(No Model.) 2 Sheets—Sheet 1.

J. E. CAREY.

WINDING AND CONTROLLING SYSTEM FOR ELECTRIC CLOCKS.

No. 341,450. Patented May 11, 1886.

Fig. 1.

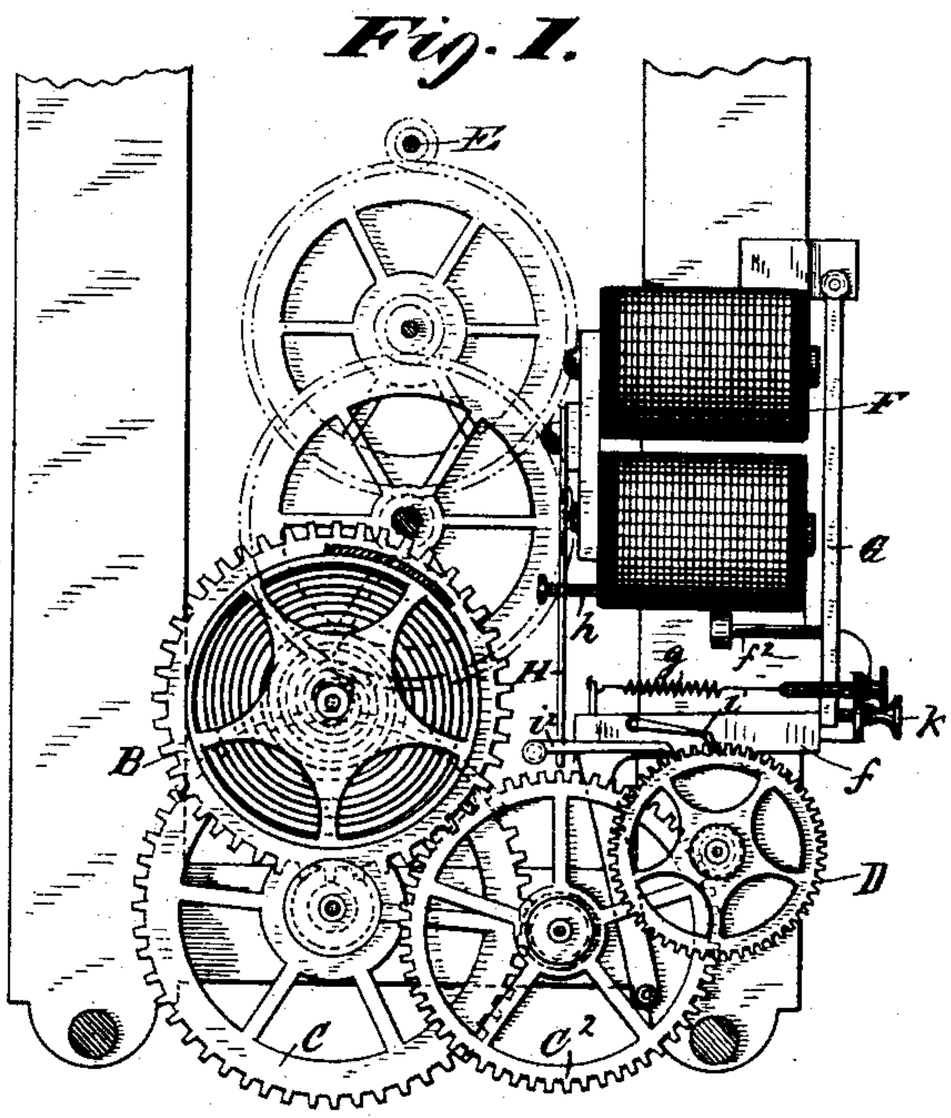


Fig. 2

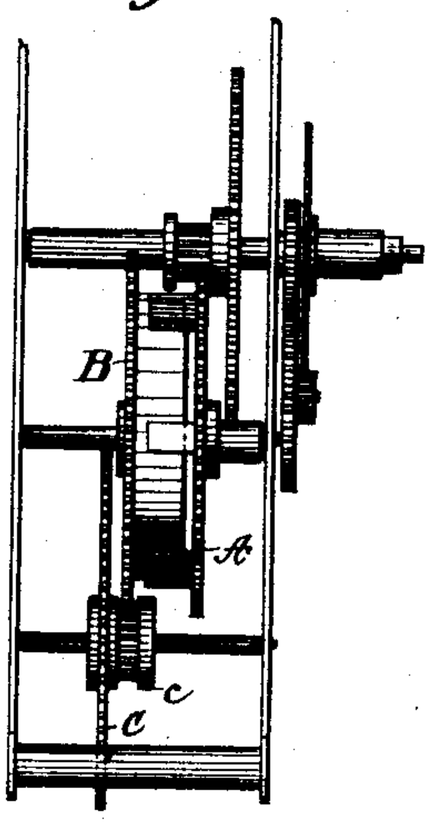
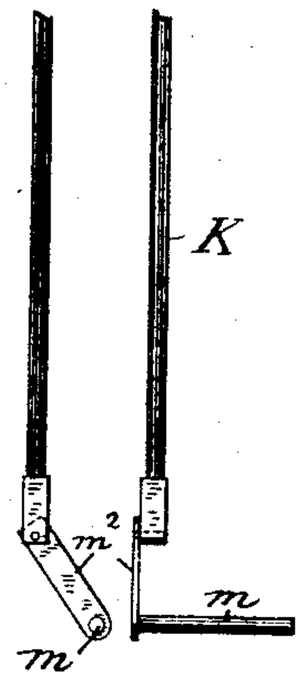


Fig. 3.



WITNESSES

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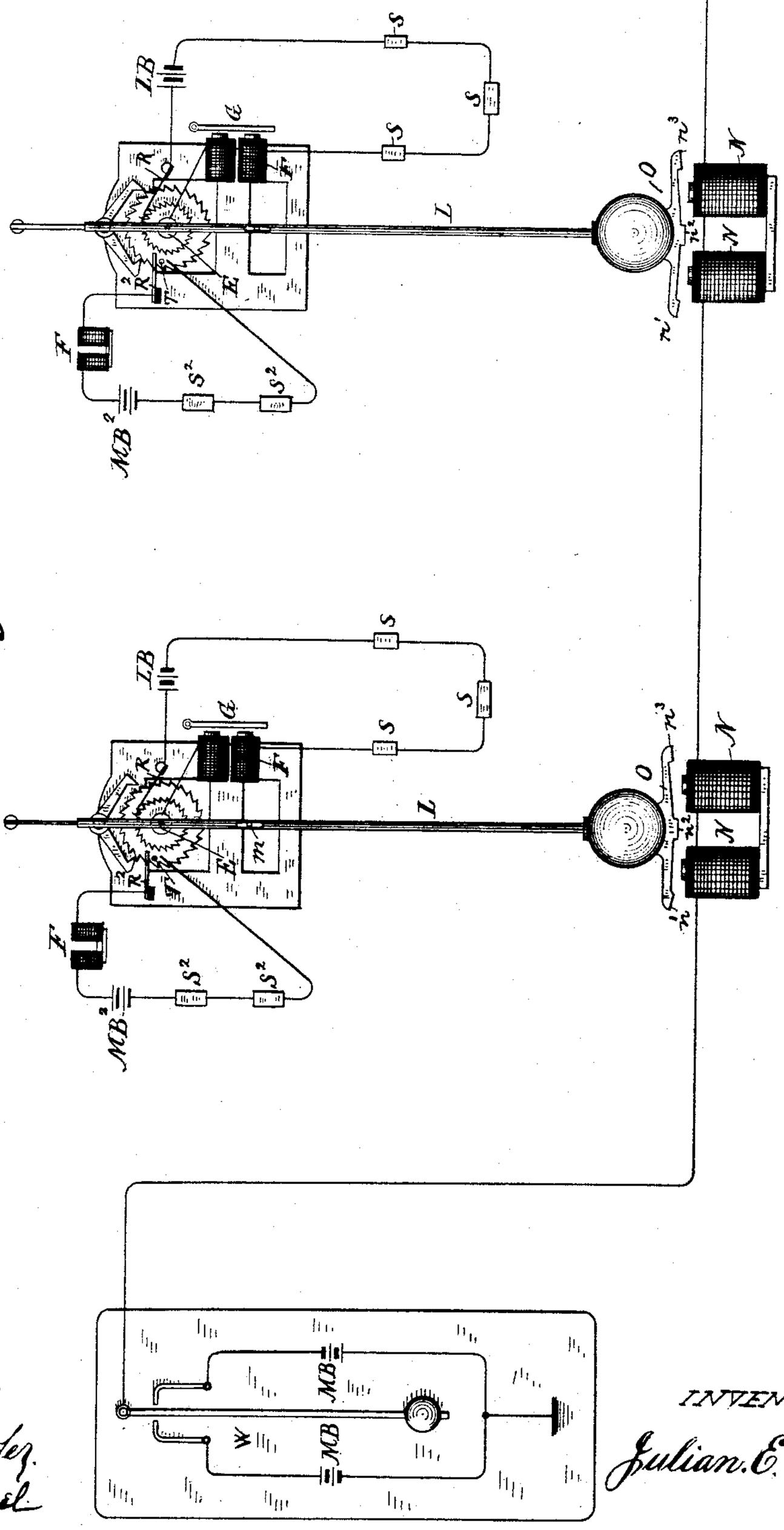
Fig. 4.



WITNESSES:

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INVENTOR

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UNITED STATES PATENT OFFICE.

JULIAN E. CAREY, OF NEW YORK, N. Y.

WINDING AND CONTROLLING SYSTEM FOR ELECTRIC CLOCKS.

SPECIFICATION forming part of Letters Patent No. 341,450, dated May 11, 1886.

Application filed March 2, 1886. Serial No. 193,756. (No model.)

To all whom it may concern:

Be it known that I, JULIAN E. CAREY, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Electric Clocks, of which the following is a specification.

The object of my invention is to furnish a simple and convenient arrangement of circuits and devices whereby a number of electric clocks may be conveniently maintained in operation and kept in synchronism with a main or controlling clock at the central or time-keeping station.

The invention herein described and claimed was originally contained in an application, No. 136,044, for patent, filed by me June 26, 1884, and the present application is a division of the prior one.

My invention consists in the arrangements of circuits and apparatus that will be described in connection with the accompanying drawings, and then more particularly specified in the claims.

My invention has reference more particularly to systems in which the secondary clock, placed upon a circuit with the main or controlling clock, is what, for convenience, I term a "normally-operated" clock—that is, one which has a constant driving-power, such as a spring or weight.

My invention relates to arrangements of circuits and devices whereby such normally-operated clock, which is controlled or kept in synchronism over a circuit connected with a prime clock, may have its driving-power—such as a spring or weight wound—and whereby also additional clocks on a sub-circuit may be kept in time with a main or primary clock.

I have herein illustrated my invention as carried out in connection with a secondary clock of a construction forming the subject of the prior application filed by me June 26, 1884; but it is to be understood that normally-operated clocks of other constructions might be employed.

I have shown herein one only of the constructions of winding devices and operating-magnet for actuating said winding device that may be employed in practice.

My invention has to do with the general combinations into which devices of such a nature enter as elements, and not with the special constructions of such devices.

In the accompanying drawings, Figure 1 is an elevation of a normally-operated clock that I prefer to employ. Fig. 2 is an edge view of the same. Fig. 3 shows in elevation and side view the connection between the pendulum and the escapement-lever. Fig. 4 is a diagram illustrating my present invention.

A indicates the main wheel of a clock-movement, from which wheel the power of a mainspring, a weight, or other source is imparted to a clock-train of any usual or desired description, provided with a regulating or controlling device, such as a pendulum or balance-wheel.

E indicates the arbor of the escapement-wheel for the clock-movement.

With the escapement-wheel engages an ordinary escapement connected by a crutch wire or rod, K, Fig. 3, and pin *m*, projecting therefrom, with the pendulum I in the ordinary way, as indicated in Fig. 4; and to said pendulum or such other regulating device as may be employed to take its place are applied controlling or synchronizing devices, as will be presently described, through which regularly-recurring electric impulses may be sent to assist in keeping the pendulum in motion to maintain its movements or vibrations isochronous with those of a primary or controlling time-piece.

For the sake of simplicity, I have herein illustrated my invention as applied to an ordinary spring-driven clock, but do not wish to be understood as limiting myself to such driving-power.

Leaving out the electric synchronizing devices, the parts as thus far described constitute one form of what I term a "normally-operated clock."

B indicates a winding-wheel, connected to the spring or other motor device in any desirable way, so that by turning the wheel the spring or weight may be wound up or put into action. Wheel B is connected through a train of wheels, C C^2, with a wheel, D, in obvious manner, which train serves as a reducing-train for permitting a comparatively small power applied to wheel D to wind the mainspring or weight of the clock. The wheel D is actuated, step by step, through the agency of a winding

electro-magnet, F, operated by electric currents coming with sufficient frequency to keep the mainspring or other motive device wound.

The desired step-by-step movement of the wheel D may be produced by any suitable actuating ratchet or pawl moved by the vibrating armature or core of the electro-magnet F. In the present case the actuating device consists of a pawl, *i*, carried by a lever, *f*, against which latter the armature or armature-lever of the electro-magnet F bears. The pawl or ratchet *i* is arranged to impel the wheel D on the reverse movement of the armature under the influence of its retractor. The retractor consists of a spring, weight, pendulous weight, or other retracting device suitably constructed to exert an increased force as the armature approaches the magnet, so that the impelling action may be the greatest when the pawl begins its actuating movement. By this arrangement I am enabled to most effectually utilize the power of the magnet in operating as a winding-magnet. It is obvious that a weight on an arm, f^2, might be employed, since, when so arranged, it would act after the manner of a weight in a pendulum weighing-balance to exert an increasing retracting-power as it is gradually raised.

I do not limit myself to the kind or form of retractor, the only requirement to obtain the best results being that it should have an increased retracting force as the armature approaches the poles of the magnet. When the pawl is arranged to impel the wheel on the forward movement of the armature, it is obvious that it would have to do its greatest work under the weakest pull of the magnet on the armature, since at the beginning of the impelling movement the force required to start the wheel is the greatest, and under the conditions supposed the armature would be farthest away from the magnet, or in its least effective position. As the armature approaches the magnet, the pull would rapidly increase, but would then be exerted when a lesser power is required. By the arrangement described, however, the strongest pull of the magnet is husbanded and stored in the retractor, (which latter, as described, exerts its smallest pull when the armature is retracted,) and the strong pull of the magnet is made effective in applying power to the wheel at the beginning of its movement, when it is most required.

In addition to the retractor described, I propose to employ an additional retractor, suitably arranged to come into play only as the armature approaches the end of its forward movement toward the magnet, and to thus store and make effective the momentum acquired by the armature and its parts, instead of permitting the same to be wasted upon a dead or rigid stop. One form of such device is herein shown. It consists of a blade-spring, H, suitably supported with its end in the path of the lever *f*, so that the latter will impinge against the spring near the extremity of its movement under the influence of the magnet. An adjusting set-screw, *h*, serves to adjust the end of the spring H, so as to determine the point at which the arm shall in its movement impinge against the spring. When the armature draws the pawl *i* backward to a new position of engagement, the lever *f* strikes the spring H, and the resiliency of the latter gives the pawl a sudden impulse to assist in starting the wheel D.

At *k* is indicated a back stop for the armature, while at i^2 is shown a suitable retaining-pawl for the wheel D.

I prefer to send electric impulses through the electro-magnet F with sufficient frequency to energize the same every second. The spring in which the energy transmitted through the lever *f* is stored is adapted to give movement unaided to the clock for a period of several hours, and in this respect is a material improvement upon the clocks heretofore devised to be wound by electricity. Where it has heretofore been proposed to wind the clock by electric means once an hour, the amount of stored energy in the spring or weight has been necessarily limited, owing to the infrequency with which the magnet acts.

Such clocks as ordinarily made have been adapted to run without a winding for a very limited period, and an interruption of the winding current or currents for any considerable period would result in stoppage of the clock. In other cases where the winding has been done as often as once a minute the amount of stored energy has been sufficient to run the clock for a limited period only, inasmuch as it was impossible to use a spring of very considerable power.

By the employment of the reducing-train I am enabled to use a spring of any desired power, sufficient to run a clock for a week even. In fact, my devices may be applied to any ordinary day or eight-day clock by simply applying the wheel—such as B—and its connected devices to the winding-arbor. The pendulum L of the clock-movement imparts movement to the crutch-wire through a pin, *m*, as before mentioned, which pin is, by preference, made adjustable, so as to adjust the action of the crutch to unusual or irregular conditions of vibration of the pendulum.

The clock-movement is driven and kept in operation by the devices described, and is electrically synchronized or made to keep its proper rate of going by any electric devices applied, preferably, to its pulsative or vibratory regulating devices. When the regulative device is a pendulum, as here shown, I apply synchronizing devices thereto in any desired manner; but I prefer to apply them in such way as not to stop or interfere with the free vibration of the pendulum. I therefore employ an electro-magnet and armature, one fixed and the other carried by the pendulum in close proximity to the other, but without striking the same. The form of such device as here shown is one described and claimed in a prior

application filed by me, and consists of a fixed horseshoe-magnet, N, having its poles arranged in a line parallel with the plane of vibration of the armature, and an armature, O, carried by the pendulum and swinging therewith in close proximity to the magnet. The armature has the three attracting portions n' n^2 n^3, either extreme one of which, with the intermediate portion, n^2, is adapted to form an armature for the horseshoe-magnet. At or near one extreme of vibration of the pendulum the portions n^2 n^3 bridge the poles, while the portions n' n^2 bridge them at or near the other extreme of vibration. By this means the vibration of the pendulum may be kept isochronous with those of a primary or controlling clock by causing electric impulses to energize the magnet at regular times in the well-known way; or said impulses may be utilized as actuating impulses and a partial means for keeping the pendulum in vibration, thus assisting the spring or weight and the winding-magnet in their work. Said impulses may come from any source, or be produced in any way, provided they be made to energize the magnet in isochronism with the natural time of vibration of the pendulum. In so far as they help to actuate the pendulum, they might come from the normally-operated clock itself. They are shown, however, produced by the agency of a primary or controlling time-piece, which, directly or indirectly, in any suitable way, sends the impulses at the proper time.

In the diagram, Fig. 4, which illustrates the arrangements of circuits and apparatus forming the subject of the present case, I have illustrated at W a pendulum for a controlling or primary clock, arranged to close the circuit of a battery or other source of electric energy to line at each vibration. The pendulums and synchronizing-magnets of two normally-operated clocks are shown on the circuit controlled by the clock-pendulum W. The winding-magnets F for the two normally-operated clocks are each energized at proper times by a battery, L B, or other generator of electricity, placed in a local or sub circuit separate from that over which the pendulums L are synchronized, and the action of said winding-magnet and local battery or generator is controlled by the normally-operated clock itself. This is effected by causing a portion of the clock mechanism to intermittently operate on a circuit-closing device that shall complete the circuit. A circuit-closing device proper for this purpose consists of a spring, R, adapted to make momentary contact with the spurs or projections of a wheel on a minute-arbor of the normally operated clock. The poles of the local circuit are connected, respectively, to the frame of the clock, and so to the spur or toothed wheel and to the insulated spring R. Connection might be made in any other desired manner. In the local circuit with the winding-magnet I sometimes prefer to arrange one or more secondary clocks of any desired kind, which clocks are merely indicated at S. The circuit of these clocks is periodically closed by the normally-operated clock, which latter thus acts as the primary or controlling clock, while being itself electrically wound and controlled and synchronized. In such a combination I contemplate synchronizing the clock on the main circuit and keeping it to uniform time with a standard clock by any means known in the art. I might obviously employ the device of setting its hands hourly or at every minute to time, instead of controlling or keeping the movement of the clock mechanism in isochronism with those of a primary clock.

The toothed wheel with which the spring R makes contact has in the present case a sufficient number of teeth properly placed to cause a closure of the circuit at every beat of the pendulum, and to thus cause the secondary clocks S to be actuated or controlled by every beat of pendulum L. These clocks S may be electrically actuated, controlled, or synchronized clocks of any description. I do not limit myself to putting them in circuit with the winding-magnet. They might be placed in a separate local circuit over which synchronizing, controlling, or actuating impulses are sent by the clock once a second, minute, or at greater or less intervals.

The secondary clocks might be clocks S^2 m, placed in a circuit for a generator, M B^2, closed once a minute by means of a circuit-closing stud, T, placed on a minute wheel or arbor, or on the seconds or escapement wheel of the normally-operated and electrically-wound clock, and arranged to make contact with a circuit-closing spring, R^2, at every revolution of the minute-wheel. The wheel is electrically connected with one pole of the local circuit by any suitable means, and the spring with the other pole thereof.

The local circuit just described might, if desired, include a winding-magnet, and the closure might be for a greater or less period of time, as desired.

It is obvious that if two local circuits are controlled at once from the same clock, the circuit-closing devices for the two circuits may be insulated therefrom by mounting them on separate insulated wheels, or otherwise insulating the two circuits.

What I claim as my invention is—

1. The combination, with a clock-movement, of an actuating electro-magnet periodically energized to keep the prime mover of the clock wound and one or more secondary clocks in a circuit containing said electro-magnet and controlled by the clock.

2. The combination, with a secondary or controlled clock, of electric synchronizing or controlling devices, an actuating-magnet for keeping said clock-movement in operation, and a circuit controlled by the clock and containing the actuating-magnet and one or more secondary electric clocks.

3. The combination, with a secondary clock having its movements kept isochronal with

those of a controlling-clock and provided with a magnet for winding its spring or weight, of a circuit controlled by said secondary clock and containing the winding-magnet and one or more secondary clocks.

4. The combination, with a secondary electric clock, of a circuit containing secondary clocks, controlled thereby, and electrically-operating winding devices in said local or sub circuit for keeping the clock controlling said sub-circuit in action.

5. The combination, for a system of time-distribution, of a secondary electric clock having a spring or weight, a winding-magnet for the same, a synchronizing-magnet for the time-train operated by the electrically-wound spring or weight, a main or controlling clock, and controlling-circuit connected with the synchronizing-magnet, and one or more additional electric clocks connected to a sub-circuit controlled by the said secondary electrically-wound clock, all as set forth, so as to give the time of the primary or controlling clock.

6. The combination, with a spring or weight driven clock placed on a circuit with a controlling or primary clock, and having synchronizing devices controlled by said primary clock, of a local or sub circuit and generator independent of the synchronizing or controlling circuit that is connected with the primary clock, an electro-magnet in said sub-circuit, actuating devices operated by the magnet for winding the spring or weight, and a circuit-closer operated by the spring or weight driven clock for controlling said independent circuit and generator.

Signed at New York, in the county of New York and State of New York, this 23d day of February, A. D. 1886.

JULIAN E. CAREY.

Witnesses:
WM. H. CAPEL,
GEO. C. COFFIN.