Feb. 21, 1950 L. J. STERN 2,498,462

CLOCK SETTING SYSTEM

Filed Aug. 29, 1942 3 Sheets-Sheet 1

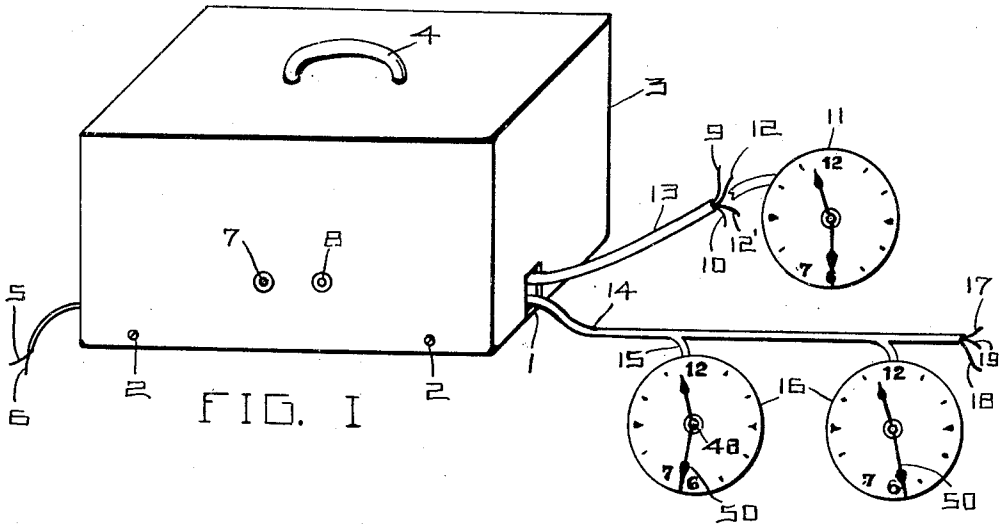


FIG. 1

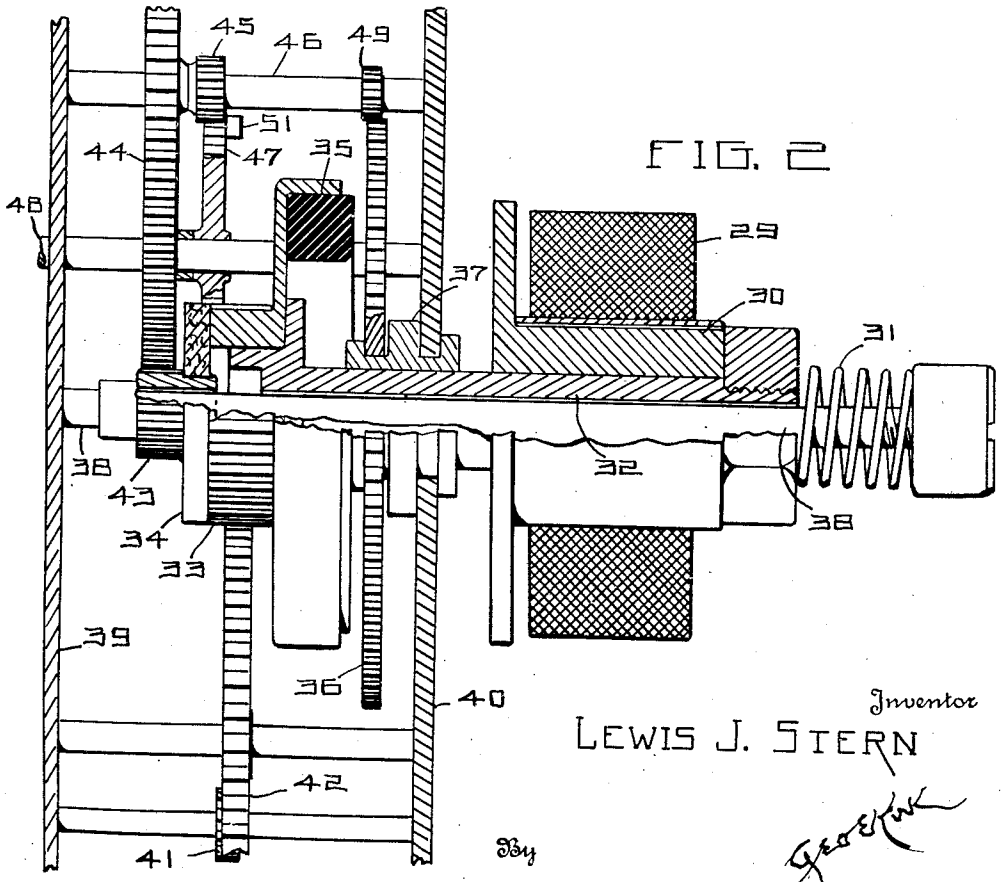


FIG. 2

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Feb. 21, 1950 L. J. STERN 2,498,462

CLOCK SETTING SYSTEM

Filed Aug. 29, 1942 3 Sheets-Sheet 2

FIG. 3

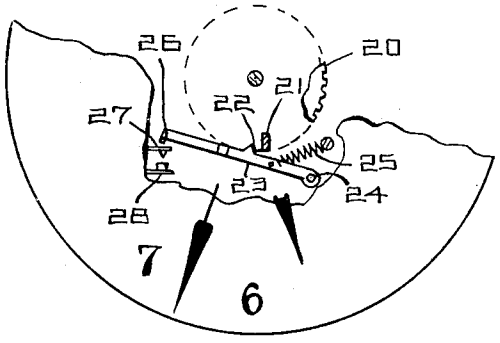


FIG. 4

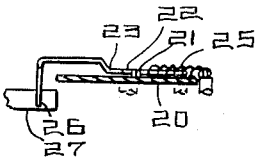


FIG. 5

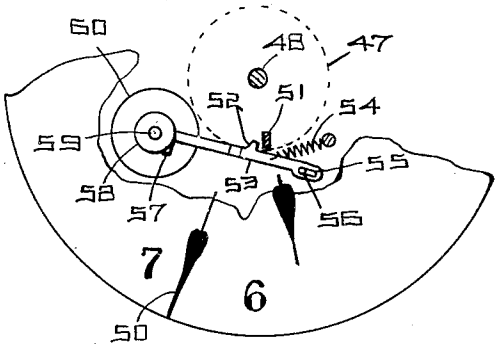


FIG. 7

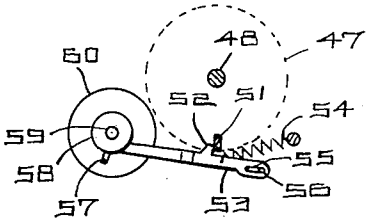


FIG. 6

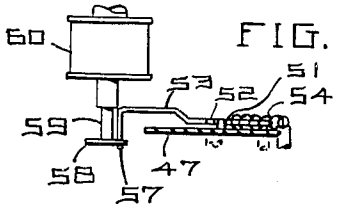
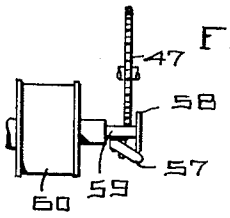


FIG. 8



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Feb. 21, 1950 L. J. STERN 2,498,462

CLOCK SETTING SYSTEM

Filed Aug. 29, 1942 3 Sheets-Sheet 3

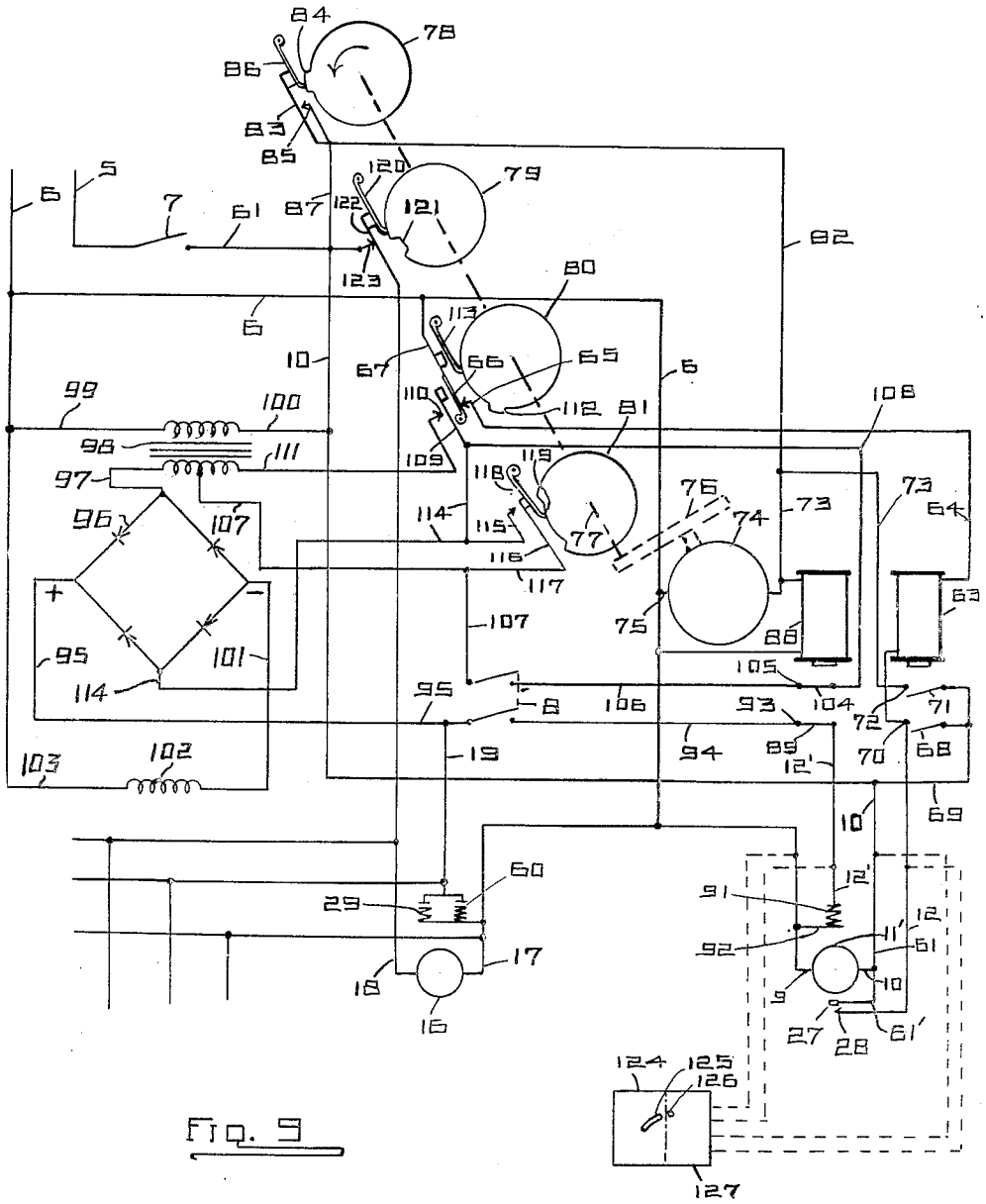


FIG. 9

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2,498,462

UNITED STATES PATENT OFFICE

2,498,462

CLOCK SETTING SYSTEM

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Application August 29, 1942, Serial No. 456,718

2 Claims. (Cl. 58—35)

1

This invention relates to a system of independently operable devices and a monitor device therefor.

This invention has utility when incorporated in synchronous motor operated electric time pieces for master clock periodic resetting of the time pieces as secondary clocks in a system.

Referring to the drawings:

Fig. 1 is a perspective view of a housing or container for clock resetting and control of secondary clocks from a master clock;

Fig. 2 is a view, partly in medial section of a secondary clock speed-up mechanism and controls therewith;

Fig. 3 is a fragmentary view of the master clock switch as a control for the secondary clock speed-up mechanism of Fig. 2;

Fig. 4 is a plan view of the switch controlling arm or lever of Fig. 3;

Fig. 5 is a view of a secondary clock face and mechanism of control therein;

Fig. 6 is a plan view of the lever or control device of Fig. 5 in position at the solenoid;

Fig. 7 is a view of portions of the device of Fig. 5 at the hold or stop position for the secondary clock;

Fig. 8 is a view of the device of the lever cam, and solenoid from the left of Fig. 7; and

Fig. 9 is a wiring diagram of the general system as interconnected from a master clock to secondary clocks.

The General Structure

The special cooperating features herein involve the switch at the master clock (Fig. 3), the control features at the secondary clocks (Figs. 2, 5), and the electric inter-relating control therefor in the housing (Fig. 1). Upon a base 1, screws 2 may assemble a cover or housing 3, having a handle 4. 110 volt, 60 cycle electric current may be fed into the housing 3 by supply lines 5, 6. A switch 7 may cut in the current from the lines 5, 6. Manual resetting, say for the electric clocks after an interval of power failure, may be effected from positioning a switch 8.

From the housing 3, electric lines 9, 10, extend to a synchronous motor of a master clock 11. Additionally, control lines 12, 12', are in a conduit 13 with the lines 9, 10, from the housing 3 to the master clock. The box or housing 3 is a sort of central station of control with a conduit 14 having branches 15 extending to the various secondary clocks 16 of the system. Conductor lines 17, 18, in the conduit 14 provide the power current for synchronous motors at the respective

2

secondary clocks. A third control line 19 is also in the conduit 14.

The Control From the Master Clock Minute Hand to Pick Up Secondary Clock Lagging Minute Hands

For controlling the several clocks with a minimum of discrepancy between the time indications thereof, applicant has herein developed the control for recurring at intervals of one hour. Applicant's experience has been the portion of the hour where clock time changing may be least open for question is 34 minutes after the hour, which time feature of control is adopted at the master clock 11.

The master clock minute hand operating wheel 20 (Fig. 3) has projecting laterally therefrom a lug 21 located to ride against a cam lug 22 projecting upward from the edge of a lever 23. The lever 23 has a fixed fulcrum 24. A tension helical spring 25 pulls the lever 23 upward in the path of the lug 21. The lever 23 is thus yieldably held in the path of the lug 21 of the minute hand operating wheel 20 of the master clock 11. When the lug 21 rides along the lever 23 to the cam lug 22 thereon, the lever 23 is rocked on its fulcrum to shift downwardly offset free end 26 and move a switch contact 27 to abut a companion contact 28. This closing of the switch 27, 28, is for but a brief interval during the continued rotation of the wheel 20. However, this interval is effective thru conductor lines 12, 12' as extending from the clock 11 back to the housing or box 3.

This control connection from the master clock 11 back to the housing 3, in its transmission therethru goes to the control line 19 for the respective secondary clocks 16. In each of these secondary clocks 16, there is a solenoid 29 (Fig. 2). The circuit by way of the line 19, is completed by lines 17, 6. With the solenoid 29 thus energized, a core 30 therein is axially shifted against the resistance of compression helical spring 31. This movement of the core 30 takes with it a brass or non-magnetic sleeve 32 therein which has fixedly mounted thereon a gear wheel 33. Accordingly, in this shifting of the core 30, and sleeve 32, the gear 33 is pulled away from a Bakelite friction clutch face 34, toward which it had been held by the spring 31. From the opposite side of the gear 33 to that as toward the clutch face 34, the gear 33 has a rubber-like or neoprene friction clutch face 35. The unclutching of the gear 33 from the face 34 has now effected a clutching at the face 35 with the face of a gear 36. The gear 36 is coaxial with the gear 33 and is loose in a bearing 37 about the sleeve 32.

In the sleeve 32 is a mounting shaft 38 therefor, which not only locates the spring 31, but is mounted to extend against clock housing plate 39 and thru clock housing plate 40.

The secondary clock synchronous motor 16 operates a driving pinion 41 (Fig. 2) in mesh with a gear 42 with which the axially shiftable gear 33 is in mesh to be driven thereby. When this gear 33 is in its normal position, that is, against the clutch face 34, it serves to drive a pinion 43 in mesh with a gear 44 fixed with a pinion 45 on a shaft 46. The pinion 45 is in mesh with a gear 47 on a minute hand shaft 48.

Therefore, it is to be noted, that the energizing of the solenoid 29, by disconnecting the clutch 34, renders ineffective the drive thru the gears 43, 44, 45, to the gear 47. However, there is simultaneously a reconnection, for the transmission from the gear 33 to the gear 36 for speed-up driving of a pinion 49 fixed on the shaft 46. The speed reduction train 43, 44, is now in reverse but as disconnected from the gear 33, it means nothing. By selecting neoprene for the clutch face 35, it is desired to have such face not subject to deterioration if it be exposed to oil.

The high speed driving from the gear 36 is something which occurs or it is intended to have taken place only when the particular secondary clock be behind time. A secondary clock minute hand 50 which is lagging is, by this connection, speeded up in the minute from 34 minutes after the hour to 35 minutes after the hour.

Forward Limit Set and Release for the Secondary Clock Minute Hands

The discussion as just had has to do with the lagging or too slow secondary clocks, and the cure therefor. When the secondary clock has been running too fast, or overrunning, another control for holding back is herein effective. To this end, the gear 47 (Figs. 2, 5) has a lug 51. As the secondary clock 16 has its minute hand 50 come to the 35 minute past the hour position, the lug 51 moves against a projection 52 on a lever 53. A tension helical spring 54, in pulling the lever 53 upward into the path of the lug 51, shifts the lever 53 longitudinally for a slot 55 to ride on fulcrum pin 56. Accordingly, when the lug 51 strikes the hump or projection 52, it shifts the lever 53 lengthwise, to move the fulcrum pin 56 from the end of the slot 55 toward the projection 52, away therefrom and toward the fulcrum end of the lever 53.

Accordingly, when the gear 47 on the minute hand shaft 48 is driven, either thru the train 43, 44, 45, or the train 36, 49, 45, and the lug 51 comes into service at 35 minutes past the hour time for the secondary clock 16, the lever 53 is shifted lengthwise and offset cam free end 57 thereof is brought into position at the side of a disk 58 mounted on a plunger or core stem 59 of a solenoid 60. The location is thus given the end 57 of the lever 53 between the disk 58 and the solenoid 60. It follows then, as the solenoid is energized, the disk 58 is moved to carry with it the free end of the lever 53, thereby to move the lever 53 sufficiently to be clear of the lug 51. As thus released, the spring 54, at once resets the lever 53 and its projection 52 for the next cycle operation.

The interval of operation which releases the clutch 34 and connects the clutch 35 is one minute from 34 minutes past the hour at the master clock 11, to 35 minutes past the hour. This electric circuit control is thru the lines 17, 19, as to the secondary clocks, and is at a different voltage for response thru the coil 29, than is required for the coil 60. From the housing 3, a differing or higher voltage control comes in at the 35 minute period past the hour at the master clock for the secondary clock control. This higher voltage, as energizing the coil or solenoid 60, snaps the lever 53 clear of the lug or stop 51, thereby releasing the wheel 47. The minute interval for the clutch 35 having been completed at this time, the clutch 34 at once picks up thru the gear train 43, 44, 45, for the normal driving of the minute hand shaft mounted gear 47 until the next resetting control period be reached at 34 minutes past the next hour.

Wiring Layout

Control motor cut in and cut out

The housing 3 has therein an assembly of electrical devices inter-acting in response to the master clock 11 control lines 12, 12', in transmitting the control to the secondary clocks 16 as responding thru the lines 19, 17, 6.

The power supply line 5, upon the closing of the switch 7, is connected thru a line 61 with the lines 10, 61' to the switch contact 27 at the master clock synchronous motor 11'. For a brief interval in the rotation of the minute hand wheel 20 of the master clock 11, the lug 21 (Fig. 3), throws the lever 23 to close the switch 27, 28.

From the closed switch 28, there is the line 12 to a relay coil 63, with a line 64 therefrom to a switch contact 65. Besides various coils, there is in the housing 3 a motor 74 and a set of cams 78—81 as timing controls actuated from the motor. The contact 65 is in this timing control system at complementary switch contact 66, at this interval closed, so that current flow circuit may be completed from the contact 66 by a line 67 to the power supply line 6. There is but one coil in this circuit, the coil 63, which is now energized. The energized coil 63 now closes a normally open switch 68 which has connection thru a line 69 with the line 10 one way, and the other way with a contact 70, in the line 12 to the coil 63. It is thus seen that the switch 68, 70, is in parallel with the switch 27, 28. Therefrom it follows, that notwithstanding the switch 27, 28, be closed for operation but for a brief interval, in so doing, it has brought in the switch 68, 70, to hold the coil 63 energized.

In addition to the switch 68, 70, the energized coil 63, closes a switch 71, 72, thus connecting the line 69 from the line 10, with a line 73 to one side of a motor 74. The other side of the motor 74 is connected by a line 75 with the line 6. The coil 63 has thus functioned not only for holding in itself from the quick cut in and out operation of the switch 27, 28, but has started the control motor 74.

The motor 74 has a speed reduction transmission 76 therefrom to a shaft 77 on which are located a series of cams. The working cycle is for the motor 74 to rotate the shaft 77 one complete turn. The shaft 77 has fixed thereon cams 78, 79, 80, 81.

In order to maintain actuating current for the motor 74 for the full rotation cycle of the shaft 77, an additional or supplemental power supply connection is provided in parallel with the switch 71, 72. This additional connection is thru a line 82 from the line 73, to a switch contact 83. A cam 84 on the disk 78, once the motor 74 starts, rides away from a spring arm 86. This then allows the contact 83 to close with a switch

contact 85, which thru a line 87 then completes a circuit thru to the line 61, the switch 7 and the line 5. This means that even though the switch 71, 72, should be opened after the motor 74 has started, the power current for the motor 74 will be maintained until the cam lug 84 makes its complete rotation back to ride under the spring 86 and move the contact 83 clear of the contact 85. The switch 86, 85, is thus opened, breaking the power circuit to the motor 74 at the completion of one full rotation of the cam shaft 77.

The switches 71, 72, and 68, 70, at the relay or coil 63 are normally open. However, at the energizing of the coil 63, they are each closed at the same time. Connected to the power line 73 to one side of the motor 74 is a coil 88 with line circuit completing connection therefrom to the line 6. The coil 88 is thus in parallel with the motor 74. Similar to the solenoid 29 in the secondary clocks 16, there is a solenoid coil 91 in the master clock 11 having line connection 92 with the line 9 to the motor 11'. From the coil 91 a line 12' extends to a contact 89, normally closed and adjacent the coil 88. With switch 89, 93, closed, there is circuit thru a line 94 to the switch 8, which is normally open. The switch 8 is closed as a manual control for speed-up setting of the master clock 11. For this circuit, there is from the switch 8, a line 95 to a rectifier 96, say as the positive side, with a negative line 101 from the rectifier 96 to a choke coil 102, and by a line 103 to the lines 6, 9, in completing the direct current circuit for the coil 91. The coils 91, 29, are low voltage, say 12 volts, and from the transformer 98, the energizing circuit therefor is from the lines 97, 107, the latter being a mid-transformer take-off or tap line. Considering the positive wave half from the line 97 to the rectifier 96, its circuit is by the line 95, closed switch 8, line 94, closed switch 93, 89, line 12' to the coil 91, and from thence by the lines 92, 9, 6, 103, choke coil 102, line 101, to the rectifier 96. The energizing circuit therefor to the transformer 98 by the line 107 is thru switch 116, 115, closed by the starting of the motor 74 moving the disk 81 to have the arm 118 ride out of the short radius portion 119. The circuit to the switch 115 is by the line 114 from the rectifier 96. The next half wave positive current from the transformer 98, instead of by the line 97, is now by the line 107 thru this last-traced circuit to the rectifier 96 by the line 114. The direct current thus is from the rectifier by the line 95 and the hereinbefore traced circuit back by the line 101, while the energizing circuit therefor by the line 114 passes back to the transformer 98 by the line 97.

Simultaneous manual setting of the master and secondary clocks

The manual setting of the master clock 11 is achieved by the operator observing the clock 11 when the switch 8 is closed, and opening the switch 8 as the energized coil 91 has thru a clutch 35 with a wheel 36 operated the minute hand operating wheel 20 of the master clock, to bring the minute hand of the clock up to the desired clock setting position. The occasion for this manual control is at starting initially, or to correct the system after an out-of-service interval, as from lack of electric power supply. The energizing of the coil 88, which is effected at all times that the motor 74 is running, opens the switch 89, 93, and thus provides a positive safeguard against any manual disturbance during the automatic functioning of the control in the housing 3. With the switch 89, 93, open there is not a power supply to permit an energizing of the coil 91 in the master clock 11. Therefrom it follows that the driving clutch 34 from the motor 11 is continuously in driving relation for operating the minute hand operating wheel 20. In this manual resetting, the coils 91, 29, are in parallel, which means that the direct current in energizing the coils 29 at the secondary clocks 16, brings about a resetting of the entire system as the master clock 11 is set.

Low voltage connections for the coils 29, 91

These clock setting speed-up drive coils 29, 91, are low voltage. The control therefor is coincident or in parallel, for at the coil 88, besides the normally closed switch 89, 93, is a switch 104, 105. One way from the switch 104, 105, is a line 106, which as the switch 8 be manually closed, is connected with a line 107 to a mid or intermediate take-off connection with a transformer 98. The transformer 98 has a line connection 99 to the power line 6 and another line connection 100 to the power line 10.

The other way from the switch 104, 105, a line 108 extends to a line 114 and the rectifier 96, which has its other side connected by a line 97 with the transformer 98. The direct or continuous current is from the positive side of the rectifier 96 thru the lines 95, 19, to the coils 29, 91, and from thence by the lines 17, 6, 103, thru the choke coil 102 and the line 101 to the rectifier 96. The energizing current for this circuit is from positive half waves coming alternately from the lines 97, 107, the transformer 98 to the rectifier 96 for the low voltage coils 29.

High voltage connection for the coil 60

A lug 112 on the cam disk 80, just prior to completing the counterclockwise single rotation cycle (Fig. 9), rides against a spring arm 113, first to open the switch 66, 65. This de-energizes the coil 63 for simultaneously opening the switches 71, 72, and 68, 70. The lug 84 on the cam disk 78 is at this time still away from opening the switch 83, 85, and accordingly the motor 74 remains running. During this short interval of continued running of the motor 74 until the switch 83, 85, be opened, the opening of the switch 65, 66, by the lug 112 on the cam disk 80 has connected a switch contact 109 from the line 108, with a switch contact 110 to a line 111 to a higher voltage connection relation with the transformer 98 than the connection 107.

During the cycle interval of the lug 84 on the cam disk 78, and the lug 112 on the cam disk 80, the cam disk 81 has its short radius portion 119 exposed to have a spring arm 118 ride therein, thereby to leave during this period a switch 115, 116, open. At the starting of the operation cycle, as the arm 118 rides out of the reduced diameter portion 119, the switch 115, 116, is closed to connect mid transformer line or low voltage connection 107 with a line 117, thru the switch 116, 115 and the line 114 in completing transformer energizing circuit, to the rectifier 96. This closing of the switch 116, 115, is for a circuit in parallel with the switches 104, 105, and 8 providing an additional circuit for energizing the rectifier 96 from the transformer 98, in which additional circuit these switches 104, 105, 8, are in series. The functioning of the cam 80 to have its lug 112 close momentarily the switch 109, 110, for the high voltage connection from the transformer 98

by the line 111, to pass by the line 114 to the rectifier 96, takes place as the switch 115, 116, is opened at the cam disk 81, during the automatic control program sequence of the supplemental circuits.

The higher voltage, say 24 volts, for the coil 60, as against 12 volts for the coils 29, 91, energizes the coils 60 for shifting the levers 53 clear of the lugs 51. The secondary clocks 16 are thus released for normal running.

The choke coil

As disclosed herein, the electric clocks 11, 16 are power actuated from an alternating current electric circuit. The control elements as of alternating current are completed thru the power supply lines 5, 6. However, the direct current circuits as developed herein, are complete in the wiring diagram showing of Fig. 9. Alternating current cycles or pulsations from the lines 6, 103, on one side, and from the line 5, closed switch 7, the line 61, the switch 123, the line 18, the motor 16, the line 17, the coils 29, 60, the lines 19, 95, the rectifier 96, and the line 101 on the other side are not passed by the coil 102. Furthermore, from the choke coil 102, there is shown direct current line 103, to the line 6 for the several coils 91, 29, 60, from which the circuit as direct is completed by the lines 12', 94, 19, 95. It follows that the direct current control coils 91, 29, 60, do not have their performance disturbed by alternating current.

Secondary clocks transition from resetting

As the interval for the direct current high voltage is about to pass from causing the secondary clock levers 53 to clear the stops 51 for the minute hand wheels 47, there is not accumulated force to put the wheel 47 in motion from the action of the spring 31 having thrust the clutch 33, 34, into transmission relation. The cam disk 79, just before the completion of the control cycle for the shaft 77, has its recess 121 in position for a spring arm 120 to drop thereinto. Thereupon, the switch 122, 123, is opened, and the 110 volt current from the line 61 to the line 18 is interrupted. The motors 16 of the secondary clocks are thus cut out. Immediately thereafter, the arm 120 rides out of the recess 121 at the cycle completion for the shaft 77. The switch 122, 123, is closed. The secondary clocks 16 having thus been precleared of torque disturbance, are now started simultaneously at the reset position dominated and carried thru by the automatic control.

Adaptation to different clock systems

In the event of current failure to the system, a stand-by master clock, operated from a source of stored energy, measures the period of the current outage, whereby on resumption of power to the system, the contacts 125, 126, may be closed to reset the system. This stand-by master clock may be housed in a unit 124, including a synchronous motor device 127 for controlling the operation of the stand-by master clock during normal operation of the system.

The automatic control operation

Regardless of whether the master clock 11, 127, or 126, be in control, under the particular program for hourly corrections, the lugs 51, at any of the too-fast operating secondary clocks 16, come into action at 35 minutes past the hour. Thereby each of these too-fast secondary clocks is stopped for the interval until the hourly incoming minute of the automatic control be completed. As the automatic control nears the end of the 34 minute cut-in and is about to reach the 35 minute point, the coils 60 are energized. The respective secondary clock hold back levers 53 are kicked clear of the lugs 51. All of the secondary clocks 16 in the system are thus simultaneously released to start the succeeding hour, each as set at 35 minutes past the hour.

The too-slow or lagging secondary clocks, each receive control attention commencing at 34 minutes past the hour. The precision of this timing cut-in is from the master clock switch 27, 28. Inasmuch as the master clock operation continuity is not checked, the closing of the switch 27, 28, is of short duration, that is, less than to 35 minutes past the hour, in which one minute the control is to function. The closing of the switch 27, 28, in energizing the coil 63, has such coil maintained energized, by closing the switch 68, 70, in parallel with the switch 27, 28. Accordingly, as the switch 27, 28, is opened, the coil 63 is kept energized.

The energizing of the coil 63, besides closing the normally open switch 68, 70, also closes the normally open switch 71, 72, in circuit to start the motor 74. Upon this starting of the motor 74. the cam disk 78, cuts in the switch 83, 85, for a circuit in parallel to the switch 71, 72. This provides a hold-over to just short of completing the full rotation of the shaft 77, for the motor 74, so that the coil 63 may, in the interval before the lug 84 opens the circuit for the motor 74 to stop, be de-energized by the lug 112 opening the switch 65, 66.

As the shaft 77 starts its counterclockwise rotation (Fig. 9), the cam disk 81 closes the switch 116, 115, and thereby connects the transformer 98 into low voltage supply to the rectifier 95 to energize the secondary clock direct current coils 29. Lines 17, 6, from the coils 29, connect by line 103 to the choke coil 102 in completing the direct current circuit to the rectifier 95 by the line 101. The energizing of the coils 29, overcomes the springs 31 to disconnect the gears 33 from the clutch faces 34. This cuts out the normal speed reduction drive to the minute hand wheels 47. Simultaneously the shifting of the gear 33 away from the clutch face 34, connects the clutch face 35 with the gear 36, for a high speed driving of the minute hand wheel 47. This driving of the wheel 47 can only proceed until the lug 51 catches the lever 53. It is thus seen that any retained connection for the face 35 means slippage as to the wheel 36, until the coil 29 be de-energized. Inasmuch as the too-fast clocks have been stopped by the lugs 51, there is this non-detrimental slippage thruout the system at the secondary clocks as brought to the correct reset position.

The reduced diameter portion 119 at the cam disk 81, allows the switch 116, 115, to open, de-energizing the coils 29. Immediately, the lug 112 closes the switch 109, 110, for a higher voltage connection to the transformer 98 to be effective thru the rectifier 95 for energizing the coils 60. Thruout, the levers 53 are tripped clear of the lugs 51. The shaft 77 rotation is then completed. The control is cut out. The clock system is back in service to run until 34 minutes past the next hour.

What is claimed and it is desired to secure by Letters Patent is:

1. A clock system comprising a plurality of electric motor driven secondary clocks, a transmission in each of said clocks including a normal driving clutch and a high speed clutch, a shiftable

member directly in the transmission between the clock motor and each of said clutches, time indicating means for the respective clocks, said clutches being between the motor and the time indicating means therefor, stop means for the time indicating means between the time indicating means and the normal driving clutch effective as the time indicating means reaches a predetermined position, a master clock having a switch, means in the master clock for actuating said switch at an interval in advance of the predetermined time position for the secondary clocks, circuit means for energizing the respective clocks for the normal operation thereof, in addition to said circuit means an additional electrical circuit means from the master clock switch to the secondary clocks, an electric release means for the stop means, a different electric control means for shifting the normal driving clutch, said release means and control means being energized by said additional electric circuit means, and transmission modifying means actuatable from the master clock switch through the additional electrical circuit means in conjunction with a portion of said circuit means to shift said member for disengaging the normal driving clutch from being driven through the member from the clock motor, to cause the member to connect the clock motor through the member to operate the high speed clutch to bring the secondary clock time indicating means to said predetermined position.

2. A clock system comprising a plurality of electric motor driven secondary clocks, a transmission in each of said clocks including two-way clutch shiftable member directly in said transmission and operable from the clock motor, said transmission one way from the member embodying a normal driving clutch and the other way from the member embodying a high speed clutch, time indicating means for the respective clocks, said clutches being between the motor and the time indicating means therefor, stop means for the time indicating means between the time indicating means and the normal driving clutch effective as the time indicating means reaches a predetermined position, a master clock having

a switch, means in the master clock for actuating said switch at an interval in advance of the predetermined time position for the secondary clocks, circuit means for energizing the respective clocks for the normal operation thereof, in addition to said circuit means an additional electrical circuit means from the master clock switch to the secondary clocks, an electric release means for the stop means including a solenoid, a different electric control means including another solenoid for shifting the normal driving clutch, said release means and control means solenoids being energized by said additional electrical circuit means, and transmission modifying means actuatable from the master clock switch through the additional electrical circuit means in conjunction with a portion of said circuit means and the shiftable member for disengaging the normal driving clutch from being driven through the member from the clock motor, to cause the member to connect the clock motor through the member to operate the high speed clutch to bring the secondary clock time indicating means to said predetermined position.

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