C. F. BRUSH.

ELECTRIC CLOCK.

No. 189,998. Patented April 24, 1877.

Fig. 1.

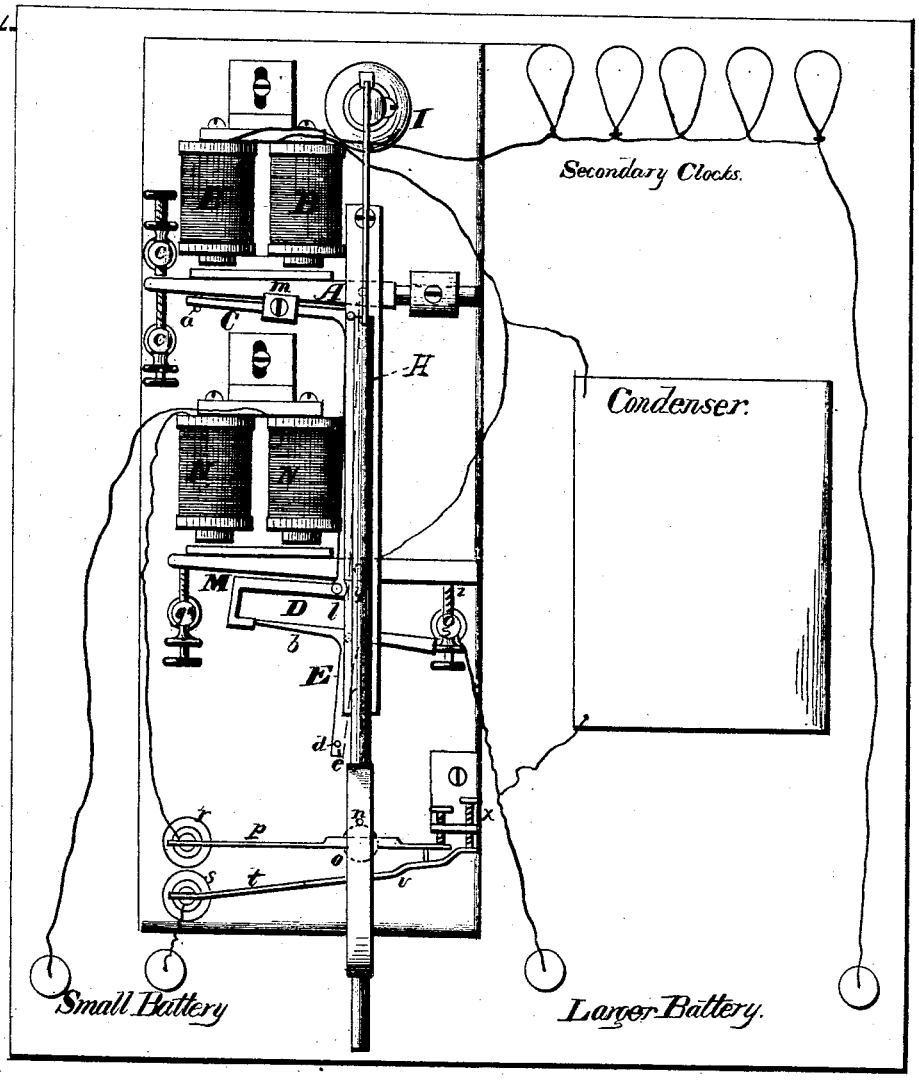


Fig. 2.

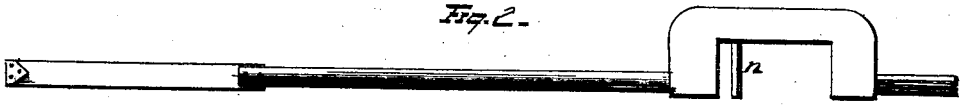
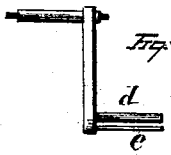


Fig. 3.



WITNESSES

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UNITED STATES PATENT OFFICE

CHARLES F. BRUSH, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF HIS RIGHT TO THE TELEGRAPH SUPPLY COMPANY, OF SAME PLACE.

IMPROVEMENT IN ELECTRIC CLOCKS.

Specification forming part of Letters Patent No. **189,998**, dated April 24, 1877; application filed August 28, 1876.

To all whom it may concern:

Be it known that I, CHARLES F. BRUSH, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electrical Clocks; 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in electrical clocks.

The object of the invention is to furnish a simple and reliable mechanism by which an electric current or circuit can be closed and opened at suitable regular intervals, for the purpose of operating one or more electric dials or "secondary clocks" included in said circuit.

This mechanism I shall call, for convenience, the "primary clock." It consists of a device or combination of devices for automatically closing and opening an electric circuit by means of a pendulum, actuated either by a weight or spring, and train of wheels, in the usual manner, or by an electro-magnet. The latter arrangement is preferable, and is the one I shall describe. The electro-magnet attracts and raises an armature attached to a horizontal arm or lever. This lever, by means of a projecting pin, raises the end of another lever parallel with the first, and attached at its fulcrum to the upper end of a vertical arm, the lower end of which, being thus thrown to the right or left, is retained by a clutch when the electro-magnet releases its armature. This occurs when the pendulum is near the middle of its arc. The pendulum-rod, continuing to move to the right or left after the breaking of the circuit, encounters, near the completion of its arc, a projecting pin and spring, which, being moved thereby a short distance, raises the clutch above mentioned and releases the vertical arm, which, receiving motion by the falling of a small adjustable weight attached to the second lever mentioned, imparts, through a projecting pin at its lower end, an impulse to the pendulum during part of its receding movement. This impulse occurs every alternate second, and maintains the motion of the pendulum. At a convenient point on the pendulum-rod is attached a horizontal pin, which, at every vibration, engages with a small wheel or cam carried by a horizontal spring of weak tension, which latter is thus depressed sufficiently to touch a platinum point projecting upward from another weak horizontal spring. An electric circuit is thus established with but very little resistance to the motion of the pendulum. But it has been found by all electric-clock makers that when several electro-magnets are included in a circuit carrying sufficient current to operate them, a spark occurs at the point of rupture of the circuit, due to what is technically known as the "extra current." This spark rapidly destroys the metal surfaces where it occurs so that after a short time they begin to mis connection occasionally, thus making the cloc very unreliable. But the inventor has observed, during several years' experience, that when the current to be closed and opened is of low electro-motive force, and operates only one or two small electro-magnets wound with coarse wire, no visible spark occurs at the point of rupture, the surfaces are not altered, and connection never fails from this cause. I therefore include in the circuit opened and closed by the pendulum, as above described, only one small electro-magnet, wound with coarse wire, and operated by a single cell of battery of low electro-motive force, such as a small "Smee" cell. This small magnet operates a "relay" differing from an ordinary relay in that the armature is placed on the longer end of a lever, the shorter end of which carries the platinum or gold contact-surface. This arrangement causes the surfaces to be brought together with more force than in the ordinary relay; still the latter may be used. The contact-surfaces are made quite broad so as to avoid rapid wear. In the electric circuit closed by the relay is included the magnet which moves the pendulum, and also those of all the secondary clocks to be run.

Of course a spark occurs at the relay at every rupture of the current; but the contact-surfaces, being large and moved with considerable force, are far less liable to miss connec-

tion from its destructive effects than in the case of the first break-piece moved by the pendulum, where the force employed must necessarily be very little, and the surfaces small accordingly. But the repeated occurrence of a spark would eventually render even the relay break-piece unreliable. I therefore connect each side of this break-piece with one of the coatings of a condenser, such as is used with induction-coils, and consisting of large surfaces of tin-foil separated by sheets of varnished paper or other insulator. The effect of the condenser is the absorption of the spark exactly as is done at the break-piece of an induction-coil. The spark is thus caused to disappear entirely, or is reduced to such small size and intensity as to be harmless. Instead of the condenser just described, a long fine metallic wire, or other conductor offering high electrical resistance, may be employed, its ends being connected with the break-piece in the same manner as the coatings of the condenser. In that case the extra current which is induced on breaking the circuit traverses the conductor of high resistance, instead of producing a spark where the break occurs. The high resistance of the conductor affords a sufficient barrier to practically prevent the passage of the direct current.

If but a small number of secondary clocks are to be run by the primary one, the relay may be dispensed with, the condenser being, in this case, connected with the first break-piece moved by the pendulum.

In the drawing, Figure 1 represents a front elevation of my complete electric primary clock. Fig. 2 is a side view of the pendulum detached, and Fig. 3 is a side view of the dog or clutch.

A, Fig. 1, is a lever, carrying an armature and counter-weight, and attached to a horizontal arbor near the counter-weight, as shown. This lever is raised by the attraction of the electro-magnet B when the latter is magnetized. *c c* are posts, with set-screws for regulating the movement of the lever A. Projecting downward and outward from the lever is the hook or pin *a*, which enables the latter to raise with it the second lever or arm C, which is pivoted on an arbor at its other end. This lever is attached at its fulcrum to the vertical arm D, which has an offset at its lower end, as shown. E is a clutch or dog, having a horizontal arm, *b*, which falls into position and retains the arm D when the latter is thrown to the left by the action of the magnet B, and also a vertical arm carrying at its lower end a projecting pin, *d*, and weak spring *e*. These are shown in side elevation in Fig. 3, which also shows the arbor on which the clutch or dog is carried. The pendulum-rod H is suspended from the clock I in the usual manner.

The operation of the device is as follows: When the pendulum-rod swings toward the left and is at the middle of its stroke, the magnet B will operate, as will be hereinafter shown, and the arm D will be thrown to the left, as indicated; but the magnet very soon releases its armature, owing to the rupture of the electric current, and the lever A falls. The arm D, however, being retained by the clutch E at *b*, does not move. The pendulum-rod, continuing to move toward the left, encounters the light spring *e*, which is depressed until it (the rod) touches the pin *d*, projecting from the arm E. This moves the arm to the left, and releases the clutch at *b*, which is then thrown upward by the recoil of the spring *e*. This arrangement prevents the sudden resistance that would be offered to the pendulum by striking the pin *d*, and requiring the friction at *b* to be instantly overcome, and substitutes therefor the gradual resistance of the spring, which resistance gradually overcomes this friction at *b*, and distributes the resistance against the pendulum over a considerable length of its stroke. The pin *d* is to protect the spring *e* and raise the clutch, should the spring prove inadequate.

When the rod finally stops and starts back toward the right, it is urged forward by the pin *l*, which is actuated by the weight *m* on the lever C. The pin follows the rod farther than it was lifted by the latter, because the clutch-arm *b*, being held out of the way by the spring *e*, allows the arm D to move past it. The spring *e* is thus seen to serve another purpose, as, without it, it would be necessary to have the pendulum raise the clutch entirely out of the way before striking the pin *l*, and the latter would have to fall a little to meet the pendulum, in order that it might not be retained on its return by the clutch. The force of impulse to be given the pendulum is regulated by moving the small weight *m* to the right or left on the lever which carries it.

At the lower part of the drawing will be seen the electric-circuit "break-piece," which is operated by the pin *u* on the pendulum-rod. The rod is cut away for the accommodation of the break-piece, as shown in Fig. 2. This break-piece consists of a small wheel or cam, *o*, carried by a weak spring, *p*, which is attached to the post *r*. At the other end of the spring, on its lower side, is a small platinum or gold plate. (Not shown.) Another similar spring, *t*, is attached to the post *s*, and has a platinum or gold wire, *v*, attached near its free end, and projecting upward so as to touch the platinum or gold plate carried by *p* when the latter is slightly depressed. This occurs when the pin *u* on the pendulum-rod passes the wheel or cam *o*. *x* represents screws for adjusting the springs *p* and *t*, both with reference to each other and to the pin *u*. In this way the length of contact may be varied at pleasure, but should be made short to economize battery-power. The ends of the adjusting-screws *x* are isolated, as are also the posts *r* and *s* and the pin *u*. This arrangement of parts may be varied by attaching the cam to the pendulum-rod, and the pin to the spring;

or the motion imparted by the pendulum-rod may be upward instead of downward.

In the circuit closed by this break-piece are the electro-magnet N and a small battery, as shown.

The magnet N operates an armature attached to the lever M, which has its fulcrum at *y*. At the other end of the lever is attached a piece of platinum or gold, opposite the platinum or gold end of a set-screw, *g*. *g'* is another set-screw for regulating the movement of the lever. The parts form the relay or second break-piece referred to. In its circuit are included the magnet B, the secondary clocks, and larger battery, as shown. The drawing also shows how the "condenser" is attached, for the purpose of absorbing the spark which would otherwise occur at the point *z* at every rupture of the current.

By means of these simple devices an exceedingly accurate and reliable primary electric clock is formed.

I desire it to be distinctly understood that by the term "condenser" in the claim I mean any device, such as a Leyden jar, or series of surfaces, or wire, or other device, whereby the "extra current" is absorbed or discharged, as hereinbefore described.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The pendulum-actuating lever, in combination with the clutch or dog E, provided with springs *e* and pin *d*, substantially as and for the purpose described.

2. The combination, with the pendulum, of the angular pendulum-actuating lever C D, and angular clutch E, and spring *e*, substantially as and for the purpose described.

3. The clutch or dog E, provided with spring *e* and pin *d*, substantially as and for the purpose described.

4. In an electrical clock, the combination, with a magnet and armature-lever, of adjusting mechanism and contact-surfaces *z*, the latter carried on the shorter arm of the armature-lever, and the whole constituting the relay, substantially as and for the purpose described.

5. The combination of the relay, pendulum H, break-piece, and a battery of low electromotive power, substantially as and for the purpose described.

6. In an electrical clock, the combination, with a relay, of a condenser and main battery, substantially as set forth.

7. In an electrical clock, the combination, with relay, of a condenser and secondary clocks, substantially as and for the purpose described.

8. The combination of a light battery-circuit, embracing break-piece and relay, with a battery-circuit embracing condenser, secondary clocks, and electro-magnets B, said magnets B operating, through intermediate mechanism, to vibrate the pendulum H, substantially as and for the purpose described.

9. The combination of a light battery-circuit, embracing break-piece and relay, with a battery-circuit embracing condenser and secondary clocks, said light battery-circuit made or broken by the vibration of the pendulum H, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES F. BRUSH.

Witnesses:
FRANCIS TOUMEY,
JAMES P. WALSH.