(No Model.) 2 Sheets—Sheet 1.

C. L. CLARKE.

TRANSMITTING DEVICE FOR PRIMARY ELECTRIC CLOCKS AND MEANS FOR ACTUATING SECONDARY CLOCKS THEREBY.

No. 301,805. Patented July 8, 1884.

Fig. 1.

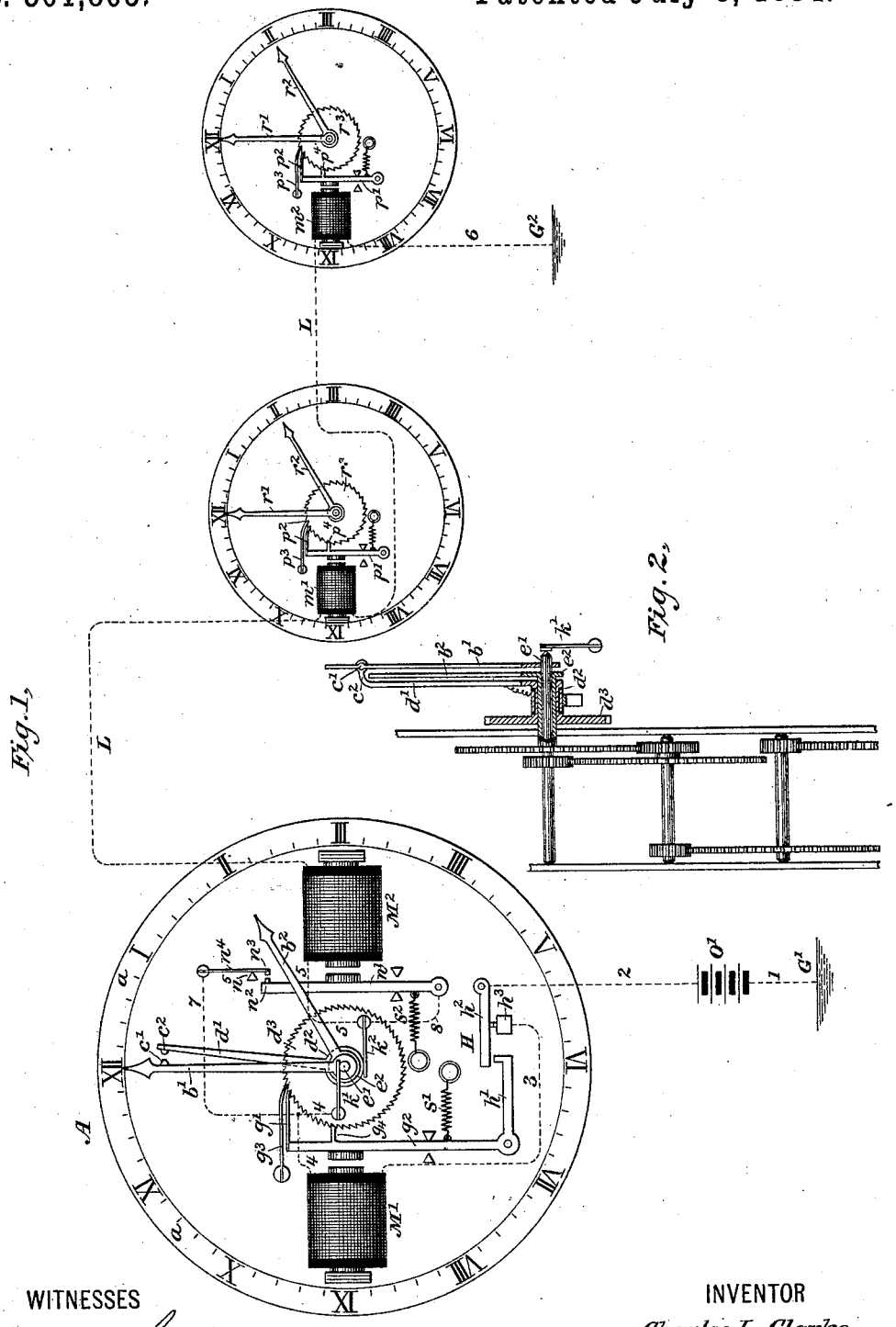

Fig. 2.

WITNESSES

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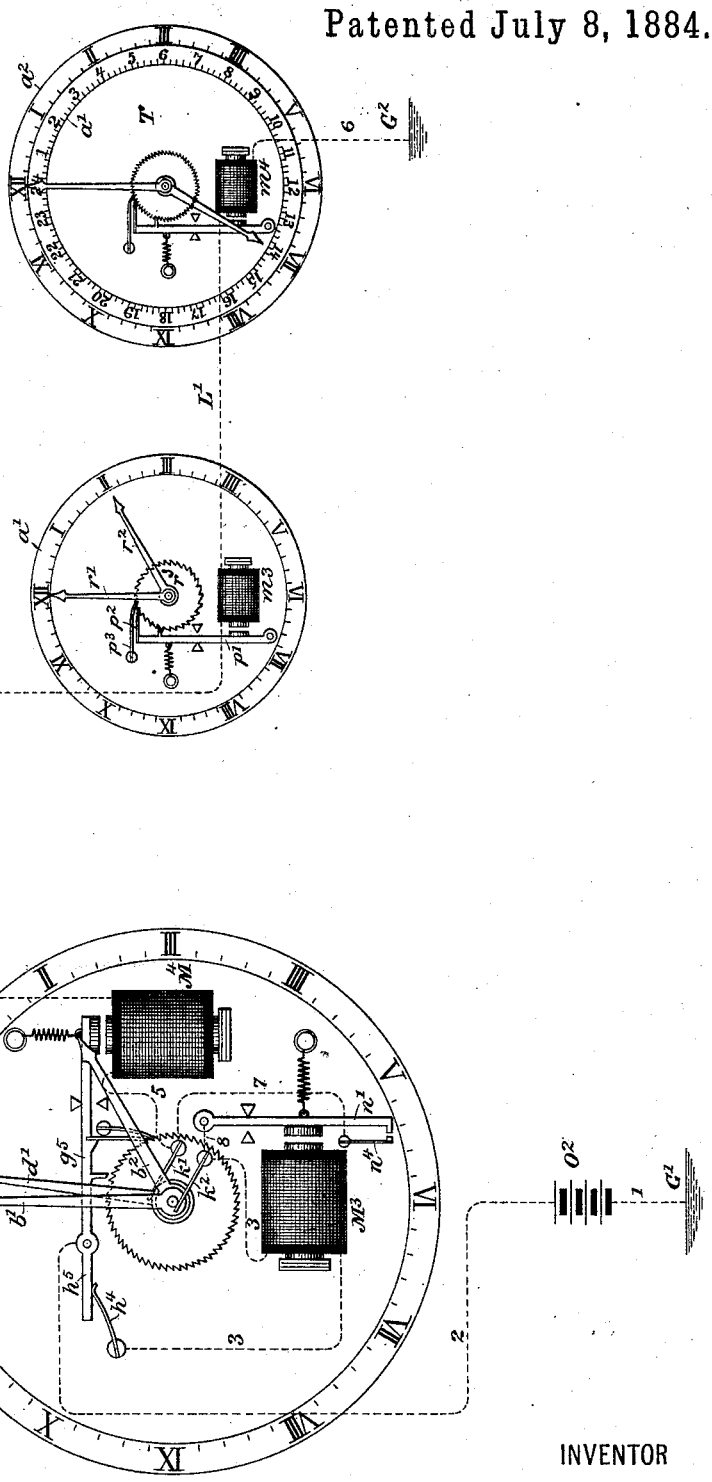

Fig. 3.

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UNITED STATES PATENT OFFICE.

CHARLES L. CLARKE, OF NEW YORK, N. Y., ASSIGNOR TO THE TELEMETER COMPANY, OF SAME PLACE.

TRANSMITTING DEVICE FOR PRIMARY ELECTRIC CLOCKS AND MEANS FOR ACTUATING SECONDARY CLOCKS THEREBY.

SPECIFICATION forming part of Letters Patent No. 301,805, dated July 8, 1884.

Application filed January 14, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. CLARKE, a citizen of the United States, residing in New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Clocks, of which the following is a specification.

The object of the invention is to provide means for causing the movements of a primary clock to transmit electric impulses to any required number of secondary clocks at the proper intervals for advancing the same correlatively with the primary clock, to prevent the occurrence of electric discharges at the contact-points, in accomplishing these results to so construct the secondary clocks that they will respond accurately to the impulses transmitted thereto, and, in general, to provide a reliable operating electric-clock system.

The invention consists, generally, in applying to the arbor of the primary clock a circuit-closing arm, which may or may not be one of the hands of the clock, and supporting in front of the same a contact-point which, when impinged against by the circuit-closing point, completes an electric circuit, in which circuit are included an electro-magnet adapted to advance the contact-point away from the circuit-closing point, and a series of electro-magnets adapted to actuate any desired number of secondary clocks. The contact-point is carried upon an arm extending from a sleeve surrounding or concentric with the arbor of the circuit-closing arm, and upon this sleeve is carried a toothed wheel, which is adapted to be advanced through the distance occupied by one tooth each time the circuit is completed and interrupted. The distance through which the point is thus advanced may be made greater or less, as desired, and the frequency with which the contacts are made may be varied by mounting the circuit-closing arm or point upon a faster or slower moving arbor or sleeve. The contact-points through which the circuit is primarily closed are usually delicately constructed, and it is evident that with an electric circuit of any considerable static or inductive capacity an interruption of the circuit at these points would be accompanied by an electric discharge tending to corrode the points, and thus destroy the contact-surfaces. For the purpose of avoiding such a result, a suitable device is employed for completing connections of the circuit through a shunt around these points at the moment the primary circuit is completed. This device preferably consists of an electro-magnet adapted to be vitalized at the first completion of the circuit, thereby causing an arm to be brought into contact with a circuit-closing point, through which the main-line circuit-connections will then be complete. The electro-magnet which is employed for advancing the contact-point, and thus interrupting the primal contact, is preferably organized to respond more slowly than the electro-magnets which operate the secondary clocks. In connection with the armature-lever of this electro-magnet, a device is employed for automatically interrupting the main-line connections, when the armature has responded to the attractions of its electro-magnet at a point specially adapted to receive whatever discharge may take place without injury. The armature will thereupon immediately fall away from the electro-magnet, and the normal condition of the apparatus will be again established, the contact-point having been advanced through the distance corresponding to one tooth of the wheel by means of which it is actuated. It will be understood, therefore, that each time the hand of the primary clock has advanced a predetermined distance—say through the space corresponding to one minute—the circuit-connections will be completed, the secondary clock will be advanced through a corresponding distance, and the main-line connections interrupted and the primal-circuit-closing points separated and placed in a position to repeat the operation at the termination of the succeeding minute.

In the accompanying drawings, which illustrate the invention, Figure 1 is a diagram illustrating the organization of a primary and two secondary clocks; and Fig. 2 is a transverse section of a portion of the primary clock,

showing the organization of the circuit-controlling device. Fig. 3 is a diagram illustrating a modification in the organization of the apparatus.

Referring to Figs. 1 and 2, A represents a primary clock, having a dial, a', in front of which the minute-hand b' and hour-hand b^2 are respectively organized to move in their proper periods through the influence of a suitable train of mechanism actuated by a spring, weight, or other force. Upon the minute-hand b' or other convenient part of the mechanism is carried a circuit-closing point, c', which is caused, by the movement of the clock mechanism, to periodically impinge against a corresponding contact-point, c^2, carried upon an arm, d'. Surrounding the arbor e' of the minute-hand b' is a sleeve, d^2, upon which the contact-point c^2 is carried. The sleeve d^2 preferably, also, surrounds the quill e^2, which carries the hour-hand b^2. Upon the sleeve d^2 is carried a toothed wheel, d^3, which is provided with a number of teeth corresponding to the number of electric impulses which it is desired to transmit each hour, or during each revolution of the minute-hand b'. This wheel is designed to be actuated by means of a suitable pawl, g', which is preferably resilient, and is carried upon an armature-lever, g^2, of an electro-magnet, M'. Each time this electro-magnet is vitalized the armature-lever is drawn into its forward position, and the pawl g' is caused to engage a succeeding tooth upon the wheel d^3. A pawl, g^3, prevents a retrograde movement of the wheel, and, if desired, suitable means may be employed for preventing the wheel from being accidentally advanced while the armature is in its forward position. When the electro-magnet M' is demagnetized, the armature-lever is drawn backward into its position away from the electro-magnet by means of a suitable spring, s', and the pawl g' thereby causes the wheel d^3 to be advanced through the distance occupied by one tooth, while the retaining-pawl g^3 engages it in its advanced position. For the purpose of preventing the wheel from being advanced more than one tooth by the momentum derived from the movements of the armature-lever g^2, an engaging-dog, g^4, is rigidly secured to the armature-lever, and is so constructed that it will enter a succeeding tooth upon the wheel and securely lock the same in the advanced position which it is caused to assume at each retrograde movement of the armature-lever.

The electro-magnet M', together with the remaining electro-magnets of the system which will be hereinafter described, are caused to be periodically vitalized in the following manner: A battery, O', is placed preferably at the transmitting-station of the system, having one pole connected by a conductor, 1, with the earth at G'. The remaining pole is connected by a conductor, 2, through a circuit-interrupting device, H, which will be hereinafter described, with a conductor, 3, leading to one terminal of the coils of the electro-magnet M'. The remaining terminal of the coil of this electro-magnet is connected through the conductor 4 with a contact-brush, k', resting upon the arbor e' of the minute-hand b'. The circuit is completed through this hand to the contact-point c', and the contact-point c^2 is connected through the arm d', sleeve d^2, and a contact-brush, k^2, resting thereupon, with a conductor, 5, leading through the coils of an electro-magnet, M², which will be hereinafter described, and thus with a main line, L. In the main line L are included a series of electro-magnets, m, designed to actuate a corresponding series of secondary electric clocks in a manner hereinafter described. The main line L is connected at the last station of the series with the earth at G² by means of a conductor, 6. It will be seen thus that whenever the contact-point c' is caused by the movements of the clock mechanism to impinge against the corresponding contact-point, c^2, the circuit of the battery O' will be completed through the electro-magnets M' and M², the main line L, and the electro-magnets m, included in the system. The several electro-magnets are preferably so adjusted that the armature of the magnet M² will first respond, and immediately thereafter the armatures of the several electro-magnets m, and finally the armature of the electro-magnet M', the principal object being to insure that the armature g^2 of the electro-magnet M' will respond last in the series.

The armature n' of the electro-magnet M² is provided with a contact-point, n^2, which is designed, when the armature is in its forward position, to impinge against a contact-point, n^3, carried upon an arm, n^4. The arm n^4 is preferably flexible, and it is also preferably provided with limiting-stops n^5, which serve to prevent any undue vibration of the same when the armature breaks contact therewith. The arm n^4 is connected by means of a conductor, 7, with the conductor 4, while the armature-lever n' is connected by a conductor, 8, with the contact-brush k^2. When, therefore, the armature n' is drawn into its forward position, the circuit will be completed from the electro-magnet, through the conductor 7, the contact-points n^2 and n^3, the armature n', the conductors 8 and 5, and the coils of the electro-magnet M², to the main line L. The main circuit will then be completed around the contact-points c' and c^2, thus affording both a more rigid and reliable contact than that obtained at the contact-points c, and the possibility of an electrical discharge across the last-named points will be avoided.

Upon the armature-lever g^2 of the armature M' is carried an arm, h', which extends into proximity to a horizontal arm, h^2, normally resting upon a corresponding contact-point, h^3. The circuit of the battery O' is normally completed from the conductor 2 through the arm

h^2 and contact-point h^3 with the conductor 3. When, however, the armature-lever g^2 is drawn into its forward position, the arm h' serves to raise the horizontal arm h^2 from the contact-point h^3, and thus to interrupt the circuit-connections of the battery O'. All the electro-magnets in the series will thereupon be immediately demagnetized, and the movement of the armature-lever g^2, under the influence of the spring s', will cause the wheel d^3 to be advanced and the point c^2 be moved away from the point c' before the arm h^2 will have time to fall back to its position upon the point h^3. Likewise, the electro-magnet M^2 will also become demagnetized and its armature will have been drawn, by means of a suitable spring, s^2, into its position of rest, thus separating the contact-points n^2 and n^3 and preventing the circuit of the battery O' from being again completed when the arm h^2 has returned to its normal position. The circuit will therefore then remain open until the clock mechanism has again caused the contact-point c' to impinge against the point c^2. The electric impulses which are thus obtained are caused to advance the hands of one or more secondary clocks by means of the movements of the armatures p' of the electro-magnets m' and m^2. Each of these armatures is provided with a pawl, p^2, similar to the pawl g', described with reference to the primary clock, and with a retaining-pawl, p^3, and dog p^4. These pawls and dog act upon a toothed wheel, r^3, to advance the same one tooth each time the circuit is completed and interrupted, and the movements of this wheel are communicated through a suitable train of clock-wheels of well-known construction to the minute and hour hands r' and r^2, respectively. The armatures p' preferably act to advance the wheel r^3 during their movement away from their respective electro-magnets. They may, however, be constructed in the manner indicated in Fig. 3, which will be hereinafter described, to advance the wheel during their forward movement.

In Fig. 2 the method of applying the contact-brush k' to the arbor of the minute-hand is illustrated, which consists in causing the same to press against the extremity of the arbor. This construction is sometimes desirable for the purpose of lessening the friction between the parts; but it will be understood it is not essential, for the contact-brush may rest against the lateral surface of the arbor. It will be evident, also, that it will be necessary to so construct the parts that the surface upon which the brush k^2 rests is insulated from the arbor e', and this may be accomplished by making the quill e^2 of non-conducting material; or the bearing-surface upon the sleeve d^2 may be supported upon non-conducting material and this surface connected with the contact-point c^2 by means of an insulated conductor, or in any other suitable manner.

In Fig. 3 a modification of the invention is illustrated, which consists in employing the forward movement of the armatures for actuating the mechanism, and in applying to the armature at the transmitting-station a resilient contact-spring, which normally continues the electrical connections with the armature, but which causes the same to be interrupted when the armature has advanced to its forward limit or nearly to that limit.

The electro-magnet M^4 is designed to respond last in the series, and when it so responds the circuit-connections at the contact-point c are interrupted in the same manner as already described with reference to Figs. 1 and 2.

Instead of the device H described with reference to Fig. 1, a resilient arm, h^4, rests against an extension, h^5, of the armature-lever g^5 of the electro-magnet M^4, and this spring and extension cause the circuit of the battery O^2, one pole of which is connected by means of conductor 2 directly with the armature, to be interrupted when the armature has been drawn into its forward position. The contact-spring h^4 is connected through the conductor 3, including the electro-magnet M^3, with the contact-brushes k^2. The contact-brush k' is connected with the resilient arm n^4 in the same manner as described with reference to Fig. 1. The lever n' is connected with the contact-brush k^2 in like manner by means of conductor 8. The electro-magnet M^4 is shown in this figure as being between the contact-brush k' and the main line L'. The operation of the instrument is essentially the same as that of the form described with reference to Figs. 1 and 2, with the exception that the movement of the contact-point c^2 is occasioned by the advance movement of the lever g^5, instead of by the movement under the influence of the retractile spring. The secondary clocks are also essentially the same in construction, with the exception that the electro-magnets m^3 and m^4 are shown as being so applied that the forward movement of their armatures will cause the hands to be advanced in precisely the same manner as they are advanced by the retrograde movement described in connection with Fig. 1.

One of the secondary clocks T is represented as being provided with a dial-scale, a', having twenty-four hours, so that one revolution of the hour-hand is required for each twenty-four hours. The minute-hand is designed to complete a revolution once each hour. For the purpose of causing the hands to revolve in their proper relative periods, it will be necessary, in this construction, to employ some organization for advancing the hour-hand at half the speed at which the hour-hand of the transmitter moves. For this purpose the usual intermediate gear between the hour and minute hands may be constructed to reduce the movement of the hour-hand as required; or the required motion may be communicated thereto through a suitable train of wheels adapted to reduce the movement to a required degree.

It will be seen that the scale a' is so divided that the minute-hand does not indicate the minute-divisions of the hour by pointing at the figures which it is customary to associate with the five-minute, ten-minute, and other similar divisions of time; and for the purpose of rendering the instrument better fitted to be substituted for those employing the former class of dials, a second dial-scale, a^2, is employed in connection with the scale a'. The scale a^2 is formed in a manner precisely similar to the ordinary form of scale, and it preferably surrounds the scale a', though it may be inside that scale. The minute-hand of the clock is preferably made of sufficient length to extend above the outer scale.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a circuit-closing point, means for causing said circuit-closing point to complete successive revolutions in the same direction, a contact-point, an electro-magnet through which an electric circuit is completed by the impingement of said circuit-closing point against said contact-point, and means, substantially such as described, for causing the movements of the armature of said electro-magnet to separate said contact-point from said circuit-closing point.

2. The combination, substantially as hereinbefore set forth, of a battery, a main line, a circuit-closing point, means for causing said circuit-closing point to complete successive revolutions in the same direction, a contact-point, a series of electro-magnets included in the circuit of said battery, an armature and armature-lever applied to one of said electro-magnets, and serving to cause said contact-point to be separated from said circuit-closing point at each completion and interruption of the circuit of said battery, and one or more secondary electric clocks actuated through the agency of the remaining electro-magnets.

3. The combination, substantially as hereinbefore set forth, of a battery, a continuously-advancing circuit-closing point, a contact-point against which said circuit-closing point periodically impinges, thereby completing the circuit of said battery, an electro-magnet included in the circuit thus completed, the armature applied to said electro-magnet, which serves to complete a shunt-circuit around said circuit-closing and contact points, and means, substantially such as described, for causing said circuit-closing and contact points to be separated, and automatically interrupting the circuit of said battery at a third point either before or after the separation of the contact-points.

4. The combination, substantially as hereinbefore set forth, of a battery, a main line, a clock-mechanism, a circuit-closing point caused to continuously advance by the action of said clock mechanism, a contact-point against which said circuit-closing point is caused to periodically impinge, and means, substantially such as described, for periodically separating said contact-point from said circuit-closing point.

5. The combination, substantially as hereinbefore set forth, of a clock mechanism, a battery, a contact-point caused to continuously advance by the action of said clock mechanism, a contact-point against which said circuit-closing point is periodically caused to impinge, an electro-magnet through which the circuit of said battery is completed by the action of said circuit-closing and contact points, and a shunt-circuit around said point, which circuit is completed by the action of said electro-magnet.

6. The combination, substantially as hereinbefore set forth, of a clock mechanism, a battery, a contact-point caused to continuously advance by the action of said clock mechanism, a contact-point against which said circuit-closing point is periodically caused to impinge, an electro-magnet through which the circuit of said battery is completed by the action of said circuit-closing and contact point, a shunt-circuit around said circuit-closing point, which circuit is completed by the action of said electro-magnet, and a second electro-magnet included in the circuit of said battery, acting, when vitalized, to automatically interrupt the circuit of said battery.

7. The combination, substantially as hereinbefore set forth, of an electric conductor, a series of electro-magnets included in said conductor, a series of electric clocks, a battery, means for automatically completing the circuit of said battery through the coils of said electro-magnets at regular intervals, means, substantially such as described, applied to one of said electro-magnets, serving to interrupt the circuit of said battery at a point other than that at which it is primarily completed, and means, substantially such as described, applied to the remaining electro-magnets, for actuating said clocks each time a circuit is completed and interrupted.

8. The combination, substantially as hereinbefore set forth, with a clock mechanism, of a contact-point moving with the minute-hand of said mechanism, a contact-point carried upon an arm concentric with the axis of said minute-hand, a toothed wheel for actuating said arm in the direction corresponding to the movement of the minute-hand, an electro-magnet through which the circuit of said battery is completed by the action of said minute-hand, and a circuit-interrupting device caused by the movements of the armature of said electro-magnet to interrupt the circuit of said battery.

9. The combination, substantially as hereinbefore set forth, with the minute-hand of a clock, of a circuit-closing point carried thereupon, a contact-point carried in front of said circuit-closing point, which contact-point is caused to periodically advance in the direction of the movement of said circuit-closing point.

10. The combination, substantially as here-

inbefore set forth, of a continuously-advancing circuit-closing point and a contact-point periodically advancing in the same direction as said circuit-closing point is advanced.

11. The combination, substantially as hereinbefore set forth, of a revolving circuit-closing point and a revolving contact-point against which said circuit-closing point is periodically caused to impinge.

12. The combination, substantially as hereinbefore set forth, of a continuously-advancing circuit-closing point, a periodically-advancing contact-point against which said circuit-closing point impinges at regular intervals, an electro-magnet through which an electric circuit is completed by the action of said points, and a shunt-circuit around said points, the connections of which are completed by the action of said electro-magnet.

13. The combination, substantially as hereinbefore set forth, with a clock mechanism and means, substantially such as described, for causing said mechanism to complete an electric circuit at intervals, a series of secondary electric clocks caused to be actuated once for each completion of said circuit, and means for causing the hour-hand of one or more of said secondary clocks to advance with one-half the rapidity of the corresponding hands of the remaining electric clocks.

14. The combination, substantially as hereinbefore set forth, with a series of electric clocks, of means for transmitting thereto periodic electric impulses, and means for causing the hour-hands of certain of said secondary clocks to complete a revolution once for each two revolutions of the hour-hands of the remaining secondary clocks.

15. The combination, substantially as hereinbefore set forth, with a primary electric clock, and means, substantially such as described, for causing said primary clock to complete an electric circuit at a given point, and to thereby transmit periodic electric impulses, of one or more secondary electric clocks, an electro-magnet for actuating each of said clocks, through which magnets said impulses are transmitted, and means, substantially such as described, for automatically interrupting the circuit of said system at a point other than that at which it is primarily closed for the purpose of transmitting said impulses.

In testimony whereof I have hereunto subscribed my name this 11th day of January, A. D. 1884.

CHARLES L. CLARKE.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.