(No Model.)

W. S. SCALES.

ELECTRIC CLOCK WINDING MECHANISM.

No. 543,707. Patented July 30, 1895.

Fig. 1.

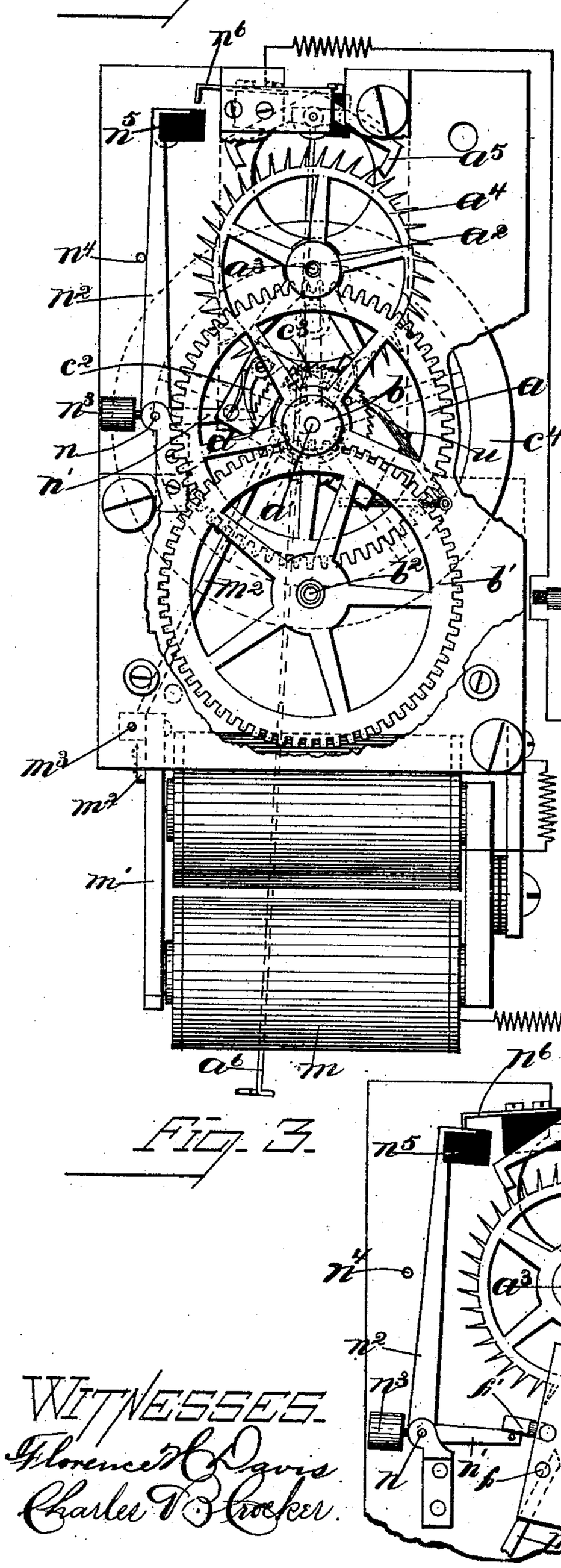

Fig. 2.

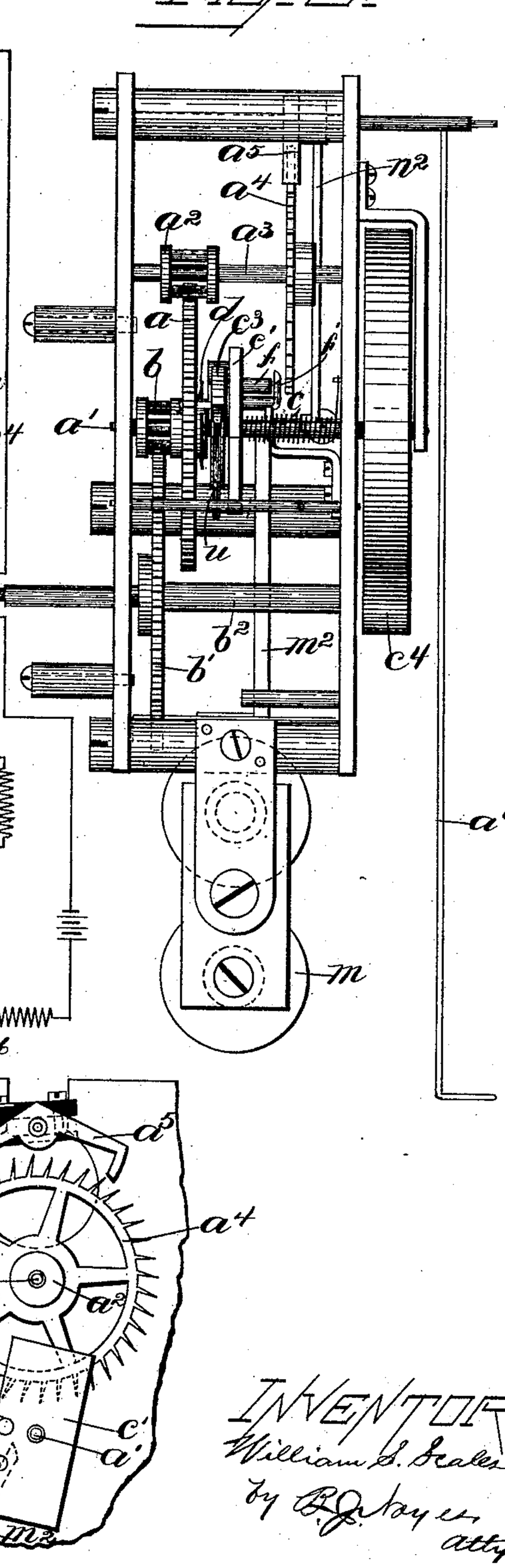

Fig. 3.

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ELECTRIC CLOCK-WINDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 543,707, dated July 30, 1895.

Application filed November 12, 1894. Serial No. 528,482. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. SCALES, of Everett, county of Middlesex, and State of Massachusetts, have invented an Improvement in Independent Electric Clocks, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve the construction of independent electric clocks, and has particular reference to the winding mechanism for the actuator or mainspring thereof.

In accordance with this invention any usual or suitable clock-train is employed for driving the hands, which is propelled by any usual or suitable mainspring or other actuator. The winding device for the spring or other actuator comprises essentially an electromagnet in circuit with a suitable battery, a vibrating armature therefor, which, each time it is attracted, winds the spring, and a balance-wheel or equivalent device connected with said actuator and operated by said vibrating armature to acquire a certain amount of momentum, which is utilized to supplement the action of the vibrating armature in winding the spring. The momentum device may be connected with said actuator in different ways. As the electromagnet is energized by closing its circuit its vibrating armature is at once attracted, its rapidity and force of action depending upon the strength of the battery in circuit, and said balance-wheel acts by momentum to wind the spring a greater or less distance, according to the strength of the battery, thereby supplementing the action of the vibrating armature, the range of motion of which is limited. The circuit of the electromagnet is herein represented as closed by a circuit-controller, one member of which is operated by the pallet-staff and the other member of which is thrown into operative position by the unwinding of the spring. Yet, so far as the balance-wheel and its action upon the actuator is concerned, whereby the strength or energy of the battery may be utilized in winding said actuator, the circuit of the electromagnet may be operated in any other desirable way. The mainspring is herein represented as connected with the train by a pawl and ratchet, which permits winding of the spring as usual, but to prevent retarding the train while winding said spring the ratchet-wheel is connected with said train by a flexible connection—such, for instance, as a spiral spring—which is connected at one end to the ratchet-wheel and at the other end to the driving-wheel of the train.

Figure 1 shows in front elevation an independent electric clock embodying this invention, the hands and dial being removed; Fig. 2, a side view of the clock-train, its actuator, and winding device therefor; and Fig. 3 a detail of the circuit-controller.

The clock-train herein shown, yet in lieu of which any other suitable form may be employed, consists of the driving-wheel a secured to an arbor a' and engaging a pinion a^2 on an arbor a^3, to which arbor is secured the escape-wheel a^4, with which co-operates the pallet a^5 secured to a bifurcated arm a^6, which is in engagement with the pendulum. A pinion b is secured to the arbor a', which engages a toothed wheel b' secured to the minute-hand shaft b^2, and the hour-hand sleeve is driven in the usual way. The actuator for the train is herein represented as a spiral spring c mounted upon the arbor a', one end of which is connected with the framework and the opposite end with the arbor. A plate c', or it may be an arm, is secured to the arbor a', to which the spring c might be connected. A pawl c^2 is pivotally connected to the plate or arm c', which engages a ratchet-toothed wheel c^3, mounted loosely upon the arbor a', adjacent to the driving-wheel a, and a spiral spring d encircling the shaft is interposed between and connected at one end to said ratchet-wheel c^3, and at the opposite end to the driving-wheel a, thereby flexibly connecting said ratchet-wheel with the train. A balance-wheel c^4 is secured to the arbor a', yet two balanced arms oppositely extended may be employed as an equivalent therefor. An electromagnet m is secured to the framework, the armature m' of which is herein represented as secured to an arm or lever m^2, pivoted at m^3, said arm extending upwardly and its upper end lying in the path of movement of a stud or projection f on the disk c'. A

bell-crank lever is pivoted at n, comprising a horizontal arm n' and a vertical arm n^2. A weight n^3 is attached to said lever, tending to hold it against a fixed stop n^4, and its horizontal arm n' lies in the path of movement of a stud f' on the plate or arm c'.

At the upper end of the arm n^2 an insulated block n^5 is secured, being cut away to expose at its upper side a portion of the arm, and attached to but insulated from the pallet-shaft is a contact pen or arm n^6, vibrating with the pallet, the outer end of said pen striking upon the block n^5, or upper exposed portion of the arm n^2, according to the position of the arm. When the arm is held in its normal position against the fixed pin n^4, by means of the weight n^3, said contact-pen will strike upon the insulated block, but when the arm is moved toward the right, as it will be by the stud f' striking the arm n', the contact-pen will strike upon the exposed portion of the arm. The circuit of the electromagnet m is closed by this contact-pen striking the exposed portion of the arm.

The clock may be started in the usual way by swinging the pendulum, and as soon as the stud or projection f strikes or is about to strike the arm m^2 the stud or projection f' engages the horizontal arm n', moving the arm n^2 toward the right until its upper exposed end is brought beneath the contact-pen n^6, and on the next vibration of the pallet the circuit is closed, the armature m' quickly attracted, causing the arm m^2, which is in engagement with the stud or projection f, to suddenly turn the plate c', and with it the balance-wheel which is connected with its shaft, said parts moving toward the right.

The movement of the armature is so quick and the force exerted so powerful, although varying according to the power or strength of the battery, that the plate or arm c' will be moved a short distance by the direct action of the armature, and thereafter such movement will be continued for a much greater distance by the momentum of the balance-wheel connected therewith, such additional distance, however, depending upon the power or energy of the battery.

In practice I find that if the plate or arm should be turned, say, one-eighth of a revolution by the armature the total movement given to said plate or arm by the armature and thereafter by the momentum of the balance-wheel will exceed three-eighths of a revolution if an ordinary battery of normal strength is employed; but, as before stated, such additional distance will vary according to the strength of the battery. As the plate c' is thus moved the pawl carried by it passes over the teeth of the ratchet-wheel c^3, and as said ratchet-wheel is flexibly connected with the train, the friction between said pawl and ratchet will not retard the movement of the train, as all such action is taken up or compensated for by the maintaining-spring d, which connects the ratchet-wheel with the train. A back-stop or click u engages the ratchet-wheel, preventing backward rotation.

It will be observed that the main driving-spring c will be wound as the plate or arm is thus turned by the combined action of the armature and momentum of the balance-wheel, the latter supplementing the action of the former. When the armature acts to thus move the plate c' in one direction, the stud f' is moved out of engagement with the horizontal arm n', permitting the weight n^3, which is attached to the bell-crank lever, to return to its normal position, so that the contact-arm n^6 may act upon the block n^5, and hence the circuit is closed but for a very short space of time. The circuit will then remain open while the clock runs, or until such time as the stud or projection f' returns and is again brought into engagement with the arm n' and the arm n^2 moved toward the right.

It will be seen that at each vibration of the pallet the contact pen or arm n^6 strikes the block n^5, except when the arm is moved toward the right, to bring its exposed portion beneath the end of the arm, and when the parts are so disposed said arm will successively strike it, if the circuit is not closed by the first contact.

It will be observed that, as herein shown, the reciprocating plate c' is secured to the arbor carrying the mainspring c, that the vibrating armature acts upon said plate c', and that the balance-wheel c^4, or momentum device, is secured to said arbor a', reciprocating with the other parts, so that the actuator c may be said to be wound by the successive action of the armature and balance-wheel and plate returning to their normal position as the clock runs down, and as I am the first to provide a reciprocating balance-wheel or momentum device which is operated by the vibrating armature of an electromagnet and arranged to supplement the action of the electromagnet in winding the clock, such supplementary action varying according to the strength of the energy of the battery in circuit with said electromagnet, I do not desire to limit my invention to any particular construction or arrangement of parts or connections therefor.

In ordinary forms of independent electric clocks wherein an electromagnet is employed the electromagnet winds the actuator a distance according to the range of motion of the vibrating armature and regardless of the strength or energy of the battery, and the circuit of the actuating-electromagnet is closed at regular intervals of time, and whether the battery is strong or weak the distance that the actuator is wound is the same; but by the employment of a balance-wheel acting by momentum this extra strength or energy of the battery is utilized, greatly increasing the duration of the interval of time between the successive closures of the circuit, although such intervals of time will gradually diminish in length as the battery runs down.

I am aware that it is not broadly new to provide an electric clock with a winding device for the actuator and supplementary means for winding the clock, operated by momentum, as this broad feature is shown in Patent No. 308,521, dated November 25, 1884. In that case, however, the armature did not vibrate or reciprocate, but moved in the same direction, and the momentum device or part which operated by momentum after the circuit was broken also operated in the same direction.

I claim—

1. In an independent electric clock, an electro-magnet having an armature vibrating toward and from its poles, an actuator connected with the mechanism of the clock, a reciprocating momentum device connected with said actuator, and made independent of but adapted to be operated in one direction by said armature moving toward the poles of the electro-magnet, receiving therefrom a sudden thrust whereby it may supplement the action of said electro-magnet in winding the actuator, and utilizing the full strength of the battery, said momentum device being restored by the clock running down.

2. In an independent electric clock, an electro-magnet having a vibrating armature with an upwardly extended arm m^2, an actuator connected with the mechanism of the clock, a balance wheel connected with said actuator, a projection on the shaft of said balance wheel, adapted to be brought into position to be struck by said arm m^2 by the running down of the clock, a circuit controller for the circuit of said electro-magnet which when operated causes the arm m^2, by striking the projection, to suddenly revolve the balance wheel, that the latter by its momentum may supplement the action of the electro-magnet in winding the clock, substantially as described.

3. In an independent electric clock, an electro-magnet having a vibrating armature, an actuator connected with the mechanism of the clock, a reciprocating momentum device connected with said actuator by a pawl and ratchet connection, operated in one direction by said electro-magnet, and supplementing its action in winding the actuator, and restored by the clock running down, a circuit controller for the circuit of said electro-magnet, one member of which is vibrated regularly by the pallet shaft, and the other member of which is brought into operative position by the clock running down, substantially as described.

4. In an independent electric clock, an electro-magnet having a vibrating armature, an actuator connected with the mechanism of the clock, a reciprocating momentum device connected with said actuator by a pawl and ratchet connection, operated in one direction by said electro-magnet, and supplementing its action in winding the actuator, and restored by the clock running down, a circuit controller for the circuit of said electro-magnet consisting of a contact pen vibrated regularly by the pallet shaft, and a pivoted bell crank lever, one arm of which extends upward to be engaged by said contact pen, and the other arm of which extends horizontally inward to be engaged by a pin connected with one of the reciprocating parts, substantially as described.

5. In an independent electric clock, the train and actuator therefor, combined with a winding device for said actuator, comprising an electro-magnet, its vibrating armature, an arm projecting from a shaft connected with said actuator, and moved by the said armature to wind the actuator, and a balance wheel connected with said arm, which continues to wind the actuator by its momentum, a pawl carried by said arm, a ratchet wheel engaged by it and a spring flexibly connecting said ratchet wheel with the train, substantially as described.

6. In an independent electric clock, the train and actuator therefor, combined with a winding device for said actuator, comprising an electro-magnet, its vibrating armature, an arm connected with said actuator and moved by the said armature to wind the actuator, and a balance wheel connected with said arm, which continues to wind the actuator by its momentum, a pawl carried by said arm, a ratchet wheel engaged by it, and a spring flexibly connecting said ratchet wheel with the train, a circuit controller for the circuit of said electro-magnet, one member of which is regularly vibrated by the pallet shaft, and the other member of which is brought into operative position by the train running down, and restored by the action of the electro-magnet, substantially as described.

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

WILLIAM S. SCALES.

Witnesses:
B. J. NOYES,
C. B. CROCKER.