

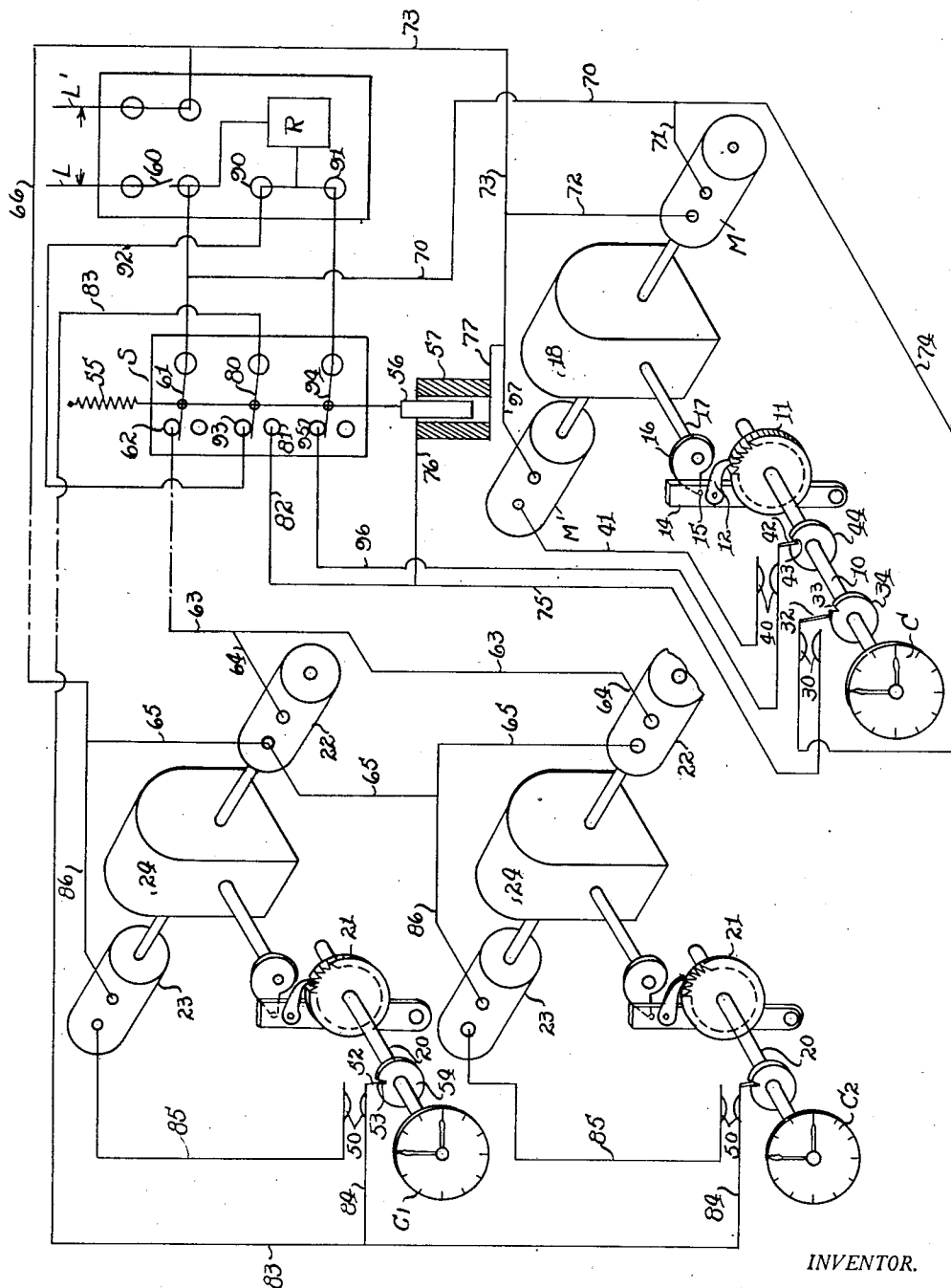
Aug. 24, 1948.

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2,447,798

CLOCK CONTROL MECHANISM

Filed Oct. 7, 1944



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UNITED STATES PATENT OFFICE

2,447,798

CLOCK CONTROL MECHANISM

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Application October 7, 1944, Serial No. 557,651

3 Claims. (Cl. 58—35)

1

This invention relates to time clocks operated by synchronous motors and relates more particularly to mechanism for resetting secondary clocks of this type to indicate the exact time shown by a master or control clock. The invention also relates to mechanism adapted to reset both the master clock and the secondary clocks after a general current interruption.

To the attainment of these general objects, I have provided certain control mechanism of simple and effective construction and which is exceptionally well adapted to its intended purposes.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawing which is a diagrammatic view illustrating my improved control mechanism.

Referring to the drawing, I have shown a master or control clock C, and two secondary clocks C1 and C2. While two clocks only are shown in the drawing, it will be understood that any desired number of additional secondary clocks may be placed in parallel with the clocks C1 and C2.

The master clock C is indicated as having a drive shaft 19 provided with a ratchet wheel 11 intermittently advanced by a feed pawl 12 on a feed lever 14. The lever 14 has a stud 15 engaged by a cam 16 on a drive shaft 17. A low-speed synchronous motor M and a high-speed synchronous motor M' are connected to the cam shaft 17 through differential gearing of any usual type enclosed in a casing 18. The cam shaft 17 may thus be driven at low speed by the motor M, at high speed by the motor M', or at a still higher speed by the combined action of both motors M and M'.

The motor M is commonly designed to turn the cam shaft 17 one revolution per minute so that the sixty-tooth ratchet wheel 11 is advanced one tooth for each minute and thus makes one revolution each hour.

Each secondary clock C1 and C2 is similarly provided with a drive shaft 20 and ratchet wheel 21 and with a slow-speed motor 22, a high speed motor 23, and a differential gear box 24.

The control clock C has a pair of contacts 30 which are normally open but which close when a spring blade 32 drops into a notch 33 in a disc 34 mounted on and rotatable with the shaft 10. A second pair of contacts 40 in the clock C are normally closed but open when a blade 42 drops

2

into a notch 43 in a disc 44, also mounted on the shaft 10.

Similarly, each secondary clock C1 and C2 is provided with a pair of contacts 50 which are normally closed but which open when a blade 52 drops into a notch 53 in a disc 54 mounted on its shaft 20.

A three-pole double-throw switch S is maintained normally in the raised position shown in the drawing by a spring 55, but is shifted to lowered position by a solenoid plunger 56 when its solenoid 57 is energized. Power is supplied through line wires L and L' and the system becomes operative on the closing of a master hand switch 60.

The line wire L is then connected through the switch 60 to the upper blade 61 of the switch S and thence through upper contact 62, wire 63 and branch wires 64 to one terminal of the slow-speed motor 22 in each secondary clock. The return circuit is through branch wires 65 and a return wire 66 to the line wire L'. The motors 22 of the secondary clocks are thus continuously energized and the clocks are regularly advanced at minute intervals.

At the same time the line wire L is connected through wire 70 and branch wire 71 to the slow-speed motor M of the control clock C. A branch wire 72 and return wire 73 completes the return to the line wire L', thus continuously rotating the motor M and advancing the control clock at minute intervals through the feed mechanism previously described.

The discs 34 and 44 on the drive shaft 10 are so set that the normally-open contacts 30 will be closed when the clock C is advanced to the fifty-ninth minute, and the normally-closed contacts 40 will be opened when the clock C is advanced to the sixtieth minute. Similarly, the control discs 54 on the secondary shafts 20 are set so that the normally-closed contacts 50 will be opened when the secondary clocks reach the sixtieth minute.

The notches 33, 43 and 53 in the control discs are of such angular extent that the normally-open contacts 30 remain closed for a minute interval only, and the normally-closed contacts 40 and 50 remain open for a minute interval only. The contacts 40 and 50 close as soon as the secondary clocks are advanced to the first minute.

The operation for time-correction is as follows: At the fifty-ninth minute, the blade 32 drops into the notch 33 of the disc 44 and the contacts 30 close. The line wire L is then connected through wire 70 and its extension 74 to the upper

contact point 30, and thence through lower contact point 30, wire 75 and branch wire 76 to the solenoid coil 57 which operates the triple pole switch S. The circuit is completed through branch wire 77 and return wire 73 to the line wire L'.

The plunger 56 is thus actuated to shift the three blades of the switch S downward to engage the lower contacts, and in particular to engage the middle blade 80 with its lower contact 81 which is connected by a branch wire 82 to the wire 75 previously described.

As the contacts 30 are at this time closed, the circuit is now complete from the line wire L through wires 70 and 74, contacts 30, wires 75 and 82, contact 81 and switch blade 80 to a wire 83 which is connected by branch wires 84 and normally-closed contacts 50 to wires 85 leading to one terminal of each high-speed motor 23. The return circuit is completed to the line wire L' through branch wires 86 and through return wires 65 and 66 previously described.

The high-speed motors 23 will thus start in operation at the fifty-ninth minute and will continue to turn the associated cam shafts at their high speed of ten revolutions per minute until the secondary clocks have reached the sixtieth minute, when the contacts 50 will separate and the high-speed motors will stop. It will also be noted that the low-speed motors 22 were previously stopped when the solenoid 57 was energized and the switch blade 61 was moved downward away from its upper contact 62. Consequently the secondary clocks will now be stopped at the sixtieth minute, which time will be indicated by each secondary clock.

As soon as the control clock C advances to the sixty minute position, the blade 32 will be raised, the contacts 30 will be opened, the solenoid 57 will be deenergized, and the spring 55 will restore the three blades of the switch S to raised position. All parts are thus brought back to their original or normal running position, and the low-speed motors 22 of the secondary clocks are again started in operation.

I have thus provided simple and efficient mechanism for advancing the secondary clocks to show the correct time of the control clock at hourly intervals, if for any reason one or more of the secondary clocks has been delayed and has gotten out of step with the control clock.

It sometimes happens, however, that an interruption of current in the line wires L and L' will throw the control clock as well as the secondary clocks out of correct time. It is customary to provide a reset unit to take care of such current interruption in a synchronous system. I have indicated a reset device R for this purpose, the specific construction of said device forming no part of my present invention. For present purposes, it may be assumed that the device R comprises a spring-driven or battery-driven clock unit which will operate during the current interruption and which will store up the interval of delay until current is again supplied.

When this happens, a circuit will be completed from line wire L through the reset device R to terminals 90 and 91 connected thereto.

The terminal 90 is connected through a wire 92 to the upper contact 93 of the middle switch blade 80, and thence through wire 93, branch wires 84, contacts 50 and wires 85 to the high-speed motors 23 in the secondary clocks, the return being through the branch wires 86 and return wires 65 and 66 to the line wire L'.

At the same time the terminal 91 is connected through the lower switch blade 94 to its upper contact 95 and thence through wire 96, contacts 40 and wire 41 to the high-speed motor M' in the control clock C, the circuit being completed through wires 97 and 73 to the line wire L'. The high-speed motors 23 and M' are thus all set in operation to advance the clocks for the period of delay stored by the reset device R.

During this resetting period, the low-speed motors M and 22 are also operative, as the blade 61 is in normal or raised position. When the delay has been corrected, the reset device R cuts out and normal operation only is continued.

It is desirable to suspend the operation of the reset device R for the period of two minutes at the end of the hour when the ordinary correcting of the secondary clocks takes place, and for this purpose the contacts 40 are provided.

Assuming that the reset device is in operation and with all of the low-speed and high-speed motors active, the blade 32 at the fifty-ninth minute will drop into the notch 33 of the disc 34 in the control clock C, thus closing the contacts 30. This will energize the solenoid 57 which will shift the triple blades of the switch S downward, thus breaking the circuits through which the low-speed motors 22 and the high-speed motors M' and 23 had been operated by the reset device R. At the same time, the middle blade 80 engages its contact 81 and operates the high-speed motors 23 as usual for time correction. This continues until the secondary clocks reach the sixtieth minute, when the contacts 50 open to stop the high-speed motors 23. When the control clock reaches the sixtieth minute, the contacts 30 are opened to deenergize the solenoid 57 and to restore the reset circuits. But at the same time the blade 42 drops into the notch 43 in the disc 44, opening the contacts 40 and breaking the circuit through the high-speed motor M' for the control clock C. The open contacts 50 already hold the high-speed secondary motors inoperative. The low-speed motors M and 22 are now in operation and at the end of the sixtieth minute the contacts 40 will close, restoring the motor M' to control by the reset device R, and the contacts 50 will close, restoring the high-speed secondary motors 23 to control by the reset device.

The reset device R then keeps all high-speed and low-speed motors in operation until the stored delay period has been made up. The reset device then cuts out, leaving the low-speed motors M and 22 only in normal operation.

In the specification and claims, the reference to fifty-ninth, sixtieth and first minutes is illustrative only to identify successive time intervals, and the corrective apparatus may obviously be arranged to operate at any other successive intervals in the hour period.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. A synchronous clock system comprising a control clock, a plurality of secondary clocks, a normally-operating low-speed motor and a normally-inoperative high-speed motor effective to drive each secondary clock, a normally-operating low-speed motor and a normally-inoperative high-speed motor effective to drive the control clock, differential connections between the low-speed and high-speed motors in each clock, means in said control clock to render the low-speed motors in the secondary clocks inoperative and the

associated high speed motors operative just prior to a selected time in each hour for the purpose of correcting the time shown by each secondary clock, means in each secondary clock to stop said high-speed motors when each secondary clock has advanced to indicate said selected time, means in said control clock to start said low-speed motors in said secondary clocks when said control clock thereafter indicates the selected time, a reset device effective to render the high-speed motors in both the control and the secondary clocks all operative to drive said clocks at above normal speed after a current interruption and until the stored interruption interval has been made up in said control clock and in said secondary clocks by said high-speed motors, and means to cause the low-speed motors in all of said clocks to operate simultaneously and cumulatively with said high-speed motors during resetting and under the control of said reset device.

2. In a clock system supplied from an alternating current source, a master clock and a secondary clock, said clocks having normal rate self-starting synchronous driving motors normally energized from such source, and self-starting synchronous resetting driving motors which are normally deenergized but arranged when energized from said source to drive their clocks at several times normal rate, energizing circuits for both secondary clock motors under control of the master clock including synchronizing switch means operated periodically by the master clock and effective during a short clock synchronizing interval just prior to the arrival of said clock at a predetermined time indication and becoming ineffective upon such arrival for opening the circuit of the normal rate motor of the secondary clock and closing the circuit of the resetting motor of the secondary clock, switching means operated by the secondary clock and effective only when said secondary clock is at said predetermined time indication for opening the circuit of its resetting motor, and energizing connections to both resetting motors which connections are independent of the aforesaid master clock synchronizing switch means, said last-mentioned energizing connections including normally closed switching means opened by said master clock during the clock synchronizing interval thereof, and normally open switch means in said energizing connections adapted to be closed when it is desired to reset both of said clocks.

3. A clock system comprising in combination with a source of alternating current supply, a master clock and a plurality of secondary clocks, each clock containing a pair of self-starting synchronous motors, one a correct rate motor for normally driving its clock at time keeping rate and the other a resetting motor for driving its clock at several times correct rate for resetting purposes, circuit connections whereby said motors may be connected to and energized from said source of supply, the correct rate motors being normally connected to said source and the resetting motors being normally disconnected from said source, clock synchronizing circuit control means for synchronizing the clocks at a predetermined time indicating synchronizing position comprising a normally open switch in the energizing circuit to all of the secondary clock resetting motors closed by the master clock during periodic synchronizing intervals, a normally closed switch in the energizing circuit to all of the secondary clock correct rate motors opened by the master clock during such synchronizing intervals and normally closed switches in the energizing circuits of the resetting motors of the individual secondary clocks opened by such clocks when they arrive at said predetermined synchronizing position, and clock resetting control means comprising a normally open resetting switch in the energizing circuit to all of the resetting motors in both master and secondary clocks adapted to be closed when it is desired to reset all of said clocks, said resetting circuit being independent of the aforesaid normally open switch controlled by the master clock but in series relation with the aforesaid normally closed switches in the secondary clocks, and means operated by said master clock for opening said resetting circuit during clock synchronizing intervals.

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