Sept. 8, 1931. G. F. HARTER 1,822,144

ELECTRIC TIME CLOCK CORRECTION

Filed Oct. 15, 1927

Fig. 1

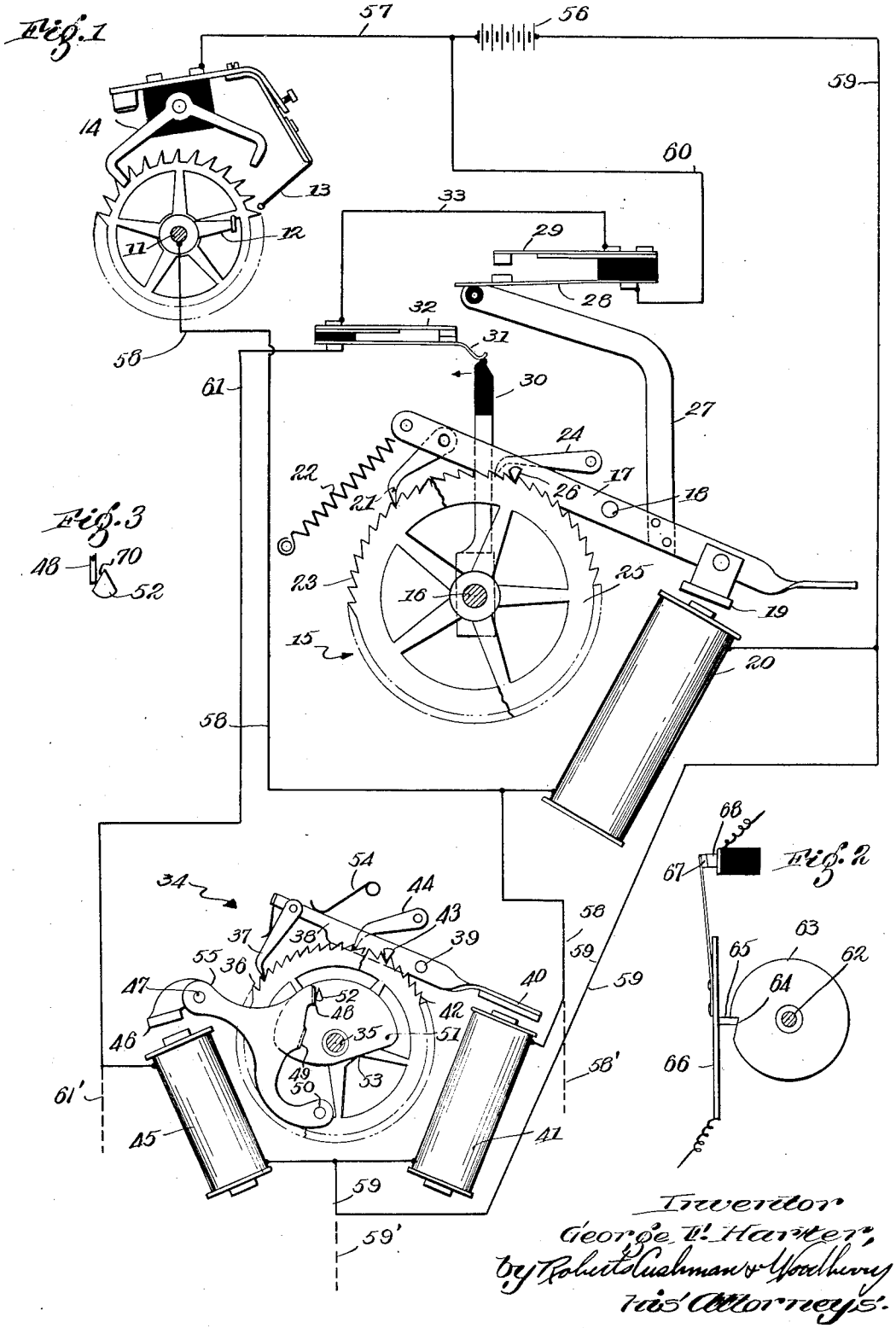

Fig. 3

Fig. 2

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Patented Sept. 8, 1931 1,822,144

UNITED STATES PATENT OFFICE

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ELECTRIC TIME CLOCK CORRECTION

Application filed October 15, 1927. Serial No. 226,317.

My invention relates to electric clocks and electric clock systems of the type wherein a master clock which is very accurate controls, by means of electric circuits, the operation of several less expensive secondary clocks, and more particularly to those secondary clocks which operate wholly by means of electric impulses received from the master clock.

Periodically, usually each minute, such clocks are advanced by an electric impulse from the master clock. In the course of 24 hours there are 1440 such impulses and if for any reason such impulses fail even once, the secondary clock or clocks will show incorrect time. If all secondary clocks become slow the same amount they may be advanced by hand by a set key usually provided at the master clock for that purpose. But sometimes, because of a weak battery for example, some secondary clocks fail to receive sufficient current to operate them as often as others. It then becomes necessary to make the rounds of all the secondary clocks and set them individually or at least make sure they need no setting.

One purpose of my invention is to provide for the automatic setting of the secondary clocks at less frequent intervals than the operating impulses are sent; and to automatically bring all secondary clocks to the same time regardless of whether they are all in error the same amount. My invention also makes it possible to set groups of secondary clocks from the master clock instead of individually because my invention not merely advances the secondary clocks, but actually sets them. I prefer to set these secondary clocks once each hour, although it is obvious that other intervals might be selected and I do not wish to confine myself to an hourly setting.

Heretofore a source of electricity, either primary or storage batteries, has been selected which would be as dependable as possible. Because of the danger of interruption of central station power due to blown fuses or other causes, such power has very rarely been used. But because of the frequency and certainty with which the secondary clocks are set by means of my invention, it is no longer necessary to provide at great expense against all minor interruptions of the source of current supply. I do not mean that I have dispensed with batteries in all cases but the objection to any source of power because it is subject to minor interruption is no longer as serious as formerly.

With these and other objects in view the invention comprises the various features hereinafter more fully described and particularly defined in the claims.

Fig. 1 shows one of the preferred embodiments of my invention;

Fig. 2 shows a modification of the hourly contact device, the function of which is performed by the corrective selector in Fig. 1; and

Fig. 3 shows the stop lever and stop just after operation.

Referring more in detail to the drawings, 11 represents the escapement wheel shaft of the master clock which carries a contact arm 12 which makes contact once a minute with the contact finger 13 carried by the escapement. This is the usual construction and needs no further description.

A corrective selector is shown generally at 15, the purpose of which is to make a contact once an hour. Most of this device is constructed like an ordinary secondary clock and such usual features will be described first. The shaft 16 rotates once an hour and corresponds to the hour shaft of the ordinary secondary clock. The lever 17 is pivoted at 18 and at one end carries the armature 19 on which the magnet 20 operates. At its other end the lever 17 carries a pawl 21 and has attached thereto a spring 22 for retracting the lever after the magnet has ceased to pull. The lever, magnet and pawl 21 cooperate to advance the ratchet wheel 23 which is non-rotatably fixed to the shaft 16 in a manner well understood in the art. Pawl 24 prevents backward rotation of wheel 23. Also non-rotatably fixed to shaft 16 is a second ratchet wheel 25 with the teeth set in the opposite direction. This wheel 25 is partly broken away to show a part of wheel 23 which lies behind it. Wheel 25 is

engaged by a pin 26 carried by the lever 17 when said lever is not actuated by the magnet. Ratchet wheel 25 and pin 26 therefore cooperate to prevent the shaft 16 from jarring forward during the time between impulses.

Proceeding to a description of the novel features of this device, carried by the lever 17 is an arm 27 which pushes together the contacts 28 and 29 during the brief period the magnet 20 is actuated. Carried by the shaft 16 is an arm 30 which pushes together contacts 31 and 32 once each hour. A wire 33 connects these two sets of contacts in series.

In operation the corrective selector maintains the contacts 31—32 closed for a full minute (e. g. the last minute of each hour) but as this would be wasteful of current the full circuit is completed only when the contact at 28—29 is also made, this latter contact being momentary. To preclude a double momentary contact, once when arm 30 is brought into operative position and once when it is moved out of operative position, it is preferable that arms 27 and 30 be so positioned that during the retractile operation of lever 17 by spring 22, the contact at 28—29 is broken before the contact is made at 31—32. That is, during that operation of magnet 20 when the arm 30 is moved to the 59th minute position the contacts 31—32 are closed after contacts 28—29 open; and during the next operation of magnet 20 when the arm 30 moves to the even hour position, the contacts 28—29 close before contacts 31—32 open, thereby sending a momentary impulse to the corrective magnets 45 of the secondary clocks through the switches 28—29 and 31—32 in series at the end of each hour.

At 34 is shown generally a secondary clock mechanism. Those parts which are old but necessary to an understanding of my invention will be described first. The shaft 35 is rotated once each hour. Carried by the shaft 35 is a ratchet wheel 36 which is impelled forward once each minute by the pawl 37 carried by the lever 38. Lever 38 is pivoted at 39 and carries an armature 40 which is attracted by magnet 41. A second ratchet wheel 42 is also carried by shaft 35 and in cooperation with pin 43 prevents shaft 35 from jarring forward during the time between impulses. Pawl 44 prevents backward rotation of shaft 35 and spring 54 retracts lever 38 after magnet 41 has ceased to attract armature 40.

In addition to the usual mechanism described in the foregoing paragraph I employ a corrective magnet 45 which operates on the armature 46 which is carried by stop lever 55. Lever 55 is pivoted at 47 and carries a stop 48, a second stop 49 slightly advanced from the first stop, and a pin 50. Non-rotatably attached to shaft 35 is a cam 51 carrying a pin 52 and having a cam face 53 adapted to be actuated by pin 50.

As shown in Fig. 1, the stop 48 normally stands in the path of pin 52 on cam 51 and if the clock hands actuated by 35 get ahead of time stop 48 stops further advance of the clock beyond the 59th minute position until corrective magnet 45 is energized on the hour to move stop 48 out of the path of pin 52. If the clock has lost time during the hour, pin 50 engages cam 53 to advance the hands to the hour position when magnet 45 is momentarily energized at the end of the hour, stop 49 then moving into the path of pin 52 to limit the advance precisely to the hour position. The engagement of pin 50 with cam face 53 will advance the cam 51 until pin 52 engages stop 49, whether the clock is on time or behind time or ahead of time, and owing to the fact that stop 49 is slightly ahead of stop 48 the return of stop 48 to normal position can not block pin 52. The pin 52 may be provided with a beveled top 70 so that it will come under stop 48 if it does not entirely clear the stop as lever 55 returns to normal position.

The electrical circuits of the system are as follows: Battery 56 is connected by conductor 57 through contacts 12—13, through conductor 58 to magnets 20 and 41 in parallel and thence through conductor 59. The magnets 20 and 41 are therefore operated once each minute by the contacts 12—13. Once each hour another path is provided for the current from battery 56 through conductor 60, contacts 28—29 and 31—32 through conductor 61, magnet 45 and conductor 59 to the battery. The magnet 45 is therefore operated and the secondary clock set once each hour.

From the foregoing it will be evident that the master clock, by the periodic closing of switch 12—13, sends impulses to magnets 20 and 41 once per minute, (or other time interval) magnet 41 stepping the clock hands around intermittently through shaft 35. At the end of each hour magnet 20 causes a momentary impulse to be sent through circuit 56—60—28—29—33—32—31—61—45—59 to energize corrective magnet 45 at the same time as magnet 41, thereby causing the secondary clock to start the new hour on time irrespective of any inaccuracy developed during the preceding hour, as above described.

A modification of the hourly contact mechanism of the corrective selector is shown in Fig. 2, wherein 62 represents the hour shaft of the master clock and 63 a cam non-rotatably fixed thereto. A notch 64 on cam 63 permits projection 65 on arm 66 to spring therein once each revolution. A movable contact 67 is carried by arm 66 and makes contact with stationary contact 68 once each revolution of the hour shaft. It will thus be obvious to those skilled in the art that contacs 67 and 68 can be used in place of contacts

31 and 32 of the corrective selector and be connected in series with a circuit controlled by contacts 28 and 29.

This last modification is not preferred for the reason that it is undesirable to complicate the master clock with extra structural details and it is also undesirable to add to the frictional load of the master clock. Moreover, the cam 63 must be accurately adjusted; a slight change in position will result in contacts 67—68 being closed too soon or too late to cooperate with contacts 28—29. For these reasons I consider the corrective relay shown at 15 preferable for securing the best results although I contemplate as within the broad scope of my invention other equivalent devices.

Only one secondary clock is shown in the drawing, but the wire 58′, 59′ and 61′ may be run to as many different secondary clocks as desired and connected thereto as will be readily understood by those skilled in the art. Also it is common to use relays so that the current through the clock contacts may be low and the parts may be of light weight. For example, contacts 12—13 may only operate an impulse relay; the contacts of the impulse relay may only operate a clock relay; and the contacts of the corrective selector may only operate a corrective relay. But the use of such relays or their omission does not change the underlying principles of my invention.

It will thus be seen that I have provided a simple and accurate means for rectifying errors of the secondary clock at definite intervals of time and to bring all secondary clocks into exact agreement whether fast, slow or correct and whether they all have the same error or different errors.

The apparatus 34 shown at the bottom of Fig. 1 is claimed in divisional application, Serial No. 295,782, filed July 27, 1928.

I claim:

1. In an electric clock system of the impulse type, a corrective selector comprising a ratchet wheel, a magnet for operating said ratchet wheel, a contact momentarily made at each operation of said magnet, a second contact made once each revolution of the ratchet wheel, the two contacts being in series and both contacts occurring simultaneously once only during each revolution.

2. An electric clock system comprising a master clock, secondary clocks of the impulse type, each secondary clock having a magnet and impulse mechanism, a contact in said master clock for sending out electric impulses at frequent intervals, an impulse circuit connecting said contact and said magnet, each secondary clock having a second magnet and corrective mechanism, a corrective selector having a contact for sending out impulses at infrequent intervals, a magnet for actuating said selector and connected to said impulse circuit, and a corrective circuit connecting said second magnet with the contact of said corrective selector.

3. In an electric clock system of the impulse type, a corrective selector comprising a rotatable shaft, a ratchet wheel fixed thereto, a magnet for advancing said ratchet wheel at frequent intervals, a contact controlled by said shaft for making contact once each revolution and a second contact operating simultaneously with said magnet, said two contacts being connected in series.

4. In an electric clock system of the impulse type, a corrective selector comprising a rotor, means including a magnet for intermittently advancing the rotor, a contact which is closed in a predetermined position of the rotor, and a second contact operating simultaneously with the magnet, said two contacts being connected in series.

5. An electric clock system of the impulse type comprising a secondary clock having means for normally advancing the hands and means for resetting the hands, and master apparatus having means for controlling said advancing means and a corrector for periodically actuating said resetting means, the corrector having a switch periodically closed for a prolonged interval and, in series with said switch, a second switch which makes a single momentary closure during said interval.

6. An electric clock system of the impulse type comprising a master clock, a secondary clock controlled thereby, means including a contact in the master clock for sending out impulses at frequent intervals, circuit closing means including a second contact operating at infrequent intervals, a circuit controlled by said second contact for controlling the secondary clock, and means controlled by said first means for causing said circuit closing means to close its circuit only during the time said first-named contact is operating.

Signed by me at Springfield, Massachusetts, this fifth day of October, 1927.

GEORGE F. HARTER.