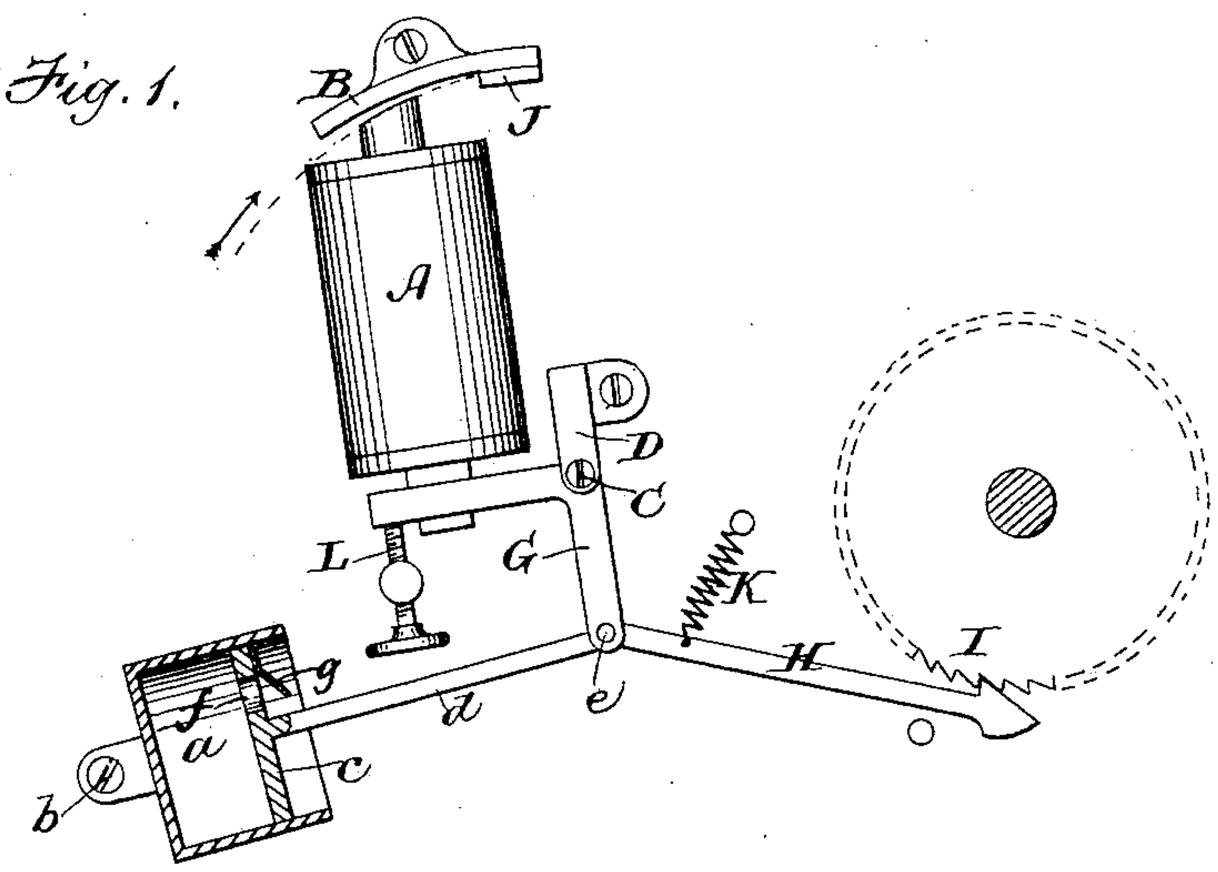


Fig. 2.

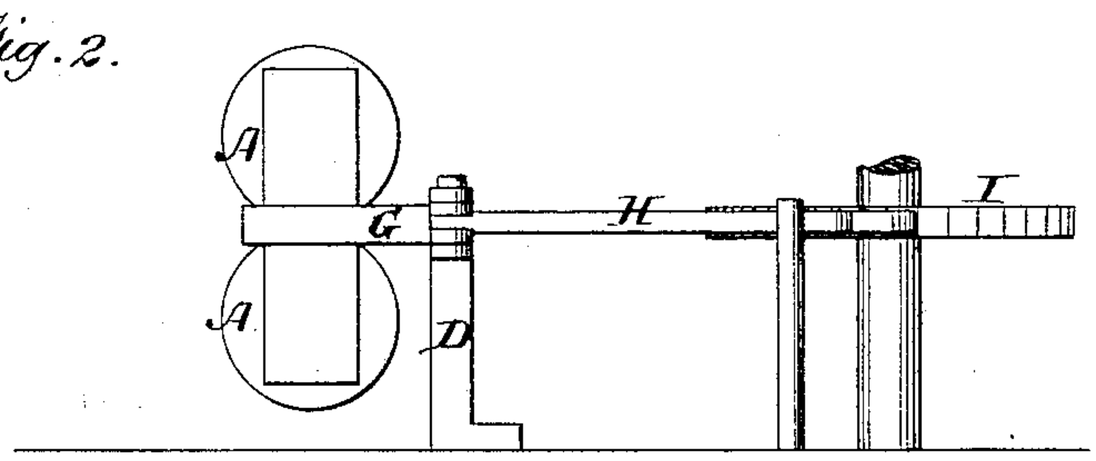
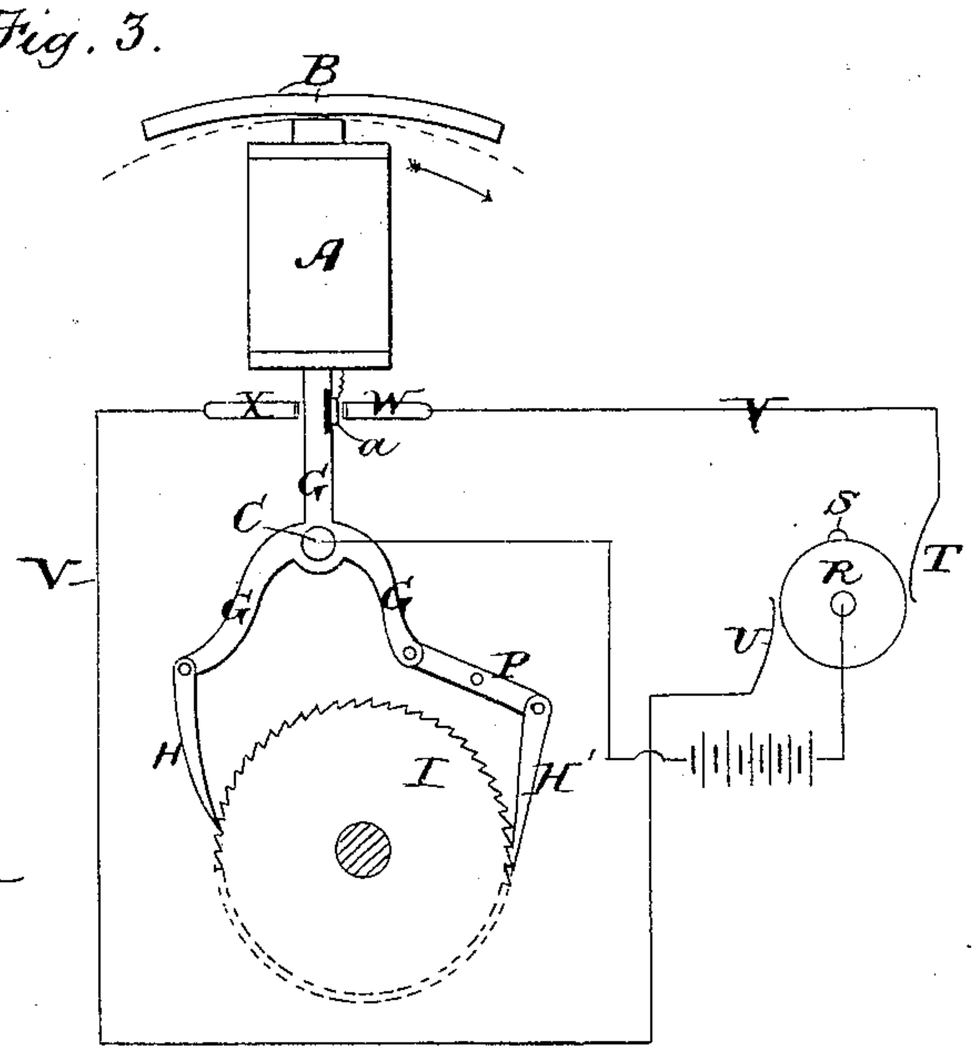


Fig. 3.



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UNITED STATES PATENT OFFICE.

AARON D. BLODGETT AND JACOB P. TIRRELL, OF BOSTON, MASS., ASSIGNORS TO THE ELECTRIC SIGNAL CLOCK COMPANY, OF MASSACHUSETTS.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 308,548, dated November 25, 1884.

Application filed August 16, 1882. (No model.)

To all whom it may concern:

Be it known that we, AARON D. BLODGETT and JACOB P. TIRRELL, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electric Motors, of which the following is a specification.

This invention has for its object to increase the power and efficiency as a motor of an electro-magnet which is excited intermittently and caused, when excited, to give motion to a pawl or dog engaging with the teeth of a ratchet-wheel, said pawl or dog being thus moved intermittently and caused to rotate the ratchet-wheel and drive the connected mechanism step by step.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a plan view of an electro-magnet and its armature embodying our invention, the magnet being adapted to operate a single pawl. Fig. 2 represents an end view of the same. Fig. 3 represents a plan view showing the magnet adapted to operate two pawls alternately.

The same letters of reference indicate the same parts in all the figures.

In carrying out our invention we pivot an ordinary electro-magnet, A, to a base or support, so that said magnet can oscillate in a horizontal plane, and secure rigidly to said support a soft-iron armature, B, so arranged that the poles or cores of the magnet can approach and recede from it when the magnet oscillates on its pivot. We prefer to pivot the electro-magnet by a pivot-pin, C, passing through ears on a post, D, on the base F, and through an arm, G, rigidly attached to the electro-magnet, said arm being thus pivoted to the post D. To the outer end of the arm G is pivoted a dog, H, which engages with the teeth of a ratchet, I, said ratchet giving motion to any suitable mechanism or apparatus—for example, the rotating time-cylinder shown in Letters Patent of the United States granted to George W. Blodgett and Aaron D. Blodgett, August 1, 1882. When the magnet is excited, the magnetic force exerted on the armature causes the magnet to swing in the direction indicated by the arrow in Fig. 1 until its poles abut against a stop, J, of diamagnetic material, attached to the armature. This movement causes the dog H to rotate the ratchet a distance equal to one tooth of the latter. When the circuit through the magnet is broken, a retracting-spring, K, arranged in any suitable manner, swings the magnet away from the stop J against a back stop, L. The spring K is in this form shown in Figs. 1 and 2 attached to the dog H and to the supporting-base, and serves both to retract the magnet and to press the dog H against the ratchet. The armature B presents a concave surface to the poles of the electro-magnet, which surface is approximately but not absolutely parallel with the path or arc in which the poles of the magnet move when the magnet oscillates, the armature being somewhat eccentric to the arc in which the poles of the magnet move, so that the poles of the magnet are closer to the armature when the magnet is excited, and thus drawn to the stop J, than when the circuit is broken and the magnet retracted. This form and arrangement of the armature locates it always comparatively near the poles of the magnet, even when the latter is retracted, and at the same time causes the poles of the magnet, in seeking the nearest point of approach to the armature, to move through an extended arc, and thus require a considerable momentum, which materially increases the force of the dog H and makes its action more positive and effective. The stops J and L limit the vibrations of the magnet and prevent the poles thereof from passing away from the armature in either direction.

In Fig. 3 we have shown an arrangement whereby the magnet, instead of being suddenly arrested by a stop in its motion toward the armature, is allowed to move beyond the point of nearest approach to the armature, and as it passes said point to break the circuit through the magnet, and as it moves onward to operate a second dog or pawl, H′, the force required to arrest the magnet being thus utilized. In this instance the arm G of the magnet is pivoted, as before, and is provided with a forked end, one part of which has the dog H; while the other is pivoted to one end of a

lever, P, which is pivoted centrally to a fixed support and has pivoted to its other end the dog H′. The proximate surface of the armature is composed of two curves, each diverging slightly from the center of the armature to the ends thereof from the arc described by the poles of the magnet. When the magnet reaches the center of the armature, it reaches the point of nearest approach, and gradually separates from the armature in moving in either direction from the center.

R represents a circuit-closing disk connected with one pole of a battery, (the other pole of which is connected with the arm G,) and having a projection, S. Said disk is rotated at a definite rate by any suitable means.

T U represent metallic springs arranged to make contact with the projection S once during each rotation of the disk R, and connected by wires V V with springs W X, which are arranged at opposite sides of the arm G of the magnet. Said arm G has at one side an insulated metal block, *a*, connected by a wire with the helices of the magnet. The spring W is arranged to bear against the block *a* after the magnet, when moving in the direction indicated by the arrow in Fig. 3, has passed the center of the armature. The spring X is arranged to bear against the arm G after the magnet, when moving in the opposite direction, has passed the center of the armature.

The operation is as follows: Suppose the magnet to be at one extreme of its movement and the block *a* bearing against the spring W, when the projection S meets the spring T, the circuit is closed and the magnet is excited and caused to move toward the center of the armature. Just before the magnet reaches the center of the armature the spring W separates from the block *a* and the circuit is broken. The armature continues its movement, meeting the spring X and passing to the other end of the armature, and remains there in contact with the spring X until the projection S meets the spring U, when the circuit is again closed and the magnet caused to approach the center of the armature, separating from the spring X and again breaking the circuit as it approaches the center of the armature, and again passing over to the spring W. The magnet is thus allowed to oscillate through a long arc, each movement causing one of the dogs to rotate the ratchet and the other to draw back to a succeeding tooth.

In Fig. 1 we have shown a device to retard the movement of the magnet when it is being retracted by its retracting-spring, said device being composed of a cylinder, *a*, pivoted at *b*, and open at one end, and a piston, *c*, working in said cylinder, and attached to the end of a rod, *d*, which is pivoted at *e* to the arm G of the magnet. The piston *c* has an orifice, *f*, with a valve, *g*, which closes said orifice when the piston is moved outwardly in the cylinder, and confines the air in said cylinder, thereby causing the piston to move slowly and retard the retracting movement of the magnet, as will be readily seen. The valve opens when the piston is moved inwardly by the opposite movement of the magnet, so that the piston and cylinder offer no resistance to said movement.

We claim—

1. The combination, with a pawl and a ratchet engaged thereby, of an operating device composed of a pivoted electro-magnet, intermediate connections between said magnet and pawl, whereby the magnet is caused to increase the force or momentum of the pawl, and a fixed armature arranged, substantially as described, with relation to the poles of the magnet, as and for the purpose set forth.

2. The combination of a pivoted electro-magnet having a curved surface arranged eccentrically, as described, with relation to the arc described by the poles of the magnet, and stops limiting the vibrations of the magnet and preventing the same from passing away from the armature in either direction, as set forth.

3. The combination of a pivoted electro-magnet, two dogs or operating devices carried thereby and adapted to operate alternately, a fixed elongated armature, and automatic devices for breaking and closing the circuit through said magnet while it is in motion, as set forth.

4. In combination with a pivoted electro-magnet, the herein-described segmental armature supported by a single centrally-located screw, and adapted to be adjusted thereon to any desired angle with respect to the path of the pivoted magnet, substantially as described.

5. The combination, with the pivoted electro-magnet and suitable pawl and ratchet operated by the oscillations thereof, of the herein-described segmental armature provided with an adjustable supporting-screw and adapted to be set at any desired angle with respect to the arc described by the poles of the magnet, and thereby afford increased attraction at the desired point, substantially as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 14th day of August, 1882.

AARON D. BLODGETT.
JACOB P. TIRRELL.

Witnesses:
C. F. BROWN,
A. L. WHITE.