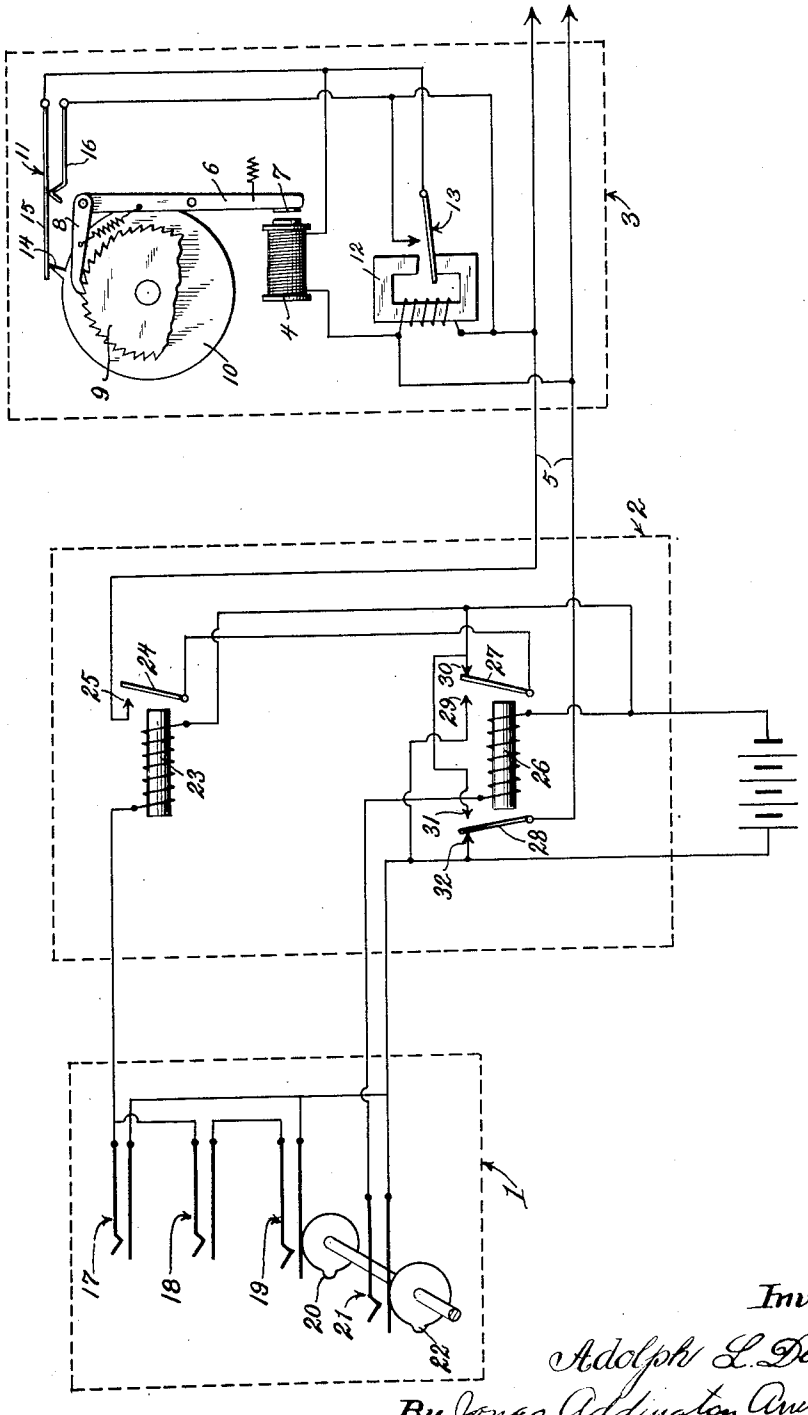
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CORRECTIVE DEVICE FOR SECONDARY CLOCKS

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CORRECTIVE DEVICE FOR SECONDARY CLOCKS

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10 Claims. (Cl. 58—24)

My invention relates to corrective devices for correcting the time of any secondary apparatus controlled by a master clock in the event that such secondary apparatus is out of synchronism with the master clock due to temporary interruptions in the current supply or for other reasons.

One of the objects of my invention is to provide a corrective device which can be used in connection with the usual two-wire relay circuit.

A further object of my invention is to provide a corrective device which can be readily combined with existing types of mechanism.

Further objects will appear from the description and claims.

In the drawing, the figure shows diagrammatically, parts of the secondary and master clock with the relay, corrective device, and wiring arrangements. The parts enclosed by the dotted lines indicated at 1 are the master clock and associated mechanism. The parts enclosed by the dotted line indicated at 2 are the relay and pole changing mechanism. The parts enclosed by the dotted line indicated at 3 are parts of the secondary clock and associated mechanism.

Referring further to the secondary clock and associated mechanism, this construction comprises a secondary impulse magnet 4 controlled by impulses sent over the wires 5 connecting the secondary clock with the relay, a lever 6 carrying an armature 7 controlled by this electromagnet, a pawl 8 on the end of this lever, a ratchet wheel 9 actuated by this pawl, a cam wheel 10 rotatable with this ratchet wheel, a circuit controller 11 controlled by this cam so that under certain conditions the secondary impulse magnet circuit will be broken by the secondary clock, a polarized magnet 12 which also is controlled by impulses sent over the wires 5 connecting the secondary clock with the relay and a circuit controller 13 controlled by the armature of the polarized magnet for temporarily re-establishing the circuit for the secondary impulse magnet after it has been broken by the cam wheel of the secondary clock mechanism.

Means in the master clock and relay, hereinafter described in detail, are provided for so controlling the current in the wires 5 connecting the secondary clock with the relay that during the major portion of an hour, the usual minute impulses will be sent over the connecting wires in a construction which will cause the armature of the polarized relay magnet 12 to remain in the position shown in the figure. This period may be from one minute after the hour to one minute before the hour. In other words, the entire corrective action may take place in the two minute period between one minute before the hour and one minute after the hour. During this normal operation the secondary clock will be advanced step by step in the usual manner if everything is working right. If, however, by any chance the secondary clock should have gotten ahead of the master clock it would automatically cut itself off from the master clock at one minute before the hour by the action of projection 14 on the cam wheel which would engage the movable member 15 of the circuit controller 11 to lift it out of engagement with the other contact 16 and thus break the circuit for the secondary impulse magnet causing the secondary clock to stop at one minute before the hour. Shortly after one minute before the hour and before the end of the hour, during perhaps a thirty second period, a number of high frequency impulses, perhaps fifteen in number, are sent out over the connecting wires 5. If the secondary clock is already in synchronism with the master clock, these fifteen additional impulses will have no effect on the secondary clock as it will be disconnected as aforesaid. However, if the secondary clock should by any chance be behind the master clock, these series of rapid impulses will quickly bring the secondary clock up to one minute before the hour when it will automatically disconnect itself from the controlling circuit.

As the secondary clock is thus disconnected from the master clock means must be provided for re-establishing the connection with the master clock in order that the next impulse will be effective to advance the secondary clock. For this purpose the polarized relay magnet is provided. Shortly after the last of the high frequency impulses have been sent out by means hereinafter described in detail, the battery connections for the wires are reversed so that the next impulse which is sent out will be in such direction that when it energizes the polarized relay magnet 12 the armature thereof will be lifted to re-establish the circuit connection through the secondary impulse magnet which will therefore be energized by this same impulse and will cause an actuation of the ratchet wheel to move it off its "dead spot". If it were thought that one impulse might not be sufficient to insure that the secondary clock be moved completely off the dead spot, the battery

connections might be held reversed for a number of minutes, ample to insure the re-establishment of the controller circuit for the secondary impulse magnet.

The means for controlling the current in the connecting wires, as aforesaid, may be similar to those disclosed in my co-pending application, Serial No. 53,231 which contains claims generic to both applications.

Referring further to the master clock associated mechanism, the construction shown here comprises the normal minute impulse circuit controller 17 which may be controlled in any usual manner so as to close the circuit once per minute, the corrective high frequency circuit controller 18 which may be caused to send out perhaps fifteen impulses about two seconds apart during the time between one minute before the hour and the end of the hour, a circuit controller 19 for temporarily placing said high frequency circuit controller in the battery circuit for a short period, say from fifty-nine minutes and ten seconds after the hour to fifty-nine minutes and fifty seconds after the hour (during which period the fifteen or more high frequency impulses are sent out), a circuit controller 21, and a cam 22 controlled by the master clock for temporarily reversing the battery connections, these battery connections being thus reversed immediately after the sending out of the last of the high frequency impulses, and the connections being maintained reversed long enough to insure that the secondary clock is moved off the dead spot and the controller circuit connections re-established. This period of reversal might be from five seconds before the hour until some time after the end of the hour, long enough to insure one and possibly more of the regular minute impulses being sent out to advance the secondary clock.

The relay controlled by the normal and high frequency impulse circuit controllers comprises the electromagnet 23 and its armature 24 which when the electromagnet is energized, closes the circuit at 25 establishing a connection between the battery and the secondary impulse magnet and polarized magnet of the secondary clock.

The pole reversing mechanism may be of any usual or suitable construction and as shown comprises an electromagnet 26 and a pair of armatures 27 and 28 cooperating with the four contacts 29, 30, 31, and 32, in such manner that when the magnet is energized, the battery connections for the wires 5 leading to the secondary clock mechanism will be reversed.

The operation has been outlined in connection with the description of the apparatus. To recapitulate, during the greater part of the hour from say, one minute after the hour to one minute before the hour, the minute impulses are sent out over the line controlled by the circuit controller 17. This should cause the secondary clock to be advanced minute by minute from one minute after the hour to one minute before the hour. If by any chance the secondary clock should get ahead of the master clock it will automatically disconnect itself from the circuit because of the cam wheel 10 on the shaft of the secondary clock which will open the circuit of the secondary impulse magnet 4. At fifty-nine minutes and ten seconds after the hour the cam 20 on the shaft of the master clock will place the high frequency circuit controller 18 in the circuit and this will send out impulses at two-second intervals until perhaps fifteen impulses have been sent out and the cam 20 on the master clock will then cause this high frequency impulse circuit controller 18 to be cut out of the circuit. During the time that these fifteen rapid impulses are being sent out if the secondary clock is already in synchronism with the master clock, it will simply stand still as it will have disconnected itself from the circuit. However, if it is slow, each of the rapid impulses will advance the secondary clock one step until it has gotten up to the fifty-ninth minute when it will automatically cut itself off from the circuit by the action of the cam wheel 10.

Immediately after the high frequency circuit controller 18 has been cut out of the circuit, the cam 22 on the master clock will close the circuit controller 21 to energize the electromagnet 26 and reverse the battery connections for the secondary clock. This reversal is effected just before the end of the hour so that when the impulse comes at the end of the hour the armature of the polarized magnet 12 will be lifted to establish a temporary circuit for the secondary impulse magnet 4 which will thus be energized and attract its armature 7 causing the ratchet wheel 9 of the secondary clock to be advanced one step. The circuit controller 11 may be so designed that this one step movement will be enough to permit the circuit controller 11 to close the regular circuit for the secondary impulse magnet 4. Of course, if desired, the battery connections might be held reversed for three or four minutes if this were necessary to enable the regular circuit connection for the secondary impulse magnet 4 to be re-established.

While I have shown but one embodiment of my invention, it is obvious that many modifications therein may occur to those skilled in the art, and I desire, therefore, that my invention be limited only by the scope of the appended claims and by the prior art.

I claim:

1. A secondary clock for use in synchronized clock systems and comprising a non-polarized impulse magnet which by its own action effects all advancing movements of the clock which are required for normal step-by-step advance or for accelerating the clock if the same is slow, with means including a polarized magnet controlled by master clock apparatus at each secondary clock for suspending its advance under certain chronological conditions of the clock and permitting a reinitiated advance of the clock under the action of the impulse magnet after its action has been suspended, said means including switching means in the secondary clock for altering the circuit relations of the impulse magnet, and means including a single line circuit extending into the clock from the master clock for sending thereinto from the master clock both the normal and fast impulses which normally advance and accelerate the clock and for also transmitting thereto current of special characteristics which upon its reception by the clock is adapted to reinitiate an advance thereof after its operation has been suspended.

2. A synchronized clock system including a master clock and a secondary clock, means in the master clock for sending uni-directional normal and fast impulses, means including a non-polarized impulse magnet in the secondary clock for actuating the clock by the impulses received from the master clock, means in the secondary clock including a switching device con-

trolled by the chronological condition of the secondary clock for arresting the advance of the secondary clock upon its arrival at a predetermined point in its cycle and a polarized magnet circuit controller for controlling the circuit of said switching device, and means in the master clock for sending out a single impulse of opposite polarity through said polarized magnet and also through said non-polarized magnet for rendering ineffective the arresting means and for again and by said current impulse stepping off the secondary clock after its action has been suspended.

3. A secondary clock for use in a synchronized clock system of the impulse type wherein each secondary impulse clock is advanced by regularly recurring impulses and accelerated if slow by more rapidly recurring current impulses and wherein each secondary comprises electrical circuit controlling means for cutting it off from operation as it reaches a certain chronological condition and including in combination therewith an actuating non-polarized magnet for driving the clock and synchronizing means including a polarized magnet, and means in the secondary brought into operation upon the receipt of a reverse current impulse in the secondary for re-establishing operative conditions of the secondary.

4. A secondary clock of the impulse type and comprising a non-polarized impulse magnet which serves the dual purpose of advancing the clock for normal step-by-step operations and for also more rapidly advancing the clock by rapid impulse operations and including in combination therewith a single pair of circuit terminals by which controlling impulses can enter and leave the clock over a common single line circuit and means intermediate said terminals for periodically suspending operation of the clock, and other means comprising a polarized magnet intermediate said terminals and arranged to be operatively effective upon the receipt of a reverse current impulse for reinitiating the advance of the clock after such suspension of operation.

5. In a secondary clock a single non-polarized impulse magnet which during a certain chronological period receives more than sufficient impulses to advance it to indicate the time which has actually accrued during such period, and in which cyclically operated means automatically suspend advance of the clock when it reaches a predetermined time position, a polarized magnet means, and a circuit controlling means cooperating therewith for restoring impulse advance of the secondary after such suspension and by and upon receipt of a current impulse of reverse polarity by said polarized magnet means.

6. In a clock system, a master clock, a secondary clock comprising an electro-magnetic non-polarized impulse actuator for driving the secondary clock mechanism, means controlled by the master clock to periodically accelerate the secondary when it lags behind the master, means to retard the secondary when it leads the master clock, and means controlled by the master clock, including a permanent magnet and circuit switching means in the secondary, to release the secondary when both clocks are in the same phase.

7. In a secondary apparatus for use in a corrective time-controlled system, an impulse magnet for effecting all advancing movements of said apparatus under the control of impulses, circuit controlling devices controlled by the chronological condition of said secondary apparatus for preventing the energization of said impulse magnet when said apparatus reaches a predetermined chronological position, and a second magnet in said secondary apparatus for rendering the operation of said circuit controlling devices ineffective and for again placing said impulse magnet under the control of the impulses.

8. In a secondary apparatus for use in a corrective time-controlled system, an impulse magnet for effecting all advancing movements of said apparatus, a pair of contacts controlled by the chronological condition of said apparatus and arranged to open the circuit of said magnet when said apparatus reaches a predetermined chronological position, and a second magnet in said apparatus having contacts for shunting said first-mentioned contacts.

9. In a corrective time-controlled system wherein secondary apparatus is operated and synchronized by normal operating impulses, rapid accelerating impulses, and a special starting impulse transmitted from a master apparatus, an impulse magnet in said secondary apparatus for effecting all advancing movements of said apparatus under control of said impulses, a switching device for opening the circuit of said impulse magnet when said secondary apparatus reaches a predetermined chronological position, and a second magnet for rendering said switching device ineffective responsive to said special starting impulse.

10. In a corrective time-controlled system wherein secondary apparatus is operated and synchronized by normal operating impulses and rapid synchronizing impulses transmitted from a master apparatus, an impulse magnet in said secondary apparatus for effecting all advancing movements of said apparatus under control of said impulses, a circuit controlling device controlled by the chronological condition of said secondary apparatus for preventing the energization of said impulse magnet when said apparatus is in a predetermined chronological position, means in said master apparatus for transmitting a current impulse of special characteristics to said secondary apparatus when said master apparatus reaches a corresponding chronological position, and a second magnet responsive only to said special impulse for again permitting the energization of said impulse magnet.

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