(No Model.)

C. H. POND & H. L. BAILEY.

ELECTRIC CLOCK.

No. 308,793. Patented Dec. 2, 1884.

Fig. 1.

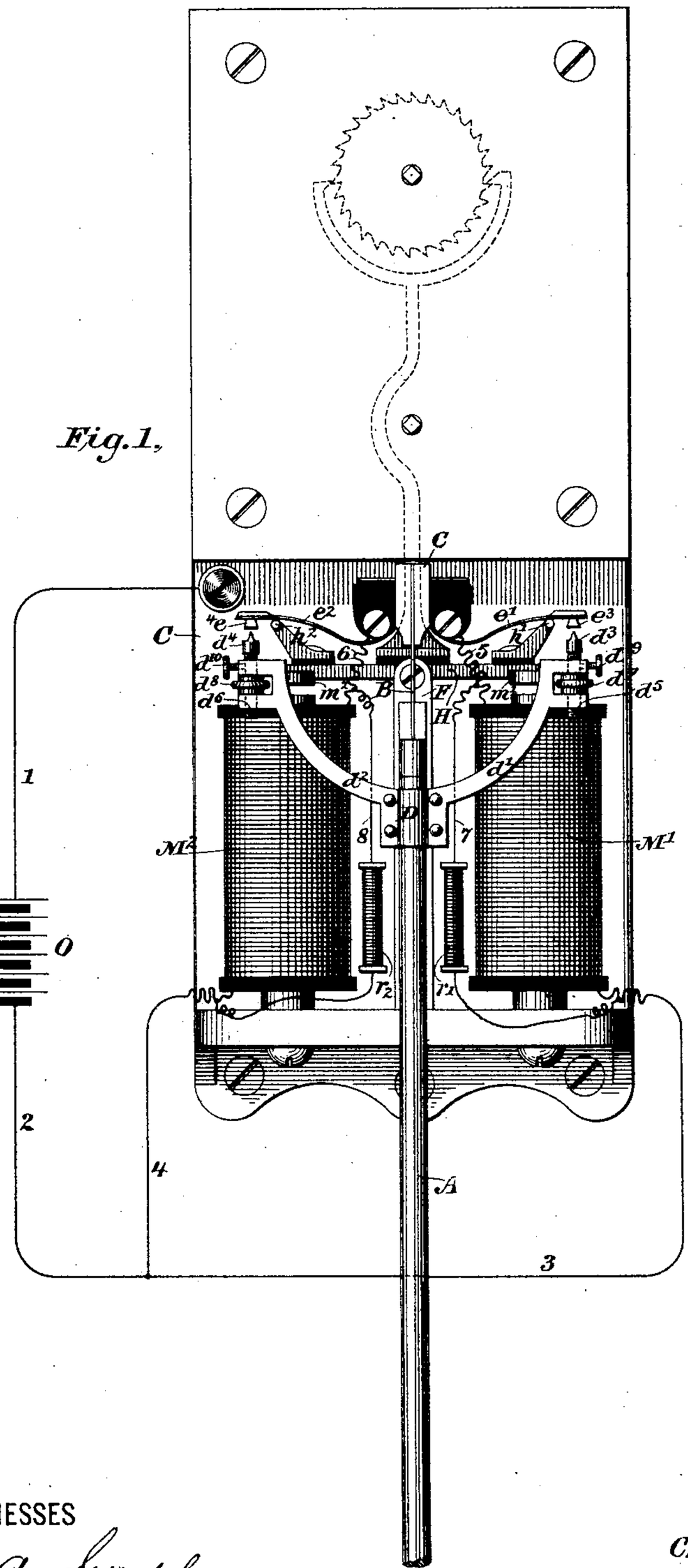
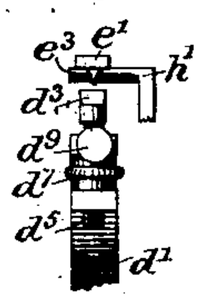


Fig. 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

CHESTER H. POND, OF NEW YORK, AND HENRY L. BAILEY, OF BROOKLYN, ASSIGNORS TO THE TIME TELEGRAPH COMPANY, OF NEW YORK, N. Y.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 308,793, dated December 2, 1884.

Application filed September 5, 1883. (No model.)

To all whom it may concern:

Be it known that we, CHESTER H. POND and HENRY L. BAILEY, citizens of the United States, residing, respectively, in the city of New York, in the county and State of New York, and in Brooklyn, in the county of Kings and State of New York, have jointly invented certain new and useful Improvements in Electric Clocks, of which the following is a specification.

Our invention relates to certain improvements in the construction and organization of self-propelling electric clocks.

The object of the invention is to provide a clock the operation of which is effected by the agency of electric currents automatically caused to vitalize in alternation two sets of electro-magnets, which magnets are adapted to control suitable mechanism for imparting a slight impulse to the pendulum at each semi-vibration of the same, and also to construct the contact-points through which the electric circuits are completed and interrupted in such a manner as to especially adapt them to this use.

The invention consists in securing to a vibrating pendulum a bracket supporting two contact-points, respectively adapted to make complete and electrical connections through a corresponding electro-magnet when near its limit of oscillation, thereby causing the magnet to be vitalized and a resilient arm to be released. This arm acts, by pressing against the contact-point, to impel the pendulum in the opposite direction. When the pendulum has swung to the opposite limit of its vibration, a similar operation takes place, and another impulse tending to reverse the direction of the pendulum is communicated to it. The contact-points through which the circuit is closed are in the form of two knife-edges intersecting each other at an angle, and the points from which the arms are supported are so located that the movement of the contact-points, caused by the vibration of the pendulum, will cause the knife-edges to rub slightly across each other, thereby keeping the surfaces free from dust and corrosion.

In a patent of A. G. Crane, No. 301,569, dated July 8, 1884, there is shown and claimed an electro-magnetic clock in which a pair of electro-magnets have their respective armatures mounted upon a lever common to both. Each armature carries a contact-finger arranged to uphold a corresponding spring, except when the spring is raised by arms carried by the pendulum. A circuit is completed through the respective electro-magnets by the contact of the respective contact-fingers with the resilient arms or springs. The swing of the pendulum interrupts such circuit and causes the contact-finger to be withdrawn from the path of the spring, and the latter then follows the arm carried by the pendulum, exerting upon it a pressure. The pressure thus alternately given to the pendulum by the two springs maintains it in motion. Such an organization as this we make no claim to. Our organization differs therefrom fundamentally in the method of controlling the circuit-connections, and in the movements of the arms or fingers employed for raising the springs. According to our organization, the circuit is through the contact-points carried by the pendulum. The armature-lever is employed for raising the springs, but immediately upon the completion of one or the other circuit the corresponding finger is withdrawn. This construction also involves a difference in the organization of circuits, as will hereinafter appear.

In the accompanying drawings, Figure 1 shows in elevation such parts of an electric clock as will suffice to illustrate our invention, and Fig. 2 is a detached view showing the construction of the contact-points.

Referring to the drawings, A represents a pendulum of any suitable form, preferably suspended by means of a flexible strip of metal, B, secured to the frame or support C. Upon the pendulum A is fixed a bracket, D, having two arms, d' and d^2, respectively projecting from opposite sides of the same. Two contact-points, d^3 and d^4, are respectively carried at the extremities of the arms d' and d^2, and these points are rendered adjustable by being mounted upon adjusting-screws d^5 and d^6. Check-nuts d^7 and d^8, each of which is in-

serted in a fork at the end of the corresponding arm, d' or d^2, serve to raise or lower the contact-points by turning upon the screw-thread. For the purpose of further preventing any lateral movement of the contact-points two set-screws, d^9 and d^{10}, are provided for binding against the side of the same. Above the arms d' and d^2 extend two resilient arms or springs, e' and e^2, secured to but insulated from the frame C. Two contact-points, e^3 and e^4, are respectively carried at the extremities of these arms, and are designed to make contact with the corresponding points, d^3 and d^4, near the respective limits of the vibration of the pendulum A. The contact-surfaces of the points are constructed in the form of prisms or knife-edges, as more clearly shown in the detached view Fig. 2, and these are so placed that their planes will intersect each other at an angle, preferably a right angle. The contacts may be constructed of tempered steel, platinum, or other suitable metal, the essential point being that the surfaces which come in contact with each other shall be sharp, the general form of the points being that of a wedge or prism.

Secured to the frame C is a bracket, F, upon which is pivoted a table or rocking support, H, having its center of oscillation in the same vertical line with the support of the pendulum A, but preferably in a lower horizontal plane. Near the respective extremities of the table H are carried two upwardly-projecting arms, h' and h^2, respectively designed to raise the corresponding spring, e' or e^2, whenever the corresponding end of the table is raised. In the drawings we have represented the table as in a horizontal position, both springs being slightly raised by the arms h' and h^2. If, however, the left-hand end of the table, for instance, be depressed, the spring e' will be still further raised, while the spring e^2 will be allowed to fall, which it will do by virtue of its resilience. The table H is designed to be so oscillated that the springs or resilient arms e' and e^2 will in this manner be alternately raised by means of the corresponding arms, h' and h^2, when the pendulum is near one limit or the other of its vibration. The remaining spring will at the same time be released and impart an impulse to the pendulum by virtue of the pressure exerted through the contact-points.

Two electro-magnets, M′ and M², are provided for tilting the table H alternately in one direction or the other by acting upon two armatures, m' and m^2, respectively, attached to the opposite extremities of the table. One pole of a battery, O, is connected through a conductor, 1, with the frame C of the clock, and thus with the bracket D and contact-points d^3 and d^4. The opposite pole of the battery O is connected through conductors 2, 3, and 4 with the outer terminals of the coils of the electro-magnets M′ and M², respectively, while the inner terminals of these coils are connected through conductors 5 and 6 with the resilient arms e' and e^2, and thus with the contact-points e^3 and e^4, respectively. It will be understood, therefore, that when the contact-point d^3, for instance, is carried by the movement of the pendulum toward the right hand against the contact-point e^3 the circuit of the battery O will be completed through conductors 2 and 3, coils of the electro-magnet M′, conductor 5, resilient arm e', contact-points e^3 and d^3, bracket D, supporting-spring B, frame C, and conductor 1. The electro-magnet M′ will thus be vitalized and the right-hand end of the table H will be drawn downward, thereby releasing the resilient arm e'; hence the arm e' will exert a pressure upon the arm d' through the contact-points e^3 and d^3. The pendulum will be caused to swing toward the left hand not only by the action of gravity, but also under the influence of the additional force exerted by the tension of the spring e'. The resilient arm or spring e' will continue to exert the pressure until it is arrested by striking against the arm h'. The further movement of the pendulum by virtue of its acquired momentum will cause the separation of the contact-points e^3 and d^3, thus interrupting the circuit of the battery O through the electro-magnet M′. The point d^4 will, however, be carried into contact with the point e^4, thereby completing the circuit of the battery O through the conductors 2 and 4, coils of the electro-magnet M², conductor 6, contact-points e^4 and d^4, bracket D, and conductor 1. The electro-magnet M² will thereupon be vitalized and the left-hand end of the table H will be drawn downward, releasing the spring e^2, which will add an impulse to the pendulum A, tending to again vibrate it toward the right hand in precisely the same manner as already described with reference to the spring e'. This operation will be repeated for each semi-vibration of the pendulum.

It is evident that the circuit through one electro-magnet may be completed immediately before that through the other is interrupted, or immediately thereafter; or the completion of one may be simultaneous with the interruption of the other circuit. In practice, however, we prefer the latter arrangement.

It is well known that after the vibration of a pendulum has been established a very slight force or series of impulses continuously imparted thereto will be sufficient to maintain that vibration, and for this reason it is only necessary that the springs e' and e^2 should exert a very slight pressure.

For the purpose of preventing the occurrence of electrical discharges at the contact-points when the circuit is interrupted, we employ two shunt-circuits, 7 and 8, respectively extending around the coils of the electro-magnet M′ and M², and including artificial resistances r' and r^2. The resistance of each of these circuits should be sufficiently great to prevent the passage of any considerable current therethrough, but not so great as to pre-

vent the extra or induced currents, which are caused by the discharge of the electro-magnets, from passing therethrough, in preference to establishing arcs between the separating contact-points, and thereby oxidizing or burning them away.

We claim as our invention—

1. The combination, substantially as hereinbefore set forth, of two electro-magnets, their armatures respectively supported upon opposite extremities of a centrally-pivoted lever, a vibrating pendulum, two prismatic contact-points respectively supported from opposite sides of said pendulum, two resilient arms, two prismatic contact-points respectively supported upon the extremities of said resilient arms in planes intersecting the planes of the first-named contact-points, a battery, conductors connecting one pole of said battery with one pair of said contact-points through the coils of said electro-magnets, and conductors connecting the remaining pair of contact-points with the remaining pole of said battery.

2. The combination, substantially as hereinbefore set forth, with a clock-pendulum, of two electro-magnets, an armature-lever, two armatures attached thereto and applied to said electro-magnets, respectively, two contact-points moving with said pendulum, two impulse-springs, and lifting-fingers applied to said springs and carried upon said armature-lever, each of which springs is adapted to close a circuit through the corresponding electro-magnet when, by the swing of the pendulum, it is touched by the corresponding contact-point, whereby through the attraction of the armature the lifting-finger is withdrawn and the spring permitted to act so as to give an impulse to the pendulum.

3. The combination, substantially as hereinbefore set forth, with a clock-pendulum, of two electro-magnets, two resilient arms, knife-edge contacts carried thereon, respectively, two knife-edge contacts moving with said pendulum and applied to the first-named contacts, respectively, two armatures applied to said electro-magnets, respectively, two lifting-arms respectively moving with said armatures and applied to said resilient arms, and electrical connections, substantially as described, from said contacts through said electro-magnets, whereby one or the other electro-magnet is vitalized when the swing of the pendulum has carried one or the other of the contacts moving therewith against the corresponding contact.

In testimony whereof we have hereunto subscribed our names this 4th day of September, A. D. 1883.

CHESTER H. POND.
HENRY L. BAILEY.

Witnesses:
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