(No Model.)

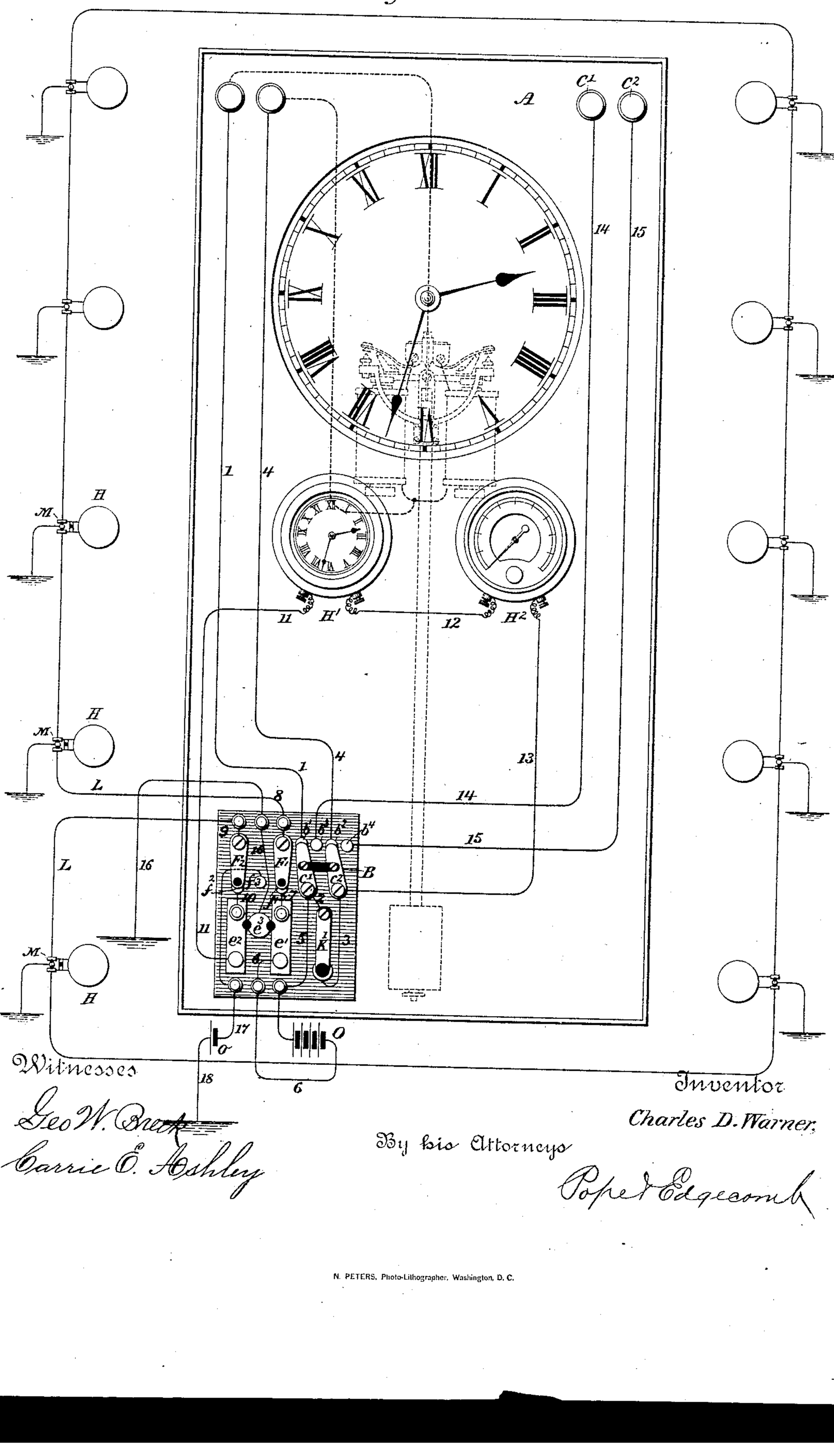
2 Sheets—Sheet 1.

C. D. WARNER.

ELECTRIC CLOCK SYSTEM.

No. 335,860. Patented Feb. 9, 1886.

Fig. 1.



Witnesses

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(No Model.)

2 Sheets—Sheet 2.

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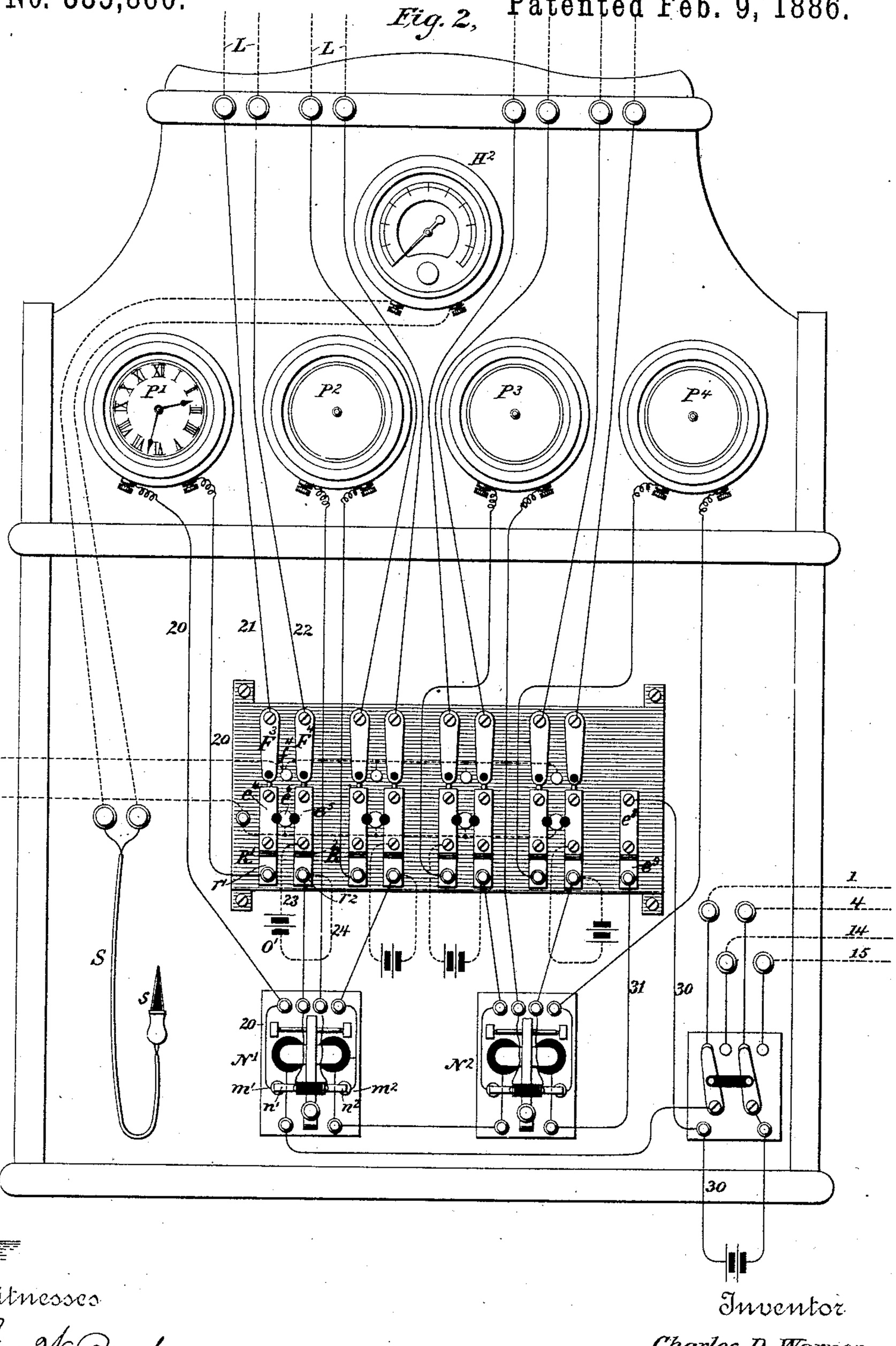
Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES D. WARNER, OF ANSONIA, CONNECTICUT.

ELECTRIC-CLOCK SYSTEM.

SPECIFICATION forming part of Letters Patent No. 335,860, dated February 9, 1886.

Application filed September 23, 1885. Serial No. 177,884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. WARNER, a citizen of the United States, residing in Ansonia, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Electric-Clock Systems, of which the following is a specification.

The invention relates to the organization of circuits and apparatus in which a central regulator controls the operation of any desired number of secondary movements or dials.

The special object of the invention is to provide convenient means for operating a system of this character, indicating the movements of the dials, measuring the current employed, and meeting the varied accidents and contingencies which are liable to occur in connection therewith.

The invention consists in organizing the apparatus in substantially the following manner: A central regulator is constructed to transmit periodic impulses from any suitable source. These impulses are either directed through the circuit containing the secondary movements or else through a relay which operates to control the circuit-connections of the system. Suitable switches are provided for connecting the system with an auxiliary or relief regulator, in case of an accident to the one normally controlling the system. An indicator consisting, essentially, of a secondary clock is located in proximity to the prime regulator, for indicating the condition of the secondary clocks throughout the system. An electric gage is also provided for measuring the battery-strength or the amount of current employed for operating the system. Convenient means are also provided for substituting a ground-circuit for the metallic circuit, in which the secondary clocks are usually included, so that in case of a break in the line at least a portion of the clocks may be operated while the line is being repaired. Still another circuit-connection is provided for inserting a test-battery, when required, for the purpose of conveniently locating a break in the line.

In the accompanying drawings, Figure 1 shows the face of the regulator, the switch devices together with the circuits and the secondary clocks in diagram. Fig. 2 illustrates the system of circuits when a relay is employed.

Referring to Fig. 1 of the drawings, A represents a controlling-regulator, which is constructed to transmit in any suitable manner electric impulses at regular intervals over a conductor, 1. The conductor 1 leads to one of the contact-points b' of a switch, B. This switch is constructed with two arms, c' and c^2, the former of which is connected by a conductor, 2, with a circuit-closing key, K', for a purpose which will be hereinafter described. The front contact of this key is connected by a conductor, 3, with the switch-arm c^2. The switch-point b', corresponding to the one b^2, is connected by a conductor, 4, back to the clock. The switch-arm c' is also connected by a conductor, 5, with one pole of a battery, O. The remaining pole of this battery is connected by a conductor, 6, with a plate, e', and from this plate by a conductor, 7, with a switch-point, f'. A switch, F', normally rests upon this point f', and this is connected by a conductor, 8, with the main line L, in which the series of secondary clocks H is included. The main line L, returning, is connected by a conductor, 9, with a switch, F^2, corresponding to the switch F'. The resting-point f^2 of this switch is connected by a conductor, 10, with a plate, e^2, corresponding to the plate e'. The plate e^2 is connected by a conductor, 11, through an indicator, H', which is in reality essentially a secondary clock-movement, and from this indicator the connections are completed by a conductor, 12, through an electric gage, H^2, constructed to indicate the strength of the currents upon the line. A conductor, 13, leads from the gage to the switch-arm c^2, which has already been referred to, and when the switch is in the position shown in the drawings the connections will be complete through the conductor 4 back to the regulator A. Each time, therefore, that the regulator completes its circuit an impulse will be sent from the battery O through the secondary clocks, the indicator, and the gage. By operating the key K' a direct connection may be made from the switch-arm c' to the arm c^2, thereby actuating the clocks independently of the regulator.

As it may sometimes occur that the regulator will be out of order or inoperative for

some reason, it is desirable that means be provided for readily substituting an extra or reserve regulator. For this reason the switch B is provided with two extra contact-points, b^3 and b^4, against which the respective arms c' and c^2 may be placed by moving them from their normal position. These points b^3 and b^4 are connected by conductors 14 and 15, respectively, with suitable binding-posts, C′ and C², which are designed to be connected, when required, with an extra regulator. It frequently chances that the main line of the system becomes broken or grounded at some point—as, for instance, by reason of the carelessness of the workmen in repairing other lines. For this reason it is desirable to provide means for sending the actuating-impulses through such portions of the main line as remain complete, or as great a portion of it as practicable, during the time that the line is being repaired, so that a portion only of the subscribers will be inconvenienced. In practice, therefore, it is proposed to employ convenient means for placing one of the clocks, preferably one located at or near the middle point of the circuit, in connection with the ground. It is then necessary only to ground one point of the battery O, and the impulses will be sent to line, and those clocks between the central station and the distant ground will be kept in operation. The plates e' and e^2 are to this end constructed in the manner of switch-board plates, so that they may be readily placed in connection with a conductor, 16, leading from a contact-plate, e^3, to the earth. The plate e^3 is placed between the plates e' and e^2, and, by placing a plug between the plate e^3 and either one or the other of the adjacent plates, the battery will be grounded upon one side or the other while impulses are being transmitted in the usual manner to the clocks upon the other side, word having been previously sent to ground the main line at the distant point.

For the convenience of testing the line in order to determine where a break may be, a battery, *o*, is employed. This may be readily placed in connection with either the conductor 8, leading to the line, or the conductor 9, leading from the line, by means of a point, f^3, applied to the switches F′ and F². The battery has one pole connected by a conductor, 17, with this point f^3, and the other pole connected with the earth by a conductor, 18. To employ this battery it is necessary only for the switch F′, for instance, to be turned into contact with the point f^3 and the inspector to go to the first clock in the series, and, having grounded it through a suitable ground-switch, M, and having inserted his gage, to discover whether or not a current traverses the circuit thus made, as well as the strength of such current. Should he find the circuit to be complete, he removes this ground and gage and passes to the second clock and repeats the operation. In this manner the break will be located between two clocks, and its precise location then discovered.

The ground-switch may conveniently consist of two insulated contact-plates respectively connected with the conductors leading to and from the corresponding clock and an intervening plate connected with the earth and adapted to be placed in connection with either of the first-named plates, as shown at M.

In Fig. 2 I have illustrated the circuit-connections as controlled by the regulator A through two relays, N′ and N². The relays are included in the circuit controlled by the regulator, and they in turn control the connections of the main lines. Preferably each relay is constructed to make and break the connections of two separate main-line circuits. The regulator, instead of operating only one set of secondary clocks, operates, in this instance, four. It is evident that the number of relays might readily be increased, and thus the number of sets of secondary clocks also extended.

The organization of the switch apparatus is essentially the same in this instance as described in connection with Fig. 1. Instead of having connections through the main line, however, the connections controlled thereby are through the relays N′ and N². Each relay is provided with two pairs of contacts, m' and n' and m^2 and n^2. The contacts m' and m^2 are carried upon opposite sides of one arm of the armature-lever by yielding springs. The contact m' is connected by a conductor, 20, through an indicator, P′, and with a contact-plate, r'. This plate is connected through a spring jack or switch, R′, with a plate, e^4. A switch, F³, normally connects this plate through a conductor, 21, with the main line L, in which a set of secondary clocks is included. The main line, returning, is connected by a conductor, 22, with the switch F⁴, and thus with the plate e^5. One pole of the battery O′ is connected with this plate by a conductor, 23. The other pole is connected by a conductor, 24, with the plate r^2, corresponding to the plate r'. The plates e^5 and r^2 are normally separated from each other, but may be brought into connection through a spring-jack, R². It is evident thus that by completing the connections at m' n' the clocks in the first set will be actuated. A second set is connected with the contacts m^2 n^2 in precisely the same manner. The ground-connections for the battery O′ are made in this instance, when required, through the plate e^4 or e^5 and the interposed plate e^6. The test-battery is applied by placing a switch, F³ or F⁴, into contact with a corresponding point, f^4, with which one pole of the test-battery is connected in essentially the same manner as described in connection with Fig. 1. It will be noticed that the gage is shown in this instance as not in circuit, but as being provided with a double switch-cord, S, and a switch pin or plug, *s*, of well-known construction. By inserting this pin in the jack R′ the normal connections from the plate r' to the plate e^4 will be substituted by a

connection through the gage. The current sent to line may then be determined.

When it is desired to determine the strength of the battery itself, the switch-plug is inserted in the jack R^2. The battery will then be placed upon a short circuit through the gage. The current of the local battery o^2 may be tested by the gage in the same manner. The wire 30 is led from one pole to the plate e^8, which is connected by the spring-jack R^3 with the plate e^9 and the wire 31, leading to the relay. The gage by being inserted at R^3 is in the local circuit, and its strength is at once ascertained. By thus having the gage independent of the circuits, one instrument may be employed for testing all the circuits.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a battery, a regulator, means controlled by said regulator for making and interrupting the connections of said battery, a series of secondary clocks included in the circuit of said battery, a circuit-closing device applied to each secondary clock, consisting of two insulated contact-plates respectively connected with the conductors leading to and from that clock, and an intervening contact-plate connected with the earth, and means for grounding one pole of said battery.

2. The combination, substantially as hereinbefore set forth, of a regulator, a circuit-controller operated thereby, a battery, a series of clocks included in the circuit of the battery, means for grounding said circuit at a distant point, means for grounding either pole of said battery, a second battery, and a switch for connecting said second battery in circuit with a portion of said clocks.

3. The combination, substantially as hereinbefore set forth, of a battery, a regulator, an indicator, secondary clocks, and an electric gage, all included in the circuit of said battery, a circuit-controller operated by said regulator, means for substituting a second regulator for the first independently of the remaining devices in circuit, means for connecting either pole of the battery with the earth, means for connecting the main line with the earth at any one of several points, a second battery, and means for connecting the last-named battery in an earth-circuit with a portion of the main line.

4. The combination, substantially as hereinbefore set forth, of a regulator, a main line, secondary electric clocks included in the same, means controlled by said regulator for transmitting impulses through said main line, a key for completing the circuit-connections through said main line independently of the operation of said regulator, means for grounding said main line at any of several distant points, and means for transmitting impulses from said regulator through either portion of said main line when so grounded.

5. The combination, substantially as hereinbefore set forth, of the battery O, the regulator, means controlled thereby for completing circuit-connections of said battery, the switch B, the key K′, the switches F′ and F^2, the plates e', e^2, and e^3, the main line L, and the circuit-connections, substantially such as described.

In testimony whereof I have hereunto subscribed my name this 21st day of September, A. D. 1885.

CHARLES D. WARNER.

Witnesses:
JOHN D. BALLOU,
GEO. B. CLARK.