(No Model.) 2 Sheets—Sheet 1.

H. R. BUTTERFIELD.

ELECTROMOTOR.

No. 422,911. Patented Mar. 11, 1890.

Fig. 1.

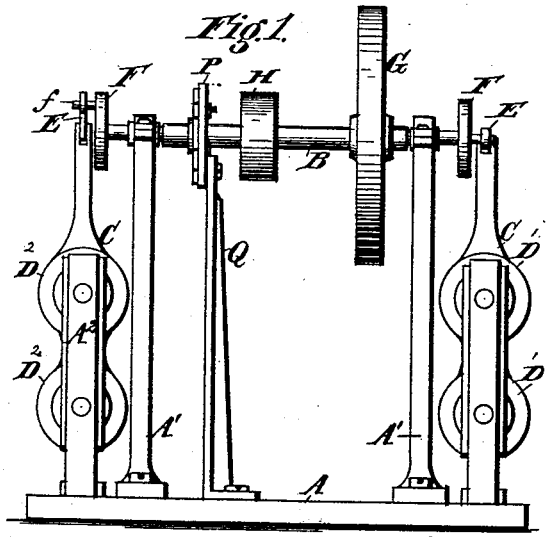


Fig. 2.

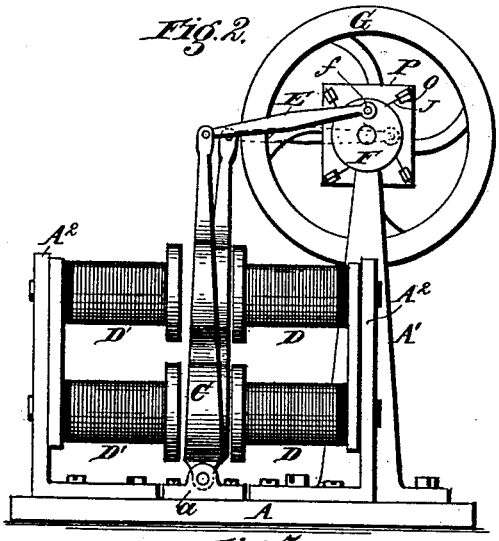


Fig. 3.

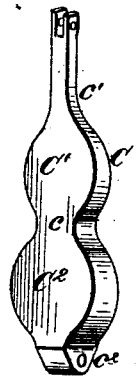


Fig. 4.

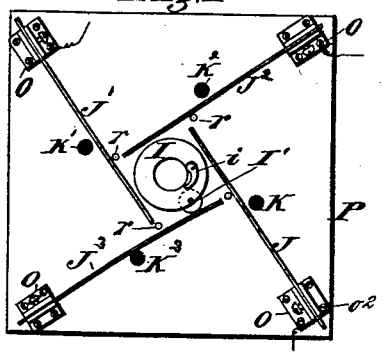


Fig. 5.

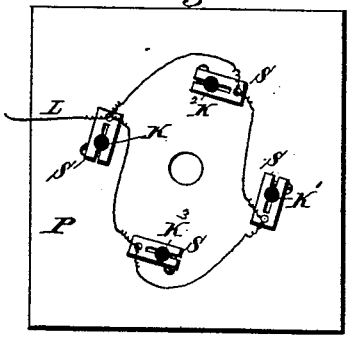


Fig. 6.

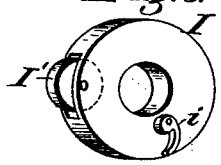


Fig. 7.

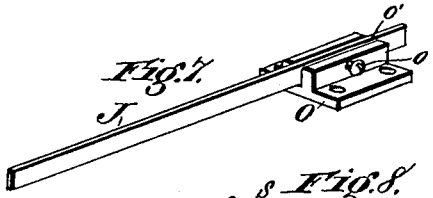
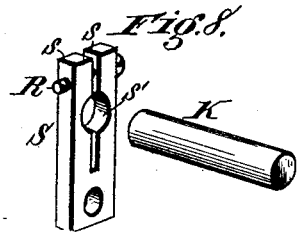


Fig. 8.



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by Wm H Babcock
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(No Model.) 2 Sheets—Sheet 2.

H. R. BUTTERFIELD.

ELECTROMOTOR.

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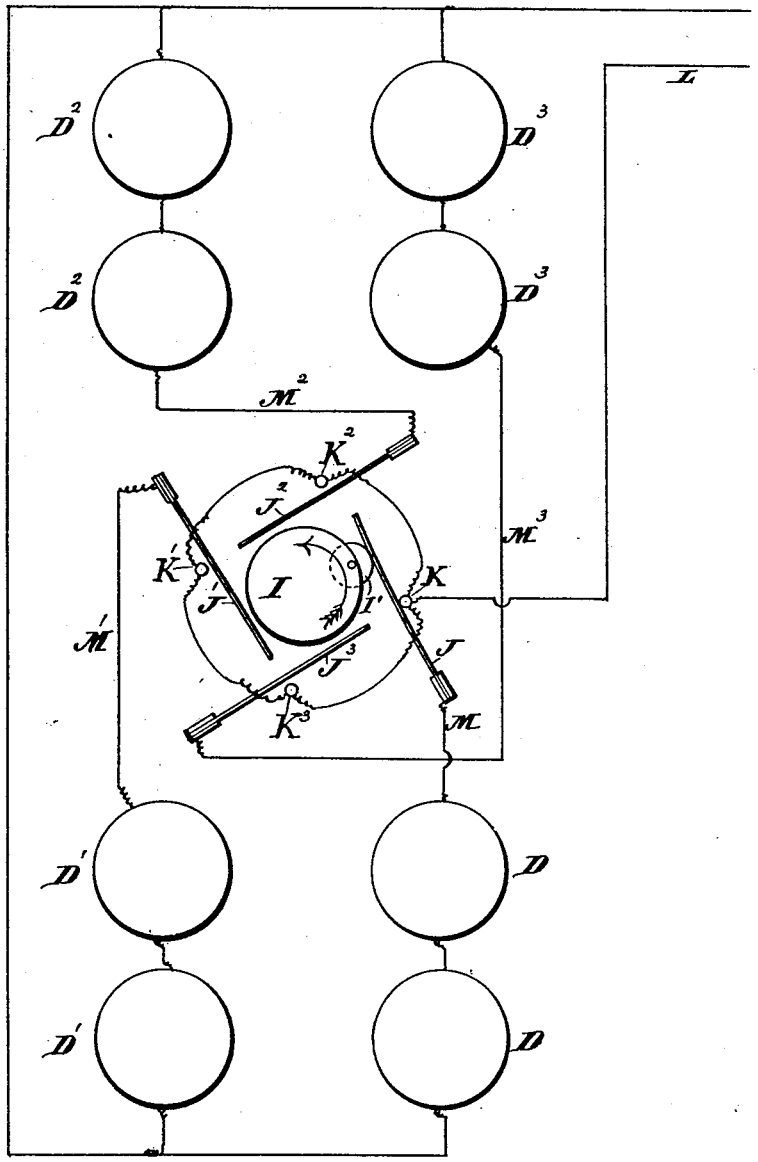
Fig. 9.



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UNITED STATES PATENT OFFICE.

HENRY R. BUTTERFIELD, OF WATERVILLE, MAINE.

ELECTROMOTOR.

SPECIFICATION forming part of Letters Patent No. 422,911, dated March 11, 1890.

Application filed May 22, 1889. Serial No. 311,685. (No model.)

To all whom it may concern:

Be it known that I, HENRY R. BUTTERFIELD, a citizen of the United States, residing at Waterville, in the county of Kennebec and State of Maine, have invented certain new and useful Improvements in Electromotors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to increase the durability, simplicity, and efficiency of electromotors, and more especially of that kind in which a vibrating pivoted armature is employed, although certain features of my invention may be used with a different kind of motor. To attain the said object I make use of the construction and combination of devices hereinafter particularly set forth, which will allow me to use the incandescent-light circuit, and which will work with very little friction or wear as well as without accumulating dirt or burned oil.

These novel features of my invention will be hereinafter more particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a front elevation of my improved motor. Fig. 2 represents a side elevation of the same. Fig. 3 represents a detail perspective view of one of my armatures. Fig. 4 represents a plan view, enlarged, of the commutator. Fig. 5 represents a rear view of the commutator-board and attachments. Fig. 6 represents a detail perspective view of the commutator-disk. Fig. 7 represents a detail perspective view of one of the commutator-springs and its clamping-blocks. Fig. 8 represents a similar view of one of the carbons and its bifurcated holder, and Fig. 9 represents a diagram of the circuits.

In the accompanying drawings, the letter A designates the frame of the machine, having standards A′ A′ raised thereon at one side to provide bearings for the shaft B. This shaft is rotated by means of at least one vibrating armature C, and at least one pair of electro-magnets arranged on opposite sides of said armature, attracting it alternately. As illustrated in said drawings, the motor has two armatures C—one opposite each end of the shaft—and also has two magnets D D′ or D^2 D^3 for each armature. The number of armatures and magnets may be increased at will, according to convenience. These magnets are arranged horizontally, with one pole facing inwardly toward said armature and having a vertical face, the faces of magnets D D^2 and magnets D′ D^3 being respectively in the same vertical planes. Standards A^2, forming part of frame A, support said magnets at the outer ends thereof.

Each armature C is pivoted at its lower end to a lug *a*, raised on the bed-piece of said frame, and is made to taper upward considered in side elevation, as shown in Fig. 2. This throws the center of gravity low, making the vibration easy, with the least possible strain on the pivot; also, the inclination of the sides is such that whichever way the armature is drawn its side will fit exactly against the faces of the ends of the attracting-magnets. This will prevent any obliquity of strain or inequality of wear, and will insure evenness of attraction and instantaneousness of release. An armature with its sides normally vertical of course could not have either of them vertical when tilted and would not fit evenly against the attractive faces of the magnets. As shown in Fig. 3, each armature is widened at C′ C^2 opposite the magnets, so as to present the greatest amount of material for attraction consistent with the weight of the armature as a whole and its tapering shape aforesaid. These enlargements have approximately the shape of disks, corresponding to that of the proximate ends of said electro-magnets, to insure the most perfect action possible of the magnets thereon. The intervening waist *c* is made narrow, and the upper and lower ends *c′* c^2 of the armature are made narrower still for the sake of lightness.

A pitman E connects the upper end of said armature to a wrist-pin *f*, arranged eccentrically on the face of a disk F, which is fast on the proximate end of said shaft B. The construction of said disk-pin and pitman is the same in each instance, and they are operated simultaneously, or, preferably, alternately, by the said armatures for turning said shaft. The latter is provided with a balance-wheel G and belt-pulley H, both of which are fast thereon. It has also a commutator-disk

I, held fast removably by a pivoted clamping-cam *i*, which is attached to said disk but bears against said shaft. An anti-friction roller I′ is journaled in a peripheral recess of said disk and extends outward therefrom at one point of the periphery, its function being that of a cam to wipe against the commutator-springs J J′ J^2 J^3 and force them successively, in the order hereinafter stated, into contact with the carbons K K′ K^2 K^3, or contact-posts of such other suitable material, as may be preferred. A line-wire L runs from one to another of all these carbons.

As shown in the diagram, Fig. 9, the succession of the magnets in arrangement and operation is as follows, the commutator-disk I turning from right to left in the direction of the arrow: First, the magnet D at the right hand of Figs. 2 and 9 is connected by wire M with commutator spring or brush J, which is forced into contact with post K by projecting roller I, completing the circuit through the helices of said magnet, and of course energizing the latter, so as to attract the armature C, which is between magnet D and D′, and partly rotate the shaft. As the commutator-disk continues its rotation this circuit is broken by the passage of the roller I′ from the spring or brush J, and the automatic separation of the latter from the carbon post K. The next brush or commutator-spring to the left J^2 is then struck by said roller and forced into contact with its carbon post K^2. This commutator-spring is connected by wire M^2 with the magnet D^2 on the opposite side of the shaft, but at the other end of said shaft from magnet D. This magnet D^2 being thus energized attracts the other armature in the opposite direction, continuing the rotation of said shaft. The roller I′ on the commutator-disk thus being carried around releases this brush J^2 with the same result as before, and shortly comes in contact with commutator spring or brush J′, which is connected by spring M′ to magnet D′, directly opposite magnet D. The said brush or spring J′ is forced by roller I′ against contact-post K′, completing the circuit through the helices of said magnet D′, and thus attracting the armature first operated on in the direction opposite to its first motion. As the connecting-rods E are attached to the disks F at points ninety degrees apart in the circumference of said disk, the said parts are now in such position that this attraction by magnet D′ will continue the rotation of the shaft. The roller I′ leaves this brush J′ and passes to brush or wire J^3, forcing it against carbon post K^3, so as to complete circuit through the helices of the fourth magnet D^3, which is connected to said brush J^3 by wire M^3. This magnet is on the same side of the shaft with magnet D, but at the opposite end of said shaft. The attraction of this magnet exerted on the armature C, between it and magnet D^2, completes the rotation of said shaft, and the magnet D is next made active again, as before. Of course the connections must be changed if the rotation is to be in the opposite direction, and may be changed for other reasons. I merely illustrate an efficient arrangement of parts and succession of magnetic actions without confining myself thereto. Thus the rotation of the shaft and commutator-disk will make and break circuit through said magnets in rapid succession, causing corresponding alternate vibrations of said armatures, one rocking toward the right almost immediately after the other has rocked toward the left, and then back again in similar order. This action of course maintains a rapid and even rotation of said shaft, which may apply its power through belt-pulley H to any machinery.

The springs J J′ J^2 J^3 are held by set-screws *o* in channels *o′* of metallic blocks O, which are detachably fastened by screws o^2 to a commutator-board P, supported by a standard Q, rising from the bed-piece of the frame A. By loosening said set-screws the said springs may be adjusted backward or forward in said channels to insure their proper position for the action of roller I′ thereon, as aforesaid. Normally they rest against pins *r*, attached to said commutator-board, which prevent them from coming in contact with the body of the commutator-disk. The roller or protuberance I′ forces each commutator-spring away from its pin *r*, preliminarily to making contact with the carbon, as aforesaid. The wire running to each spring from its magnets is by preference attached to one of the screws o^2, and not directly to the spring; but this is not important. Copper or other suitable conducting material may be substituted for the carbons. The arrangement of circuits may be changed, so that the two armatures will vibrate simultaneously in the same direction; but I prefer to have them as described.

The carbons K K′ K^2 K^3 are held in detachable bifurcated clamps S, which are fastened to the back of said commutator-board, each carbon also passing through a hole in the latter. The arms *s* of the clamp or holder are recessed in each instance at *s′* to fit around the carbon. A transverse screw R, passing through one of said arms and into the other, draws the said arms together against and around it. The loosening of this screw allows the carbon to be withdrawn and another substituted.

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

1. In combination with a rotating shaft and the magnets and armature operating the same, a commutator-disk mounted on said shaft rotating therewith and having a protuberance from its periphery, a series of commutator-springs arranged to be struck by said protuberance, a series of contact-posts against which said springs are forced thereby successively, and a set of circuit-wires for said magnets, the circuits being successively

opened and closed as the commutator-disk operates on said springs, substantially as set forth.

2. In combination with a rotating shaft, a commutator-disk mounted thereon and having an anti-friction roller mounted in a recess of its periphery, but extending beyond the same, a series of commutator-springs arranged to be struck successively by said roller, a series of contact-posts arranged for contact with said springs when thus struck, a series of electro-magnets, an armature or armatures actuated thereby and connected to said shaft for actuating it, and the wires completing the circuit through said magnets and having said commutator-springs and contact-posts for terminals, substantially as set forth.

3. In combination with the shaft, magnets, armature, wires, pitman, and commutator-disk having a roller or protuberance I′, the fixed carbons or contact-posts, the movable commutator-springs, and the channeled blocks and set-screws for adjusting said springs lengthwise, substantially as set forth.

4. The carbon-holders bifurcated and recessed, as described, in combination with the carbons or contact-posts fitting into their recesses, the screws for clamping the arms of said holders on said carbons, the perforated fixed commutator-board, to the rear of which said holders are fastened and through which said carbons extend, the springs arranged for contact with said carbons, and the commutator-disk and its roller arranged to operate against said springs successively, substantially as set forth.

5. In combination with commutator-springs and wires, contact-posts of carbon for completing the circuits, and the commutator for wiping against said springs to close said circuits successively by forcing said springs against said contact-posts, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY R. BUTTERFIELD.

Witnesses:

H. D. BATES,

L. B. SPENCER.