(No Model.) 2 Sheets—Sheet 1.

F. RICHARD.

ELECTRIC CLOCK.

No. 596,943. Patented Jan. 4, 1898.

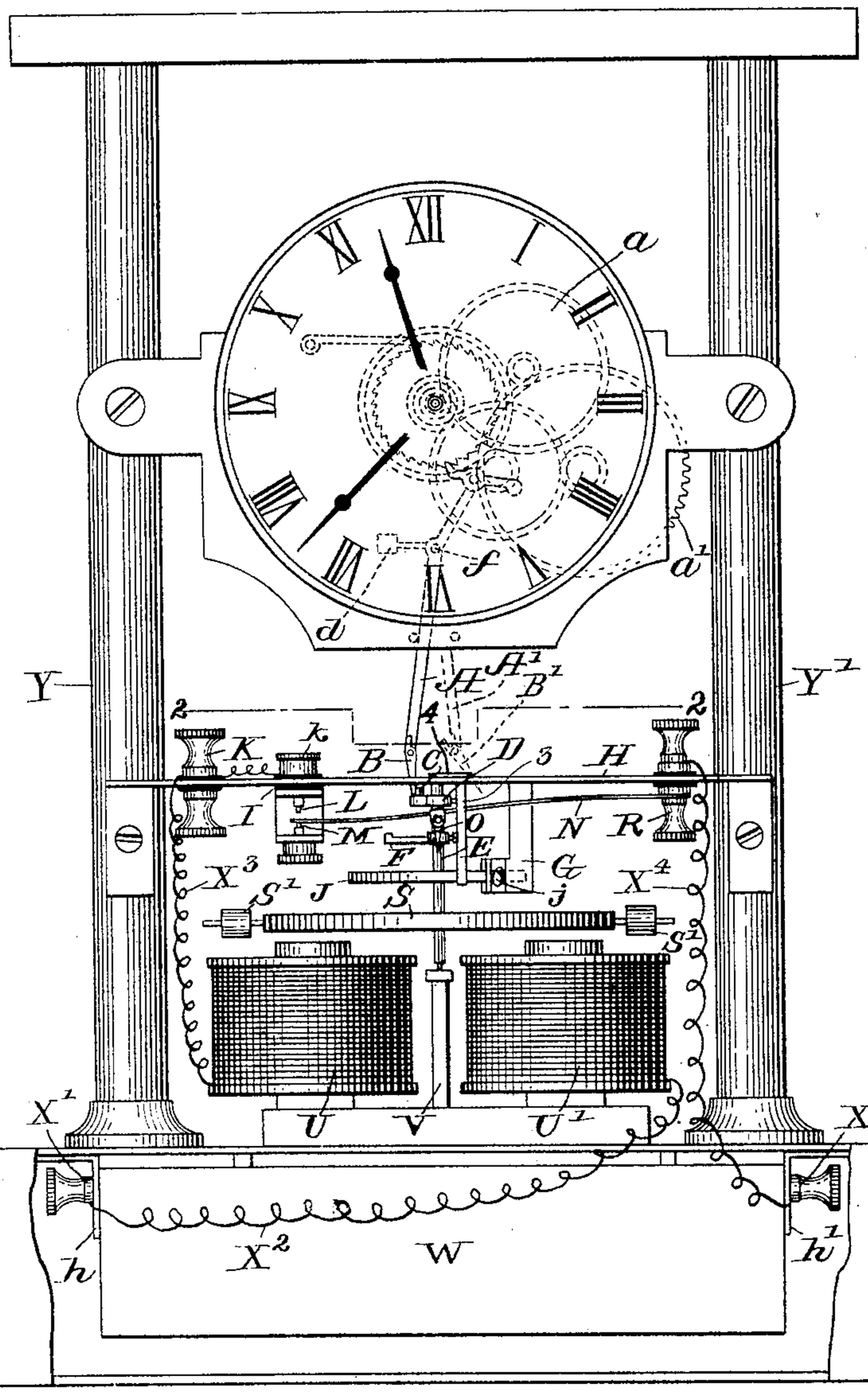

Fig. 7.

Fig. 1.

WITNESSES.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

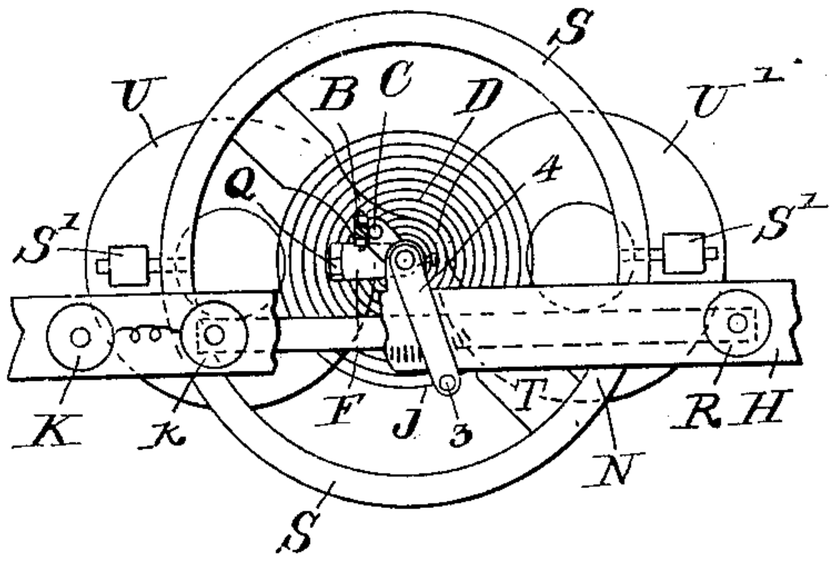


Fig. 3.

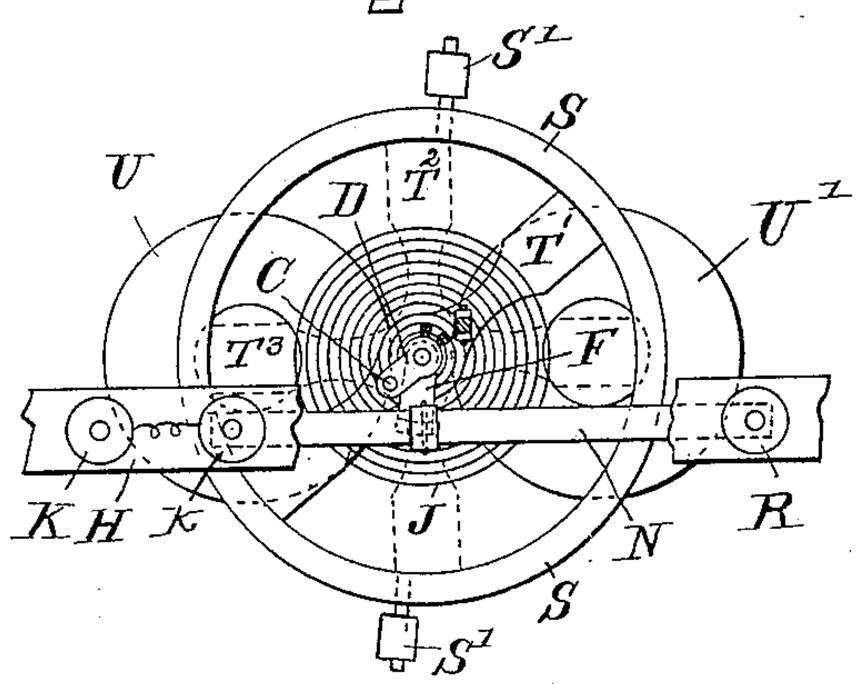


Fig. 4.

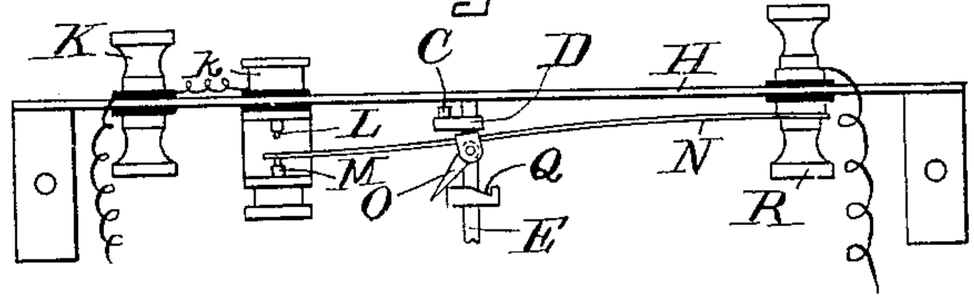


Fig. 5.

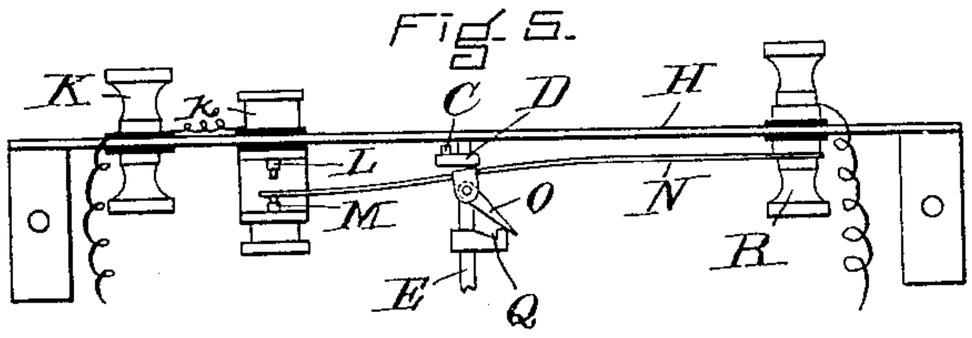
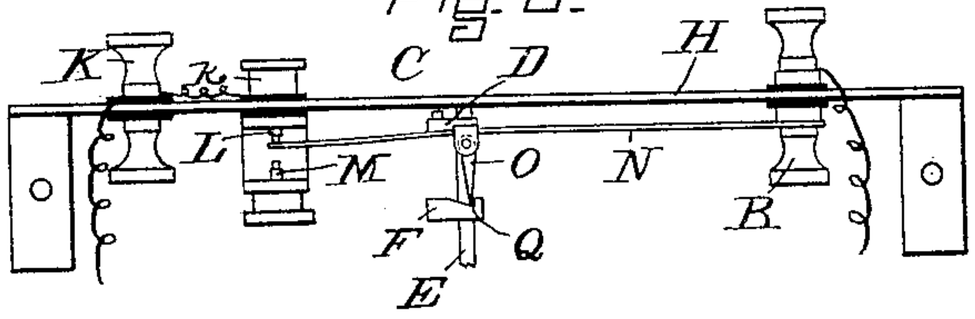


Fig. 6.



WITNESSES.

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UNITED STATES PATENT OFFICE.

FREDERIC RICHARD, OF LYNN, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO THEODORE LEUTZ, OF BOSTON, MASSACHUSETTS.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 596,943, dated January 4, 1898.

Application filed August 21, 1896. Renewed November 24, 1897. Serial No. 659,713. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC RICHARD, a citizen of the Republic of Switzerland, residing at Lynn, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Electric Timepieces or Clocks, of which the following is a specification, reference being had to the drawings accompanying and forming a part of same.

My invention relates to clocks or timepieces in which the motive power is an electric current furnished by any suitable contrivance, as a dynamo or battery.

This class of clocks may be used separate or independently, in which case a battery is commonly the source of power, or it may be used in combination with a master-clock where the power is furnished through a master-clock at regular intervals.

The object of my improvement is, first, to provide in separate or independent clocks a contacting device for using the electric current at intervals as far apart as possible and for the shortest practicable time, thus increasing the life of the battery; second, to provide means for applying the force of the electromagnet or dynamo, either in secondary or separate clocks, directly to the balance-wheel in a way to insure accurate time-keeping qualities; third, to provide in independent clocks a convenient place for the battery and means by which persons without special skill in the art can quickly and conveniently remove and replace exhausted batteries. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical view showing in a general way one form of the complete clock with a battery concealed in the base. Fig. 2 is a horizontal section taken on line 2 2, showing regulating-arm 3 4, armature balance-wheel, and connections. Fig. 3 is a section on line 2 2, showing the balance-wheel and connections in a different position. Figs. 4, 5, and 6 are details showing different positions of the contacting-spring and pallet-catch on same. Fig. 7 is a detailed side view of the bracket by which the battery is clamped to the base of the clock.

Similar letters and figures refer to similar parts throughout the several views.

In Fig. 1 the hollow base Z supports the standards Y Y′, upon which are carried the dial and a suitable train of gears *a a′* and the supporting-plate H, which carries the contact-spring and a bearing for one end of the balance-spindle. The magnet U U′ and spindle-support V are also fastened on the base.

Within the hollow base Z the cell of dry battery with terminals X X′ is fastened by two metal brackets *h h′*, Figs. 1 and 7, which are attached to and insulated from the base and provided with downward-extending slotted arms, into which fit the studs forming the terminals of the battery, so that when the binding-screws X X′ are tightened upon the arms a positive contact is made and the battery held in position. The battery may be quickly removed by loosening the thumb-screws. With the battery in position the circuit from post X′ is made by conductor X^2 through the electromagnet, and the conductor X^3 to binding-post *k*, which is an electrical connection with binding-post *k* and contact L, all of which are insulated from the supporting-plate H by the mica strip I. The opposite pole of the battery X is connected to the binding-post R and contacting-spring N by conductor X^4, all of which are insulated from the supporting-plate H. The adjusting-screw M is also insulated from the spring N, so that in the normal position of the contacting-spring N (shown in Figs. 1, 4, and 5) the circuit is open, while in Fig. 6 the circuit is closed.

Referring to Fig. 1, A is a vibrating arm pivoted at *f* and connecting at its upper end with a pawl-and-ratchet wheel, so that when the arm is moved to the left by the stud C (in the revolving arm D) it revolves the ratchet-wheel connected to a suitable train of gears *a a′*, operating the hands of the clock. The arm is brought back to its normal vertical position by the weight *d* or a suitable spring.

In Fig. 1 on the lower end of the arm A a hinge B is pivoted to turn loosely, as at B′, toward the right to allow the stud C to pass freely, but in turning to the left only as far as its normal position in line with the arm.

In Figs. 1, 2, and 3 on the spindle E is mounted and rigidly attached, first, the arm D, with the stud C, which engages the hinge or pallet B, moving the arm A as the spindle and arm C are revolved to the left; second, the arm F, with the notch Q, for engaging the pallet O of the contact-spring N; third, the armature T, which forms an integral part of the balance-wheel S S.

Surrounding the spindle E, between the arm F and balance-wheel S S and attached to the spindle E, is the hair-spring J. This spring is fastened at its outer end to the arm G by the screw *j*, and its tension can be adjusted by the regulating-arm 3 4. The weights S′ S′ are arranged to balance and regulate the balance-wheel, as in an ordinary chronometer-balance. In its normal position of rest the armature of the balance-wheel stands in the position T^2, Fig. 3, and when it is rotated from this position the spring acts to bring it back again.

If the armature be rotated by the hand to the left, opposite to the rotation of the hands of a watch, far enough to carry the arm F considerably past the pallet O, which is free to move either way, and released, the balance-wheel will be returned toward its original position by the force of the spring J passing the pallet O, Fig. 4, in its return in the same manner as in its forward movement, Fig. 5, and will rotate to the right of its original position by its own momentum, continuing to vibrate with shortening amplitude until the arm F just reaches the limit of its left-hand vibration as the point of the deflected pallet is resting upon its top surface, Fig. 6. Then as the arm F starts backward upon its right-hand turn the end of the pallet is caught by the notch in the arm F and is forced into a vertical position, carrying up the contact-spring N, to which it is attached, off from the insulating-pin M onto the contact-pin L and completing the circuit through the magnets U U′ at the moment when the armature is in the position T′, Fig. 3. The armature T′ in position is thus drawn with considerable force for a moment toward the position directly over the magnets, thus giving it a fresh impulse. The pallet O drops off the arm F and the circuit is broken just before the armature reaches the position T^3, so that the armature keeps on in its right-handed vibration until its momentum is equalized by the spring J, when it returns, the arm F continuing to pass the pallet O each way without disturbing the contact-spring N until the amplitude of the vibration is shortened again, so that the arm F reaches its turning-point under the pallet O, when the circuit will be made again and a fresh impulse given to the balance-wheel. This operation is repeated so long as the proper current is supplied, and at each vibration the stud C in arm D carries the lever A to the left and moves the clock-driving mechanism forward by one tooth of the ratchet *b*.

When the clock is used as a secondary timepiece, the contacting mechanism is dispensed with and the balance-wheel is so designed as to arrive in approximately the position T′ when the electromagnet is energized from the master-clock.

It is not necessary that the exact form of the apparatus described be used. I have constructed a clock in which none of the parts, as the pallets B and O, keep their position by gravity, but are held in place by springs, so that the clock may be turned in any position without disturbing its operation.

I have also made a clock in which a contact is made at each complete vibration of the balance-wheel and with the spindle of the balance-wheel arranged to act by a pawl directly on the ratchet-wheel driving the clock-gears; but up to the present time I find the arrangement shown in the drawings appear to work best.

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

1. In a clock or timepiece operated by a balance-wheel whose vibration is accelerated or renewed automatically as needed, the combination of the electromagnets U U′, armature balance-wheel S S, the spindle E, the hair-spring J, the automatic contacting devices consisting of radial notched arm F, pallet O and spring N, the radial actuating-arm D and pendulous arm A connected for transmitting the motion of the balance-wheel to the clock mechanism, all substantially as and for the purposes set forth.

2. In a clock or timepiece operated by a balance-wheel whose vibration is accelerated or renewed automatically as needed, the combination of the electromagnets U U′, balance-wheel S S, with regulating screw-weights S′ S′ mounted upon spindle E, the hair-spring J surrounding said spindle, the regulating-arm 3 4, adapted to regulate the clock fast or slow, the automatic contacting devices consisting of notched arm F attached to spindle E, pallet O and spring N, the radial actuating-arm D attached to spindle E, and pendulous arm A provided with pivoted catch B and connecting to ratchet-wheel *b* actuating clock gears and hands *a a*, all substantially as and for the purposes set forth.

3. In a clock or timepiece operated by a balance-wheel whose vibration is accelerated or renewed automatically as needed, the combination of the electromagnets U U′, balance-wheel S S with regulating screw-weights S′ S′ mounted upon spindle E pivoted at both ends, the spring J surrounding said spindle, the automatic contacting devices consisting of notched arm F attached to spindle E, pallet O and spring N, making rubbing-contact at L,

the radial actuating-arm D attached to spindle E and pendulous arm A provided with pivoted catch B and connecting to ratchet-wheel *b*, all substantially as and for the purposes set forth.

4. In an electric timepiece or clock operated by a balance-wheel whose vibration is accelerated or renewed automatically as needed, the combination of the electromagnets U U′, balance-wheel S S, spindle E, hair-spring J, notched arm F, pallet O and spring N, actuating-arm D, pendulous arm A connected to ratchet-wheel *b*, the hollow base, the dry battery U with terminals X X′ adapted to slip into its forked arm contact-brackets H H′ or their equivalents, all substantially as and for the purposes set forth.

FREDERIC RICHARD.

Witnesses:
CHAS. BREWER,
AGNES E. WATSON.