(No Model.) 4 Sheets—Sheet 1.

F. SCHWARTZ.

ELECTRIC CLOCK.

No. 440,441. Patented Nov. 11, 1890.

Fig. 1.

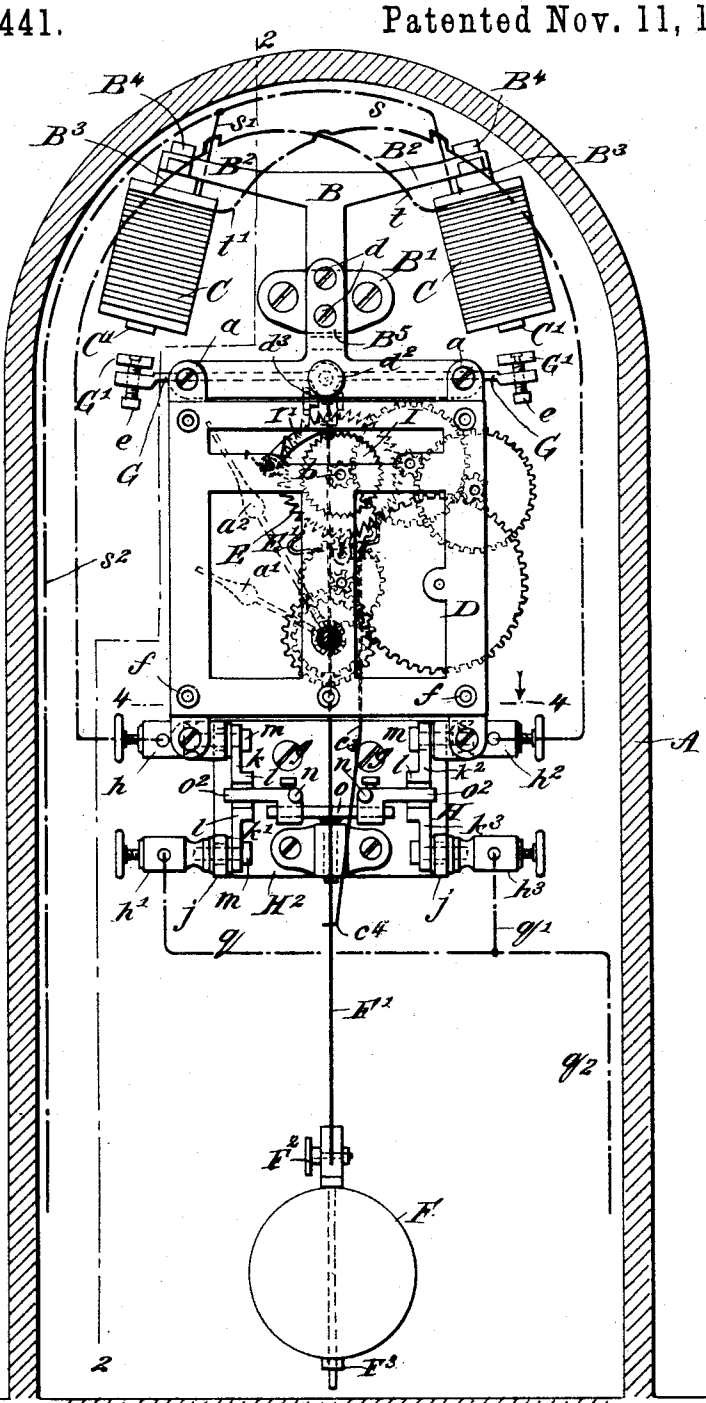

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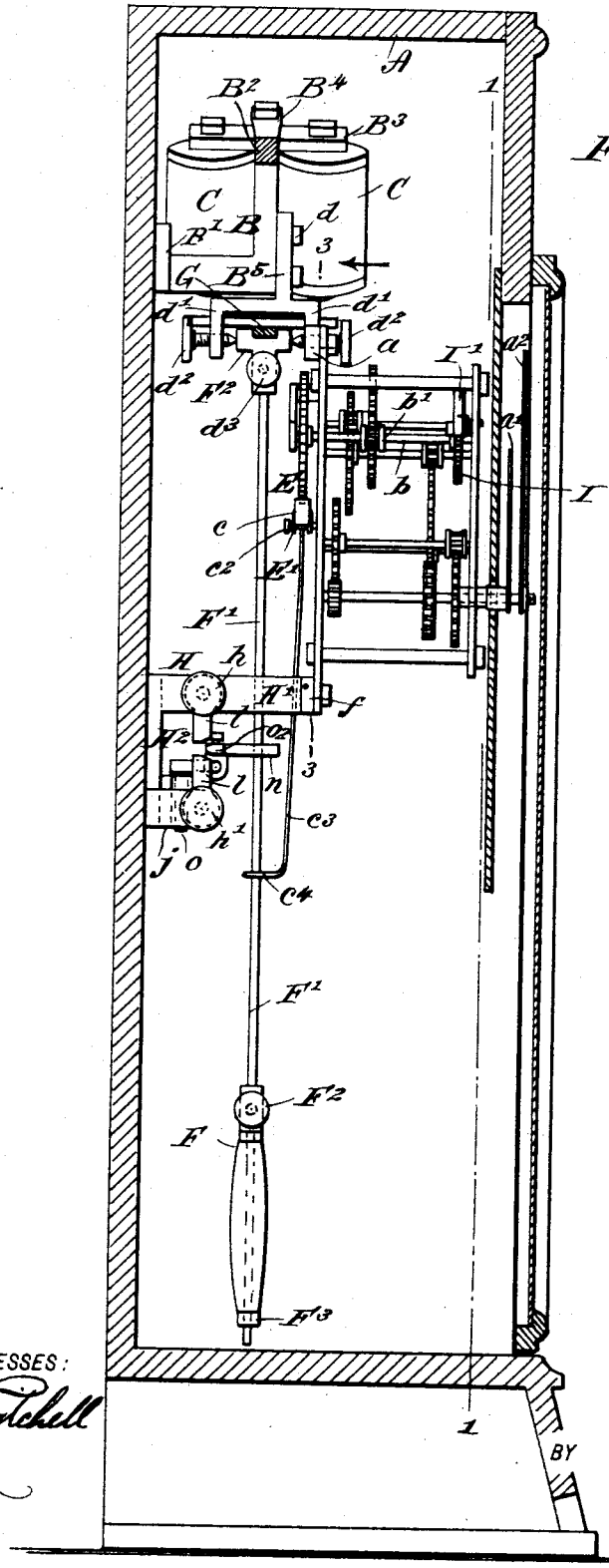
Fig. 2.



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(No Model.)

4 Sheets—Sheet 3.

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Fig. 3.

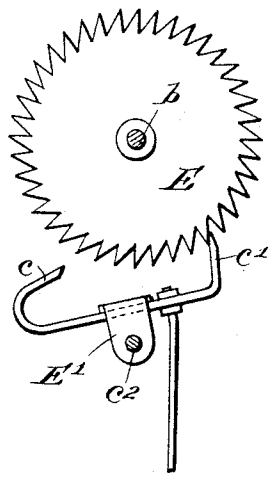
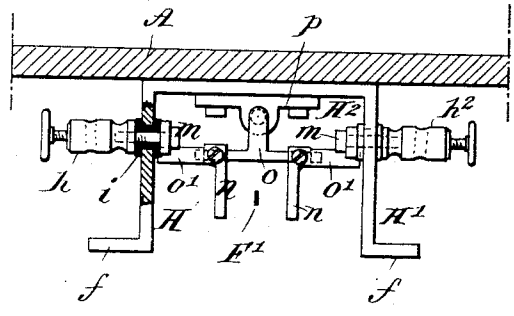


Fig. 4.



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4 Sheets—Sheet 4.

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ELECTRIC CLOCK.

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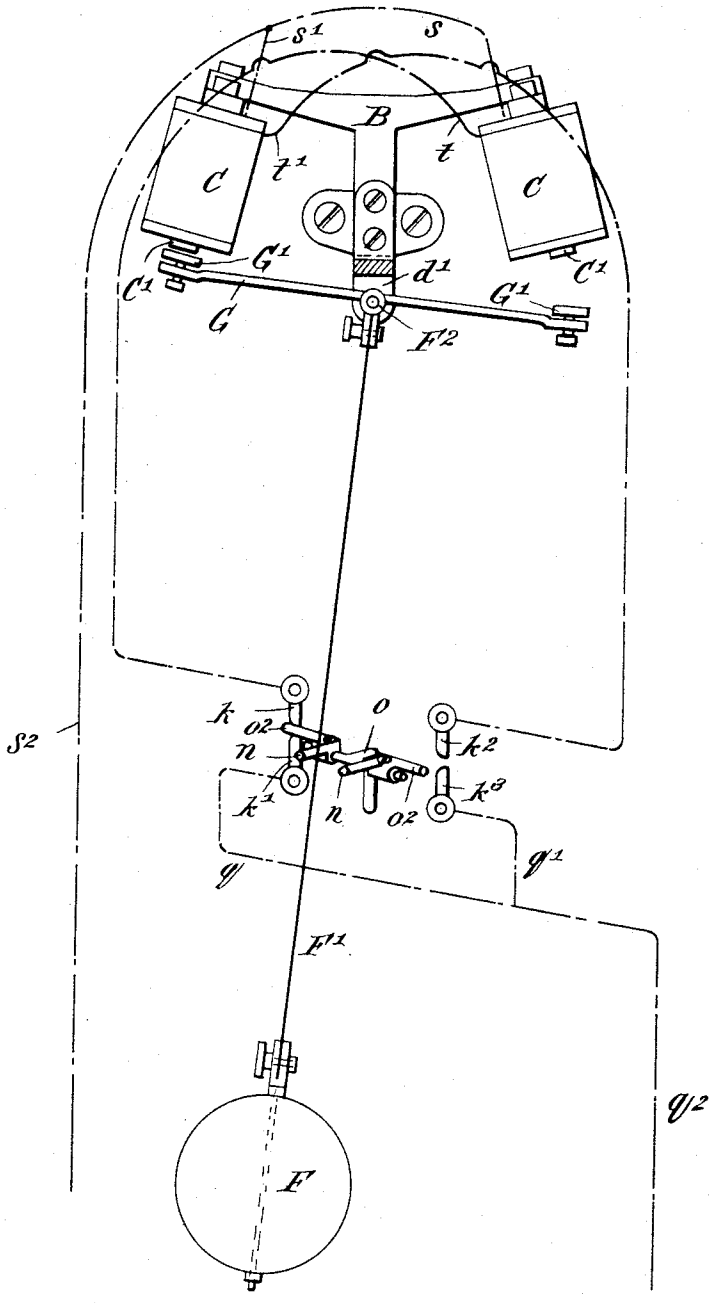
Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANK SCHWARTZ, OF HALIFAX, CANADA.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 440,441, dated November 11, 1890.

Application filed October 22, 1889. Serial No. 327,818. (No model.)

To all whom it may concern:

Be it known that I, FRANK SCHWARTZ, of Halifax, in the Province of Nova Scotia and Dominion of Canada, have invented a new and Improved Mechanism for Actuating Clocks by Electricity, of which the following is a full, clear, and exact description.

In the usual method of constructing clocks a train of gear-wheels is actuated by a coiled spring and an escapement-wheel and pallets, whereby the pendulum of the clock is given an impulse near each terminal of its vibration, and thus is made to complete said vibration and produce a proper movement of the time-indicating device.

The length of the pendulum, together with the force applied to the gearing, are co-operating factors in the process of marking time correctly, as if the pendulum is of an improper length its time of vibration will be incorrect, and if the actuating force which moves the gearing and gives impetus to the pendulum is variable the movement of the pendulum will be correspondingly altered.

The flat coiled springs, used as motors for ordinary clocks, vary in driving-force as they uncoil. Hence it is not possible to secure correct time-registration by a spring-driven clock, and a fair approximation can only be attained by employing a comparatively long spring and rewinding it frequently.

One object of this invention is to provide a mechanism utilizing electric force as a motor for clocks which will accurately regulate the impulse given a pendulum near the terminals of its vibratory arc, rendering the latter uniform, and thus affording a correct time-measure if the length of the pendulum is suitably adjusted.

A further object is to produce a mechanism of simple construction driven by electric force, whereby a compact, cheap, and reliable time-marker will be afforded, which will operate continuously without other attention than the occasional renewal of fluids in battery-cells.

With these ends in view my invention consists, essentially, in the provision of electro-magnets of correct proportions, supported on each side of a pendulum to which laterally-projecting armatures are affixed near its point of vibratory suspension, and that are carried by the movement of the pendulum within the field of force of the successively-energized magnets, and are attracted by them, said magnets being adapted to be alternately thrown into circuit with a local battery by the vibrations of the pendulum, and thus cause the pendulum to complete its predetermined arc of vibration at each terminal thereof. This movement is directly communicated through pallet-limbs to an escapement-wheel that is in gear with the train of speed-reducing wheels which it actuates, so that attached hands will indicate correct time on the usual face or dial of the clock.

My invention further consists in the construction of parts and their combinations, as is hereinafter described, and indicated in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a front elevation, partly sectional, taken on the line 1 1 in Fig. 2. Fig. 2 is a side elevation in section taken on the broken line 2 2 in Fig. 1. Fig. 3 is an enlarged detached sectional view of the escapement-wheel and pallet supported on an arbor and engaging the escapement-wheel. The line of vertical section is represented at 3 3 in Fig. 2, an arrow indicating the direction of observation. Fig. 4 is a plan view in section taken on the line 4 4 in Fig. 1, viewed in the direction of the arrow. Fig. 5 is a diagrammatic representation of the relative positions assumed by different parts of electrical mechanism that impart periodic impulses to the pendulum when the latter-named is swung to its extreme limit of vibration on one side of the clock.

On the rear wall of the clock-case A a bracket B is secured by screws inserted in integral lugs formed thereon at B′. Limbs B^2 are extended from the bracket and form a part of it. These have transverse steel or iron bars B^3 secured to them by bolts B^4, said bars engaging the cores of the electro-magnets C at their upper ends in a secure manner, holding the magnets in pairs on opposite sides of the bracket B. The limbs B^2 are inclined upwardly, as shown in Fig. 1, and thus retain the magnets C inclined outwardly from

a vertical plane taken through the center of the bracket.

At *a* a rectangular metallic frame D is secured by screws to a depending portion B^5 of the bracket B, which frame gives support to the gear-train of a clock, to which there is hour and minute hands a' a^2, attached in the usual manner, said gearing being adapted to give these hands proper relative movements to effect their office of indicating time-measurement on a dial. (Not shown.)

At a suitable point on the escapement-arbor *b* an escapement-wheel E is secured, preferably exterior to the frame D. (See Fig. 2.) Said wheel E is cut and adjusted so that its teeth will project angularly in the direction shown, and thus be adapted to have alternate engagement with the upwardly-rocked pallet *c c'* of the verge E', which is pivoted on a stud c^2, that projects from the frame D. A crutch-wire c^3 is bent into a loop at c^4, by which it is loosely secured to the rod F' of the pendulum F.

The piece B^5 of the bracket B is attached thereto at *d* by screws or other means, and is bifurcated, producing parallel limbs *d'*, to which there is a block F^2 pivoted on adjustable cone-pointed screws d^2, which penetrate the limbs. The position of the piece B^5 and connected block F^2 is central between the pairs of magnets C, and to the block named the pendulum-rod F' is attached by its upper end, a set-screw d^3 effecting the connection. By the connection of parts, as described, the pendulum, consisting of the weight or "bob" F and rod F', is supported to vibrate on bearing-points midway between the cores C' of the magnets C.

An armature-bar G is attached at its longitudinal center to the block F^2 and lies in a plane which is horizontal when the pendulum is at rest or hangs vertically. The length of the bar G is so proportioned that its free ends will project below the cores C' of the magnets, and on these ends the armatures G' are adjustably held by the set-screws *e*, which have threaded engagement with the ends.

Upon the lower portion of the frame D, that supports the clock-gearing, a bracket-frame H is secured at *f f*. Said frame has two similarly-formed arms H' H', which extend from a connecting-web H^2, that is secured by screws *g* to the vertical wall of the clock-case A. The arms H' H' are separated the width of the clock gear-frame D, (see Fig. 1,) and upon each of them and the ears *j*, which are formed on the frame-web H^2 directly below each arm H', two binding-posts are attached, which posts are insulated from the arms H' and ears *j* by a pair of flanged ferrules of hard rubber, as shown at *i* in Fig. 4, where an arm is broken away.

The four binding-posts *h h' h^2 h^3* (shown in Fig. 1) are spaced apart vertically to afford room for the contact-blocks *k k' k^2 k^3*, which are clamped to the ears *j* and the arms H' H' by the same screws *m* that secure the posts just named thereto, said screws axially penetrating the posts and engaging the contact-blocks with their heads. The similarly-shaped contact-blocks *k k' k^2 k^3* are insulated from each other, as are the binding-posts, by the insulation mentioned, and each pair are separated between their jaws *l* a proper distance to afford room for the sliding contact of the terminal ends of the adjustable limbs o^2, which are longitudinal extensions of the T-shaped switch-post *o*, that is seated in the socket-piece *p* and adapted to rock therein and alternately engage with its limbs o^2 the contact-blocks *k k' k^2 k^3* they are lined with—that is to say, the faces of the limbs are in the same plane with the adjacent faces of the separated blocks—and when either limb is rocked sufficiently there will be a close contact established between a pair of the hitherto-insulated blocks, as shown in Fig. 5.

From the limbs o^2 outwardly-projecting fingers *n* are extended, of a proper length to lie in the path of the pendulum-rod F' when it is vibrating. The lower binding-posts *h' h^3* are electrically connected by junctional wires *q q'*, that are extended as one wire q^2 to one pole of a local battery. (Not shown.)

The magnets of each pair previously mentioned are joined to produce a continuous wire coil thereon, and one terminal of one set of magnets is extended as at *s* in Fig. 1, to engage a similar terminal wire *s'* on the other pair of magnets. These terminals of magnet-coils are from the same ends of the magnets, so that electricity will flow in the same direction toward the other terminals of said magnet-coil. The joined wires *s s'* are extended as a main conductor s^2 to be attached to the opposite pole of the battery above mentioned. The remaining unattached terminals *t t'* of the magnets C are extended to be secured to the opposite binding-posts *h* h^2, the wire *t* of one set of magnets being crossed to the post *h* and the wire *t'* crossed in like manner and secured in the post h^2.

It will be evident on inspection that when the pendulum hangs perpendicular at an equal distance from the fingers *n* the armature G' will be equally distant from the poles C' of the magnets.

No current of electricity will flow through the magnet-coils until contact is had between one of the pairs of contact-blocks that can be established by the rocking of the switch-post *o*.

It is preferred that the pendulum-rod F' be made of slightly-yielding material to obviate, measurably, the shock of contact of the blocks *k k' k^2 k^3* with the limbs o^2 when in operation.

The starting of the clock mechanism is effected by giving to the pendulum an impetus which is sufficient to rock the switch-post *o* and cause one of its limbs to make contact with the blocks it is opposite. This will complete the circuit and energize the set of magnets opposite to those the pendulum is approaching. The force of battery-current

should be of such relative potential that the energized magnets will attract the armature bar as it comes within the field of their magnetic force and draw them upwardly, giving a sufficient impulse to the pendulum to overcome frictional resistance of the point of suspension of the pendulum, the friction of the machinery, and the force of gravitation. It should, however, permit a break of contact to be produced by the weight of the pendulum, and to effect this the contact of the limbs o^3 should be adjusted to alternately take place an instant in advance of the contact of the plates G′ with the poles C′, as represented in the diagram, Fig. 5, where one limb o^3 is in contact with the blocks k k' and the armature G′ on the same side of the clock slightly separated from the pole C′ of the magnet C. This will demagnetize the magnets approached by the armature-bar at a proper time to permit the pendulum to complete by its received magnetic impulse the arc of its vibration, and energize the other set of magnets, toward which the pendulum will now commence to move. The alternate switching of the current from side to side of the pendulum will, when once established, continue as long as the battery is in working order.

As the escapement-wheel E is mounted on the arbor b, which is in geared connection at b' with the train of speed-reducing gearing of the clock, it becomes a driver, and the oscillations of the pendulum actuating the latter moves the entire system of wheels and pinions, so as to properly measure the lapse of time by the hands a' a^2.

In order to assure a proper action of the escapement-wheel and its arbor, a detent-wheel I is secured on the latter, which wheel is provided with double the number of teeth that are in the escapement-wheel, and the spring-actuated pawl I′, that engages each tooth of the detent at the termination of a vibration of the pendulum in either direction of its travel, holds the parts from improper backlash, that would result from frictional contact of the pallets with the teeth of the wheel as well as the weight of the hands.

The pendulum is made adjustable for length by a set-screw F^2, and also a set-nut F^6—one at the top and the other below the weight F—which may be accurately adjusted by their manipulation. The fingers n may also be shifted on the switch-post o to increase or diminish their distance from the rod F′, whereby their contact may be timed accurately with regard to the vibration of the pendulum and produce contact of the blocks k k' k^2 k^3 with the limbs o^2 at exact periodic intervals, so as to cause a proper action conjunctively of all working parts and obtain a correct indication of time by the hands of the clock.

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

1. The combination, with a clock-case, clock-gearing, a pendulum suspended on bearings, an armature-bar which is affixed centrally to the pendulum and projects oppositely therefrom, and armatures adjustably secured to the ends of the armature-bar, of electro-magnets having one set of their coil-terminals leading to one pole of an electric-current generator, said magnets being located with their poles opposite the armatures on the armature-bar, contact-blocks that are connected with the other pole of the current-generator, adjacent mating contact-blocks which are connected by crossed wires to the remaining coil-terminals of magnets opposite to the blocks connected, and a rocking switch-post that is adapted to have its projecting fingers moved by the vibrating pendulum and, by engagement of limbs on the switch-post, complete the electric circuit between opposite magnets alternately, substantially as set forth.

2. The combination, with a clock-gear frame, a clock-gearing, its escapement wheel and arbor, a spring-actuated detent-wheel placed on the arbor with the escapement-wheel, a pendulum, and an armature-bar attached centrally upon the pendulum near the bearings of the pendulum and projected toward the poles of two electro-magnets, of two electro-magnets oppositely located with their poles adjacent to the armatures of the armature-bar and having one set of their coil-terminals joined and extended to one pole of an electric-current generator, contact-blocks located on each side of the pendulum which are electrically connected by crossed wires to opposite magnets, other contact-blocks which are connected to each other and to the opposite pole of the current-generator, a rocking switch-post having fingers which are pushed alternately by the vibrating pendulum-rod, and adjustable limbs which are adapted to make contact with adjacent contact-blocks alternately as the post is rocked by the pendulum, substantially as set forth.

FRANK SCHWARTZ.

Witnesses:
JOHN SHEDD,
RICH. D. BROWN.