(No Model.)

J. HAMBLET.

CIRCUIT AND APPARATUS FOR ELECTRIC CLOCK SYSTEMS.

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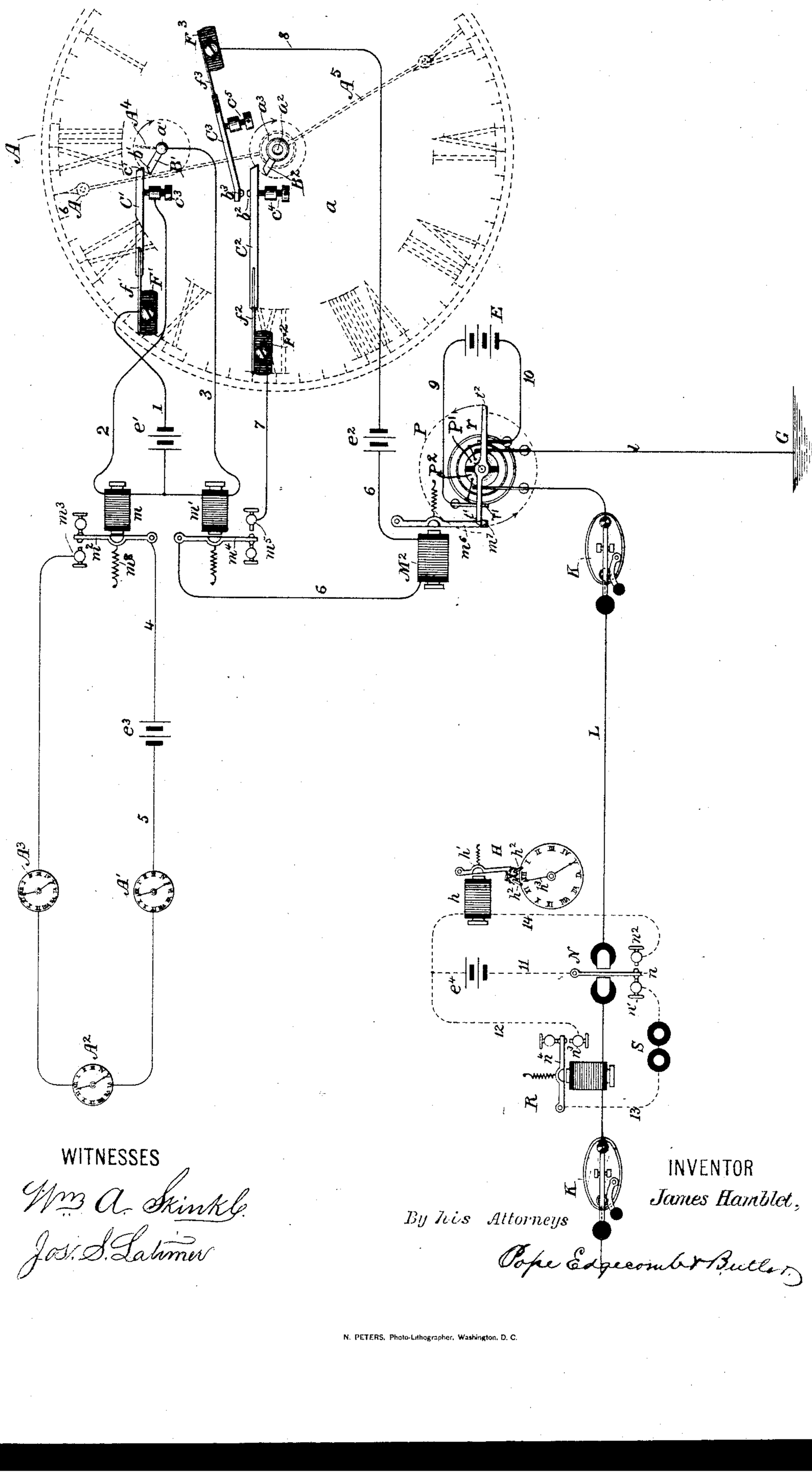

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CIRCUIT AND APPARATUS FOR ELECTRIC-CLOCK SYSTEMS.

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To all whom it may concern:

Be it known that I, JAMES HAMBLET, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Circuits and Apparatus for Electric-Clock Systems, of which the following is a specification.

My invention relates to certain improvements in the construction and arrangement of apparatus and circuits for actuating and controlling electrical and mechanical clocks.

The object of my invention is to provide means whereby a central regulating-clock may be employed both to transmit periodic electric impulses for actuating secondary electric clocks and at regular intervals to transmit impulses of suitable character for operating a series of special synchronizing devices applied to any ordinary form of clock; and it further has for its object the organization of suitable apparatus whereby the sychronizing mechanism may be operated in connection with any ordinary telegraphic circuit without materially interfering with its use for the transmission and reception of telegraphic communications.

To this end my invention consists in combining with the mechanism of a regulating-clock two independent current-transmitting devices, one of which devices is operated once per minute to actuate a relay or secondary circuit-closer for completing one or more circuits in which secondary electric clocks are included, and simultaneously with this operation to close the circuit of an electro-magnet whose armature acts to momentarily place in electrical connection at one point two sections of an independent conductor the circuit-connections of which are completed at another point only when the second circuit-controlling device is actuated simultaneously with the first. The second circuit-controlling device is operated once every hour, and when so operated simultaneously with the first-named or minute circuit-breaker serves to close the circuit of a second local battery through an electro-magnet the armature of which controls the movements of a pole-changing device included in the circuit of a main battery. A current of one polarity or the other is transmitted from the main battery upon the line-wire accordingly as the electro-magnet is or is not vitalized. The current thus transmitted, when the electro-magnet is vitalized—that is, during the instant both circuit-closers are simultaneously actuated—operates a polarized relay at each of the various sub-stations through which the line-wire extends in such a manner as to momentarily transmit a current from a local battery through a suitable synchronizing device for placing the minute-hand of any clock to which it is attached in a predetermined position, thereby causing it to indicate the correct time. Immediately upon the further operation of the circuit-closing device at the transmitting-station the corresponding local circuits are interrupted, the pole-changing device is again actuated, and its battery-connections reversed. The current then caused to traverse the line-wire is of the character adapted to so operate the polarized relays as to cause them to respectively complete the circuit-connections of their local batteries through a local telegraphic receiving-instrument with the armature and contact-stops, respectively, of a non-polarized electro-magnet included in the main line, and constituting an ordinary telegraphic relay.

The details of construction of the circuit-controlling devices will be hereinafter more particularly described in connection with the accompanying drawing, which is a diagram illustrating an organization of apparatus and circuits embodying my invention.

Referring to the drawing, A represents a central regulating-clock of any suitable construction, of which A', A^2, and A^3 are the second, minute, and hour hands, respectively mounted on the posts a' and a^2 and the quill a^3, constructed to revolve the hands in their proper periods in front of the dial a.

Attached to the second-hand post a', and making therewith one revolution per minute, is a circuit-closing arm, B′, carrying at its extremity a beveled contact-point, b'. A contact-arm, C′, supported from a longitudinally-adjustable block, F′, by means of a flexible spring, f', projects into the path of the arm B′. The arm C′ carries at its extremity a contact-point, c', which is preferably beveled in the opposite direction from the point b', as shown in the

figure. The position of the extremity of the arm C′, carrying the contact-point c', is rendered adjustable by means of a capstan-headed screw, c^3, upon which it normally rests. The position of the contact-point c' is normally so adjusted with reference to the circuit-closing arm B′ that once during each revolution of the latter the contact-point b' will engage with the contact-point c', thereby momentarily raising the arm C′ from the screw c^3. The relative movements of the arms B′ and C′ are such as to produce a firm frictional contact, while the beveled extremities of the same act to produce a sudden separation of the contact-points, thereby facilitating the accurate adjustment of the two, and relieving the clock mechanism from the frictional resistance incident to a prolonged contact. One pole of a local battery, e', is normally connected by a wire, 1, with the contact-arm C′ through the block F′ and spring f'. The opposite pole of the battery e' is connected by the conductors 2 and 3, respectively, with the contact-screw c^3 and circuit-closing arm B′. Two relay electro-magnets, m and m', are respectively included in the circuits of the conductors 2 and 3. The circuit of the battery e' will therefore remain closed through the conductor 2 and electro-magnet m so long as the contact-arm C′ rests upon the screw c^3. When, however, the arm C′ is raised by the action of the circuit-closing arm B′, this circuit is interrupted, and is replaced by a circuit through the conductor 3 and electro-magnet m'. The two magnets m and m' will therefore be alternately vitalized. The armature-lever m^2 of the electro-magnet m is provided with a back contact-stop, m^3, and the armature-lever m^4 of the electro-magnet m' with a front contact-stop, m^5. Both armature-levers m^2 and m^4 will therefore rest against their respective contact-stops only when the circuit of the battery e' is closed through the arm B′ and conductor 3, thereby vitalizing the electro-magnet m' and causing its armature m^4 to be drawn into its forward position, while the armature-lever m^2 is drawn away from its electro-magnet m through the influence of the antagonistic spring m^8.

The electro-magnet m and its armature-lever m^2 constitute a relay for transmitting electric impulses from the local battery e^3 through a series of secondary electric clocks of any well-known or suitable construction adapted to be actuated thereby. For this purpose one pole of the battery e^3 is connected by a conductor, 4, with the armature-lever m^2, while its opposite pole is connected by a conductor, 5, through the series of secondary clocks A′ A², &c., with the contact-point m^3 of the armature-lever m^2. It will be evident, therefore, that at each interruption of the circuit through the conductor 2 and electro-magnet m the circuit of the battery e^3 will be completed and the secondary clocks actuated by the impulse proceeding therefrom in a well-known manner.

The movements of the armature-lever m^4, which are simultaneous with the operation of the circuit-closing arm C′, are employed for momentarily placing in connection two sections, 6 and 7, of a conductor included in the circuit of a local battery, e^2. The complete circuit of the battery e^2 is established only when the electro-magnet m' is vitalized simultaneously with the operation of a minute-hand-circuit-controlling device. This circuit-closing device consists of an arm, B², carried upon the minute-hand post a^2, and similar in form to the circuit-closing arm B′, preferably, however, not itself employed for closing an electric circuit directly. An arm, C², similar in its general construction to the arm C′, and adjustably supported from a block, F², by a spring, f^2, projects into the path of the arm B², and is engaged thereby once in every revolution—that is, once every hour. A third contact-lever, C³, supported by a spring, f^3, from an adjustable block, F³, extends above the arm C², and is preferably placed at a slight angle thereto. The extremity of the arm C³ is provided with a contact-point, b^3, against which a corresponding contact-point, b^2, carried upon the arm C², is caused to impinge when the latter is raised by the arm B². Two adjustable capstan-screws, c^4 and c^5, are provided for determining the normal positions of the arms C² and C³, respectively, with reference to each other and to the arm B². The arm C³ is in electrical connection through the spring f^3, supporting-block F³, and conductor 8 with one pole of the battery e^2. The opposite pole of this battery is connected by the conductor 6 with the armature-lever m^4, and, when the latter rests against its contact-stop m^5, through the conductor 7, supporting-block F², and arm f^2, with the contact-lever C². It will now be apparent that the circuit of the battery e^2 will be completed only when the arms B′ and B² act upon their respective contact-levers. The positions of the two arms B′ and B² are so adjusted that during the time the contact-arm C² is held against the contact-point b^3 by the arm B² the arm B′ shall make one contact with the contact-arm C′, thereby causing the circuit of the battery to be momentarily completed at the point m^5. Before the arm B′, by completing a second revolution, is again brought into contact with the lever C′, the arm B² will have passed from beneath the arm C², and the circuit of the battery e^2 will therefore remain open. By this combination of circuit-closers I am enabled to derive from the slow movement of the hour-circuit closer a momentary completion of the circuit, such as is essential to the proper operation of the synchronizing devices, owing to the rapidity of the movement of the minute-circuit-closing device.

The means which I employ for periodically operating the synchronizing device consist of an electro-magnet, M², the coils of which are included in the conductor 6, comprised in the

circuit of the battery e^2, and provided with an armature-lever, m^6, the movements of which control the operation of a pole-changing device, P, and cause a positive or a negative current, as the case may be, to be sent over a conductor, L, from a main battery, E.

The pole-changing device P comprises a disk, p, having upon its periphery two insulated conducting-surfaces, p' and p^2. Against opposite points upon this periphery press two contact-brushes, r and r', respectively connected with the earth at G and the conductor L. Mounted upon the same axis, t, with the disk p is a cross-bar, T, extending at right angles with the shaft. Near the opposite extremities of the bar T are placed two pins of triangular section, t' and t^2, projecting therefrom at right angles, and constructed to be engaged by a corresponding pin, m^7, projecting from the side of the armature-lever m^6. The pins t' and t^2 are placed at such relative distances from the axis of motion of the bar T that the one shall be engaged by the pin m^7 while the armature-lever m^6 is in its backward position, and the other, t^2, shall be similarly engaged while the armature-lever is in its forward position, near the poles of the electro-magnet M^2. A suitable train of wheels actuated by a weight is employed for causing the shaft t and disk p to be revolved in the direction indicated by the arrow when the bar T is released from the pin or detent m^7. Thus if the armature-lever m^6 be normally held in its backward position, as represented in the drawing, the disk p will be retained with the segment p' in contact with the contact-brush r, and the segment p^2 in contact with the brush r'. When, under the influence of a current from the battery e^2 traversing the coils of the electro-magnet M^2, the armature-lever m^6 is attracted into its forward position, the detent m^7 will release the bar T and allow the disk p to be turned through one-half a complete revolution, when the pin t^2 at the opposite extremity of the bar will be engaged by the detent m^7, causing the segments p' and p^2 to remain in contact with the brushes r' and r, respectively. Immediately upon the cessation of the current traversing the electro-magnet M^2 the armature-lever will resume its former position, and the disk p will be permitted to complete its revolution, re-establishing the former relations of the segments p' and p^2 and contact-brushes r and r'. One pole—for instance, the positive—of the battery E is connected through a conductor, 9, with one segment, p^2, of the pole-changer P, while the negative pole is connected through a conductor, 10, with the opposite segment, p'. When, therefore, the pole-changing device P is in its normal position, the negative pole of the battery will be connected through the wire 10, segment p', brush r, and conductor 1 with the earth at G, while the positive pole of the battery will be connected through the conductor 9, segment p^2, and contact-brush r' with the conductor L. When the pole-changer P is operated in the manner before described, these battery-connections will be reversed, the positive pole being connected with the earth and the negative with the line L.

The line L may consist of any suitable electric conductor extending through the stations at which the synchronizing devices are placed, and it may include in its circuits any required electrical apparatus—such, for instance, as telegraphic transmitting and receiving instruments K and R. These instruments may be operated in the customary manner at all times except during a short period at the time of the operation of the pole-changing device P. For the purpose of adapting the line L to be normally used as a telegraphic conductor, and at predetermined intervals for causing the synchronizing devices H to be operated, a polarized relay, N, of well-known construction, is also included in the circuit of the line L, one such relay being placed at each synchronizing-station. The position of the armature n of this relay determines whether the circuit of a local battery, e^4, shall be closed through a local sounder, S, or the synchronizing device H. One pole of the battery e^4 is connected through a conductor, 11, with the armature n of the polarized relay N. The opposite pole of the battery e^4 is connected through a conductor, 12, with the contact-stop n^3 of the receiving-instrument or relay R. The armature n^4 of this instrument is connected through a conductor, 13, and the sounder S with one contact-stop, n', of the polarized relay N. The same pole of the battery e^4 is also connected through a conductor, 14, with the remaining contact-stop, n^2, of the polarized relay N. The armature n of the relay N is so polarized that under the influence of the current normally traversing the line L it will rest in contact with the contact-stop n', thereby completing the circuit-connections from the battery e^4 through the conductor 11, armature n, and conductor 13 with the armature n^4 of the relay R. The movements of the armature n^4, under the influence of the impulses of normal direction transmitted through the line L, will cause the circuit of the battery e^4 to be completed at the point n^3 through the sounder S, the armature n remaining in contact with the point n' until the current upon the main line L is reversed. When, under the influence of a reversal of the battery E at the transmitting-station, a current in the opposite direction is transmitted over the line L, the armature n will be thrown into contact with the contact-stop n^2, thereby closing the circuit-connections of the battery e^4 through the electro-magnet h of the synchronizing apparatus H.

The synchronizing device H preferably consists of an armature, h', adapted to respond to the magnetization of the electro-magnet h and to cause two pivoted arms, h^2 h^2, to grasp the end of the minute-hand h^3 of the clock to which it is attached and place it at a predetermined point in a manner well understood. The momentary reversal of the current from the bat-

tery E will thus actuate all the synchronizing magnets throughout the system.

I have described the actuating and the synchronizing devices as respectively applied to an independent and a telegraphic circuit; but it is evident that the synchronizing device may be employed in connection with various other systems of electric conductors and apparatus. The synchronizing device may, for instance, be readily applied to the circuit employed for carrying the impulses to the actuating mechanism of the secondary electric clocks. Such a result would be effected by substituting for the instrument K at the transmitting-station the circuit-closing device shown at B′ C′, and employing the neutral electro-magnet R for actuating the several secondary electric clocks. The conductors 12 and 13 and sounder S will then be dispensed with. The neutral electro-magnet R would respond to electric impulses of whatever polarity, while the synchronizing device, as in the former instance, will be actuated only by currents of a given direction.

By applying the circuit-controlling arm B^2 to the quill a^3 of the hour-hand of the regulating-clock A, the synchronizing device may be actuated once every twelve hours only. In some instances it may be found desirable to employ three or more circuit-closing devices similar in construction to those already described, and respectively carried by differently-timed arbors of the clock mechanism.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of two automatic chronometric circuit-closers, one measuring fractions of the periods measured by the other, two electro-magnets respectively included in branch circuits of a local battery whose connections are controlled by one of said circuit-closers, one of which electro-magnets acts as a relay for actuating secondary electric clocks, and the other as a circuit-closer for periodically placing in electric connection two sections of a conductor constituting the circuit of a second local battery, the connections of which are completed when both circuit-closers are simultaneously actuated, an electro-magnet included in the circuit of the second local battery, a pole-changing device controlled by said electro-magnet, a main line, a main battery from which currents are transmitted upon said line, having polarity of a direction dependent upon the position of said pole-changing device, a series of clock-synchronizing devices respectively included in corresponding local circuits, and devices, substantially such as described, actuated by currents of determinate polarity from said main battery to close said local circuits through their respective synchronizing devices.

2. The combination, substantially as hereinbefore set forth, of two automatic chronometric synchronizing devices, one measuring fractions of the periods measured by the other, a main line, a battery, a pole-changer, means, substantially such as described, for actuating said pole-changer when both said circuit-closers are simultaneously actuated to transmit a current of a given polarity or direction from said battery upon said main line, and a series of clock-synchronizing devices operated only when said pole-changer is so actuated.

3. The combination, substantially as hereinbefore set forth, of two chronometric circuit-closers, one causing electric impulses to be periodically transmitted through a series of secondary electric clocks, the other periodically co-operating with the first to cause a current of a predetermined character to be transmitted through a series of devices for actuating corresponding clock-synchronizing devices.

4. The combination, substantially as hereinbefore set forth, of a local battery, a contact-arm connected with one pole of said battery, a resting-contact, and a second contact-arm respectively connected through branch conductors with the opposite pole of said battery, two electro-magnets, one included in each of said branch circuits, a series of secondary electric clocks actuated by electric impulses from a battery whose circuit-connections are controlled by one of said electro-magnets, and a second circuit-closer co-operating with the second electro-magnet to complete the circuit-connections of an independent battery.

5. The combination, substantially as hereinbefore set forth, of a yielding contact-arm having a longitudinally-beveled end, a revolving circuit-closing arm, also longitudinally beveled on its end, and means for placing the beveled end of said circuit-closing arm in contact with the back or longest side of the contact-arm.

6. The combination, substantially as hereinbefore set forth, with a main line, a battery, and means for reversing the connections of said battery with said main line, of a polarized relay, a clock-synchronizing device, a telegraphic receiving-instrument or other electically-operated translating device, a local battery, and electrical connections whereby the circuit-connections of said local battery may be closed either through said synchronizing device or through the receiving instrument, according to the position of the armature of said polarized relay.

7. The combination, substantially as hereinbefore set forth, of a main line, a neutral and a polarized relay, a local battery, one pole of which is connected with the armature of said polarized relay, two contact-points, one of which is connected through the armature-lever and contact-point of said neutral relay and an electro-magnet with the remaining pole of said local battery, and an electro-magnet included in a branch circuit connecting the same pole of said local battery with the remaining contact-point.

8. The combination, substantially as here-

inbefore set forth, of a main line, a main battery, means for reversing the connections of said battery with said main line, two electro-magnets having, respectively, a polarized and a neutral armature, and a clock-synchronizing device actuated through the instrumentality of said polarized armature only under the influence of currents of a predetermined polarity.

In testimony whereof I have hereunto subscribed my name this 27th day of November, A. D. 1882.

JAMES HAMBLET.

Witnesses:
DANIEL W. EDGECOMB,
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