Aug. 14, 1962 A. I. BIORGE 3,048,964

TWELVE HOUR SCATTER CORRECTIVE MECHANISM FOR ELECTRIC CLOCK SYSTEMS

Filed Jan. 21, 1959

2 Sheets-Sheet 1

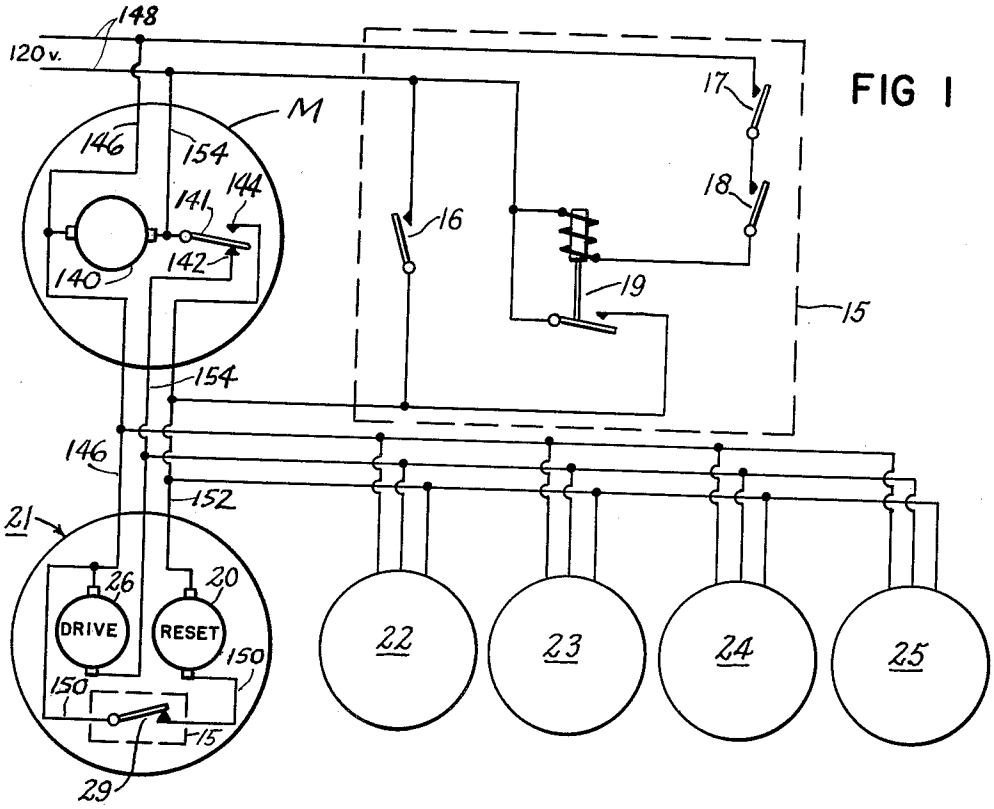


FIG 1

FIG 2 FIG 3 FIG 4 FIG 5 FIG 6

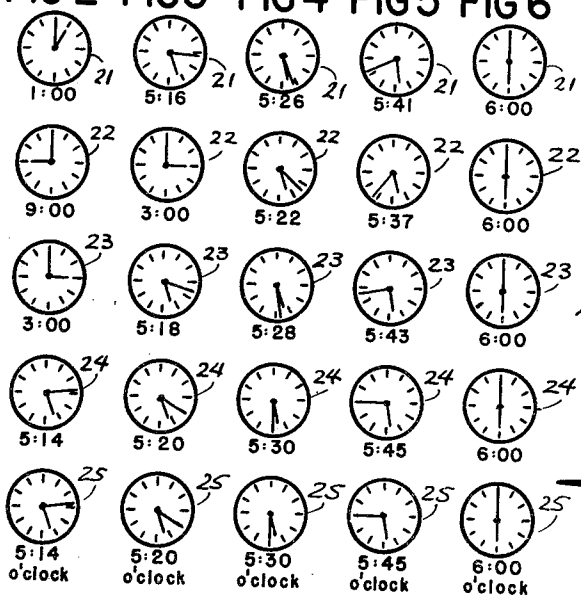
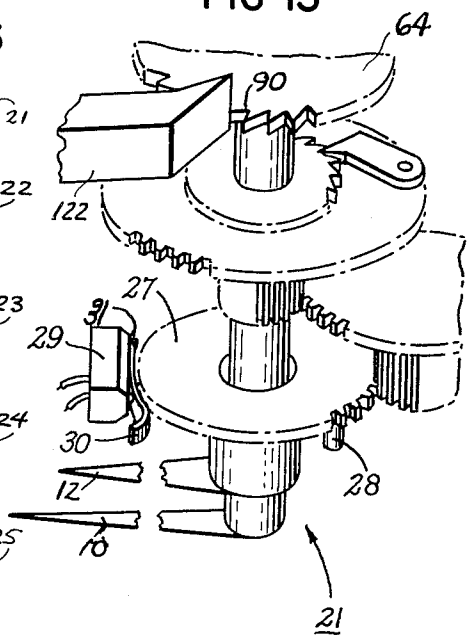


FIG 13



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2 Sheets-Sheet 2

FIG. 7.

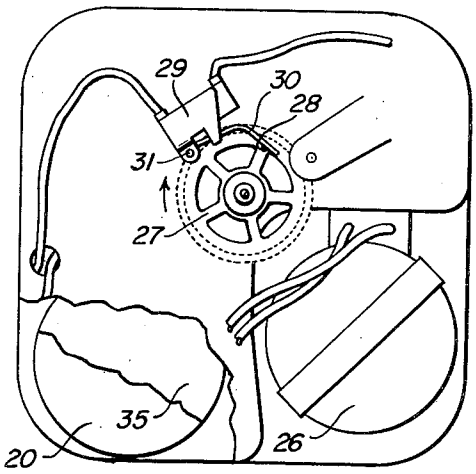


FIG. 8.

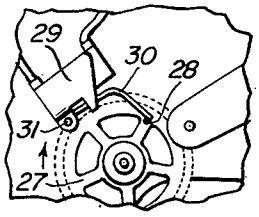


FIG. 9.

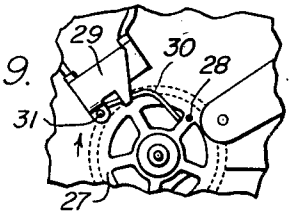
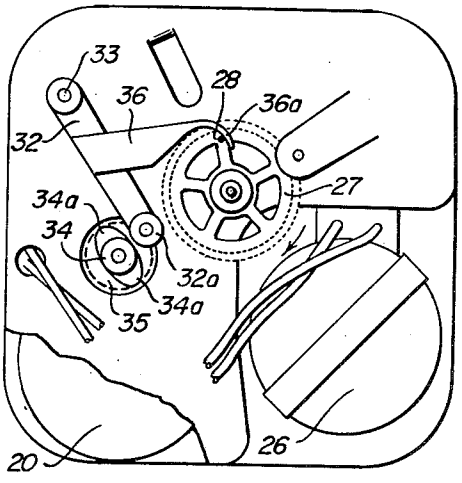


FIG. 10.



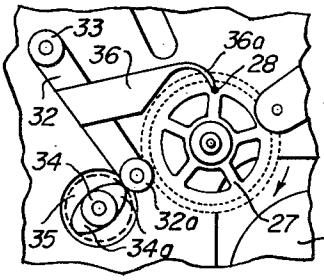


FIG. 11.

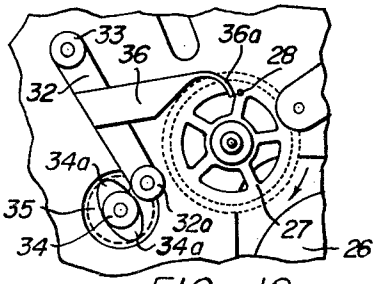


FIG. 12.

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ATTORNEYS

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TWELVE HOUR SCATTER CORRECTIVE MECHANISM FOR ELECTRIC CLOCK SYSTEMS

Alfred I. Biorge, Salt Lake City, Utah, assignor to General Time Corporation, New York, N.Y., a corporation of Delaware

Filed Jan. 21, 1959, Ser. No. 788,080
16 Claims. (Cl. 58—24)

This invention relates to scatter corrective mechanisms for electric clock systems used in schools and other institutions, office buildings, hotels, industrial establishments, etc.

Clock systems of the type concerned include individual electric clocks positioned at desired locations throughout a building. Such clocks are electrically interconnected for synchronization from a master station, which exercises control in response to either automatic or manual supervision.

Due to power interruptions, mechanical misadjustments or wear, and various other factors, the individual clocks are subject to variations in time indications which are indiscriminately scattered throughout the system. If the variations between the individual clocks are less than an hour in extent, they are corrected each hour by mechanism with which all clock systems are equipped. Variations more than an hour in extent require special, so-called "twelve hour," scatter corrective mechanism.

Most of the major clock systems presently available commercially utilize clock movements having a single motor. These systems are equipped with satisfactory twelve hour scatter corrective mechanisms. They are systems, however, which utilize dual-motor clock movements. No twelve hour scatter corrective device heretofore known is applicable to such a movement.

A principal object of this invention is to provide a twelve hour scatter corrective mechanism for a dual-motor clock movement.

A peculiar characteristic of a dual-motor clock movement is that a so-called "re-set" motor, additional to the normal drive motor, is employed to periodically advance the clock at greater than normal speed.

It does this following the transfer to it of the power from the normal drive motor by either automatic or manual means. Various ways of advancing the clock at greater than normal speed by means of the additional or re-set motor are employed for the normal hourly corrections, depending upon the particular make of clock movement.

In one type of dual-motor clock movement, disclosed in United States Patent No. 2,662,367, issued December 15, 1953, to G. L. Riggs, Jr., and assigned on its face to the Standard Electric Time Company of Springfield, Massachusetts, and as illustrated in FIGURE 13 of this application and FIGURE 5A of said patent, a cam rotated by the re-set motor is utilized to intermittently actuate a pawl **122** operative on a ratchet wheel **64** of the clock-advancing mechanism, the ratchet wheel **64** being provided with an open segment **90** for clock-synchronizing purposes. When the pawl **122** drops into the open segment **90**, it rides idly and thereby prevents advance of the clock beyond a predetermined synchronizing time indication. The system provides for this synchronizing action hourly, correcting all clocks which are up to 59 minutes slow. Clocks more than 59 minutes slow will remain slow by even hours, and such scattering will continue until each clock is individually corrected by hand.

Other dual-motor clock movements provide for periodic engagement of the normal clock-advancing mechanism by the reset motor in various ways for advancing the clock at greater than normal speed.

In all these different types of dual-motor clock movements, the normal drive motor is shut off and is not operating while the re-set motor acts to advance the clock at an abnormally rapid rate.

Referring now to FIGURE 1 of the present application and FIGURE 6 of the aforementioned Riggs patent, this is accomplished by providing a master clock M connected to power lines **148**. The master clock has a motor **140**. The master clock M is arranged so that once each hour, as determined by master clock motor **140**, switch **141** which normally connects the drive motors **26** of the secondary clocks **21—25** to the power lines 148 through conductors **146**, **154** and contacts **142** of switch **141** reverses so that the reset motors **20** of the secondary clocks **21—25** are connected to the power lines **148** through conductor **154**, contacts **144**, conductors **152**, **150** and **146**. Thus, as described in the Riggs patent, the secondary clock mechanism **21** (FIGURE 13) will be driven to a predetermined minute indication.

A feature of this invention is the routing of energizing current to the re-set motors of the several clocks of the system at twelve hour intervals for a predetermined synchronizing period while the clock drive motor is operating normally, and the provision of means for preventing abnormally fast re-set advance of such clocks if they are at or when they reach a predetermined correct time indication during such synchronizing period.

The re-set advance preventing means for each clock movement includes a trip member rigidly carried by the twelve hour (hour hand motivating) wheel at a predetermined position thereon and a trippable member extending into the path of movement of such trip member and operable, when tripped, upon control means adapted to prevent abnormal re-setting advance of the clock.

In preferred embodiments, the control means with which the trippable member is associated takes the form of either a normally closed switch controlling the supply of current to the re-set motor, so as to open such switch when tripped, or of a mechanical arrangement operative, when tripped, to disengage the drive between the re-set motor and the normal clock-advancing mechanism.

Further objects and features of the invention will become apparent from the following detailed description of the preferred specific constructions illustrated by way of example in the accompanying drawings.

In the drawings:

FIG. 1 is a wiring diagram showing how the individual clocks and the master control station of an otherwise standard clock system are electrically hooked-up for the purpose of twelve hour scatter correction in accordance with the invention;

FIGS. 2, 3, 4, 5, and 6 are each made up of front elevations of the time-indicating faces of the five individual clocks of the clock system of FIG. 1, the several views being taken at respectively different times during and subsequent to the twelve hour correction period, FIGS. 2–5 each showing scattered time indications from the beginning of the correction period to the end and FIG. 6 showing the finally synchronized time indications resulting from the immediately subsequent, normal, hourly correction;

FIG. 7 represents a front elevation of the movement of an individual clock of the system of FIG. 1 constructed in accordance with a form of the invention which utilizes a miniature electrical switch as the control means for preventing abnormal re-setting advance of the clock, the movement being shown at a time indicating position which is immediately prior to the commencement of the clock-synchronizing correction period;

FIG. 8 is a view corresponding to that of FIG. 7, but showing only significant parts of the movement at a time-

indicating and switch-opening position which is substantially maintained throughout the clock-synchronizing correction period;

FIG. 9 is a similar view showing such parts of the movement at a time-indicating and switch-closing position immediately following the clock-synchronizing correction period;

FIG. 10 represents a front elevation of the movement of an individual clock of the system of FIG. 1 constructed in accordance with a form of the invention which utilizes, as the control means, a mechanical arrangement for disengaging a conventional type of mechanical drive between the re-set motor and the normal clock-advancing mechanism, the time indicating position corresponding to that of FIG. 7;

FIG. 11 is a view corresponding to that of FIG. 10, but in which the parts shown and the time-indicating positions thereof correspond to FIG. 8;

FIG. 12 is a similar view in which the time-indicating position corresponds to that of FIG. 9; and

FIGURE 13 is a perspective view of secondary clock mechanism according to the above cited Riggs patent and as modified according to this invention.

Referring to the drawings:

The twelve hour scatter corrective mechanism of this invention may be applied to any of the conventional clock systems utilizing dual motor clock movements. Regardless of the particular system, the electrical hook-up for the purposes of the invention will be as indicated in FIG. 1. There, automatic supervision is exercised at the usual master clock provided with components according to this invention enclosed by the broken line **15**. Should it be desired to supervise the system manually, only the manual switch circuit **16** need be provided, this being operated on an exact time schedule conforming to that arranged for the twelve hour synchronization period in automatic supervision.

The special master clock components enclosed by broken line **15** comprise a twelve hour switch **17** arranged to be closed for an extended period short of an hour, e.g. for fifty minutes, once every twelve hours. Considering the construction of conventional clock movements, this must be within the time period from 5:00 to 7:00 o'clock, preferably from 5:00 to 5:50 o'clock. Included, also, in series circuit with the switch **17**, is a timer-controlled switch **18** arranged to be closed for something in excess of twelve minutes each hour, preferably shortly after the hour, e.g. fourteen minutes, for a period of say sixteen minutes. A normally open relay **19** the operating coil of which is in series circuit with these time-controlled switches **17** and **18** controls the supply of current from a suitable source of electricity, e.g. the standard 120 volt lines **148** indicated, to the re-set motors **20** of the respective clocks **21–25**. Thus, when both switches **17** and **18** are closed, relay **19** is energized to closed position, which routes energizing current to re-set motors **20** of the several clocks of the system.

It can be seen from the hook-up indicated that during 12-hour scatter correction according to the present invention the normal drive motors **26** of the respective clocks **21–25** continue to be energized during the times that the re-set motors **20** are energized. The carrying out of twelve hour corrections under such circumstances is a significant feature of the invention.

The clock movements of all the individual clocks **21–25** are identical. Each is provided with some conventional means (e.g., as shown in FIGURE 13) for correcting the time indication hourly in response to hourly energizations of the re-set motor by transfer of switch **141** of the master clock M. Such means are merely incidental to this invention, and, while they should be provided in order to obtain complete twelve hour correction, the construction and the manner in which they are provided have nothing to do with the operation of the mechanism of this invention.

Besides the normal drive motor **26** and the re-set motor **20**, each clock movement has the customary twelve hour wheel **27**, FIGS. 7–13, which motivates the hour hand **12** of the clock, see FIGS. 2–6. In accordance with the invention, the twelve hour wheel **27** carries a trip member, here shown as a pin **28**, rigidly projecting from the front face of the wheel near its rim.

As mentioned hereinbefore, the mechanism of the invention also comprises means for controlling the re-set advance of the clock through the conventional drive interconnecting the re-set motor with the clock-advancing mechanism, and a trippable member extending into the path of movement of the trip member and associated with such re-set advance control means, for causing the latter to prevent re-set advance of the clock when tripped. Also as mentioned hereinbefore, such control means may take different forms, including a miniature switch for interrupting the supply of current to the re-set motor and a mechanical arrangement for disengaging the drive between re-set motor and clock-advancing mechanism.

The clock movement shown in FIGS. 7–9 and 13 utilizes a normally closed, miniature switch **29** as the control means. A switch-actuating arm **30**, pivoted at **31** and extending into the path of movement of pin **28** to be tripped as rotation of the twelve hour wheel **27** brings such pin into pushing contact therewith, constitutes the trippable member.

In this embodiment, the re-set motor may be connected in drive relationship with the clock-actuating mechanism in any suitable manner.

The clock movement shown in FIGS. 10–12 and 13 represents a particular commercial type manufactured by the Standard Electric Time Company, the assignee of the said Riggs Patent No. 2,662,367 wherein the re-set motor **20** and clock-advancing mechanism (FIGURE 13) are interconnected by a mechanical drive arrangement, which includes a rocker arm **32** pivoted at **33** and rocked back and forth by a pair of cam members **34***a* extending oppositely from a rotor **34** and operative upon an idler **32***a*. Such rotor **34** is secured to the output shaft **35***a* of a speed reducer **35**, which is driven by re-set motor **20**. The pivoted end of rocker arm **32** is rigidly connected to a lever arm carrying a pawl **122** (FIGURE 13) operative upon a ratchet wheel **64** component to the clock-advancing mechanism, all of which is standard and none of which constitutes a part of this invention.

The control means of the embodiment of the invention shown in FIGURES 10–12 constitutes a lever arm **36** rigidly secured to rocker arm **32** intermediate the ends thereof and having a hooked end providing a finger **36***a* which constitutes the trippable member extending into the path of movement of pin **28**. When pin **28** trips the finger **36***a* of lever arm **36** and thereby raises such lever arm, rocker arm **32** is also raised so that its idler **32***a* is lifted clear of rotating cam members **34***a* and re-set motor **20** is no longer permitted to drive the clock-advancing mechanism.

With a clock system arranged to commence its scatter correction, clock synchronizing action, at 5:14 o'clock, a.m. and p.m., pin **28** of each clock movement will be rapidly advanced until it comes into contact with switch-actuating arm **30** or the finger **36***a* of lever arm **36**, see FIGS. 7 and 10, respectively, as the particular clock reaches a time indication of 5:12 o'clock. By 5:14 o'clock, it will have opened re-set control switch **29** or raised re-set control arm **36** to either de-energize the re-set motor **20** or disengage its drive connection with the clock-advancing mechanism, see FIGS. 8 and 11, respectively. In either event, the abnormal, rapid advance of the clock will be halted. This condition will prevail for the next sixteen minutes, it being realized that during this time the clock will be advanced at the normal relatively slow rate by reason of the continued operation of the normal drive motor **26**. Thus, at 5:30 o'clock, pin **28** will clear the trippable member, **30** or **36***a* as the case may be, and the re-set arrangement, including control means **29** or **36**, will be re-

stored to normal condition, see FIGS. 9 and 12, respectively. But the clocks will not resume the abnormal rapid advance, because timer-controlled switch **18** at the master clock **15** will be opened at 5:30 o'clock to cut off flow of current to the re-set motors.

The re-set means are advantageously arranged to advance the clock one full hour each minute of operation. Thus, a clock three hours slow, for example, will be three minutes slow at the completion of the twelve hour scatter corrective operation in accordance with this invention due to the three minutes required for the correction; but such discrepancy in time indication will be corrected by the next hourly correction carried out in conventional manner by the conventional mechanism provided for the purpose, as referred to hereinbefore.

This is clearly shown by the sequence of time indications of the several individual clocks **21–25** of the system during and immediately after a twelve hour correction period, as illustrated in FIGS. 2–6. In FIG. 2, the two lower clocks **24** and **25** of the system correctly indicate the time as 5:14 o'clock at the start of the correction period. Clock **21** incorrectly indicates the time as 1:00 o'clock, and is, therefore, four hours and fourteen minutes slow. Clock **22** incorrectly indicates the time as 9:00 o'clock, and is, therefore, eight hours and fourteen minutes slow. Clock **23** incorrectly indicates the time as 3:00 o'clock, being two hours and fourteen minutes slow.

Six minutes later, as shown in FIG. 3, clocks **24** and **25** indicate the correct time of 5:20 o'clock, because they have been operating normally. Clock **21** is four minutes slow, incorrectly indicating the time as 5:16 o'clock. This is due to the one minute consumed by the correction or synchronizing operation for each hour corrected. When clock **21** reached the 5:14 o'clock time indication, which stopped the correction or synchronizing operation, it was four minutes slow. For the next two minutes of the six that passed between the showings of FIGS. 2 and 3, it operated normally. Clock **22** has been corrected to the extent of six hours, so that it now incorrectly indicates the time as 3:00 o'clock. Thus it is now only two hours and twenty minutes slow, having lost six minutes during the correction or synchronizing operation. Clock **23** has been entirely corrected, hourwise but, because it lost two minutes during the correction or synchronizing operation, it now indicates the time incorrectly as 5:18 o'clock.

At 5:30 o'clock, the end of the sixteen minute correction or synchronizing period, the two lower clocks **24** and **25** still show the correct time of 5:30. The upper clock **21** is still four minutes slow, incorrectly indicating the time as 5:26 o'clock. Clock **22** reached its 5:14 o'clock time indication eight minutes after the beginning of the period, and, therefore, lost eight minutes due to the correction or synchronizing operation. It now incorrectly shows the time at 5:22 o'clock. Clock **23** is still two minutes slow, indicating the time incorrectly as 5:28 o'clock.

At 5:45 o'clock, the two lower clocks **24** and **25** are still correct, while the three upper clocks **21**, **22** and **23** are still slow by four, eight, and two minutes, respectively, indicating the time incorrectly as 5:41, 5:37, and 5:43 o'clock, respectively.

At 6:00 o'clock, however, the conventional hourly correction mechanism brings about the final correction or synchronizing of the several clocks, so that all indicate the correct time as shown in FIG. 6.

Whereas this invention is here illustrated and described with particular reference to presently preferred specific forms thereof, it should be understood that various changes may be made in such forms and various other forms may be constructed without departing from the essential concepts and teachings hereof.

I claim:

1. In a master clock system including a master clock and at least one secondary clock connected thereto and synchronized thereby, each secondary clock including a drive motor which when energized drives its secondary clock at a rate to normally maintain proper time indication, each secondary clock also including a re-set motor which when energized drives its secondary clock at a fast rate until a predetermined minute indication is attained, the master clock including means for energizing the re-set motors and de-energizing the drive motors periodically to correct the minute indications of the secondary clocks: the improvement comprising, in combination; means at said master clock for periodically energizing the re-set motors for an extended period of time while the drive motors are energized, means at each secondary clock for preventing the re-set motor from driving its secondary clock during said extended period when said secondary clock indicates a predetermined time prior to the beginning of said extended period, said extended period being less than the period of time between minute indication correction cycles of the system and terminating prior to the commencement of the next following minute indication correction.

2. The combination defined in claim 1, wherein said means at said master clock for periodically energizing the re-set motors for an extended period of time comprises a pair of series-connected switches, the first of said switches being closed during each interval between minute indication corrections for a period corresponding to said extended period of time, and the second of said switches being closed for the duration of the interval between the minute indication corrections immediately prior to and subsequent to said extended period of time.

3. The combination defined in claim 2 and an electromagnetic relay at said master clock, said relay including contacts which close a circuit to provide energization to said re-set motors when said relay is energized, the energizing coil of said relay being connected in series with said pair of switches for energization when both of said switches are closed.

4. The combination defined in claim 1 wherein each of the secondary clocks includes an hour wheel, and said means for preventing the re-set motor of each secondary clock from driving its clock comprises control means on the hour wheel at a predetermined position and cut out means actuated by said control means when the clock indicates said predetermined time.

5. The improvement of claim 4, wherein said cut out means is a normally closed electric switch interposed in the electrical supply line to the re-set motor whereby said re-set motor is de-energized when its clock indicates said predetermined time.

6. The improvement of claim 5, wherein said control means is a pin rigidly projecting from a face of the twelve hour wheel near the rim thereof.

7. The improvement of claim 4 wherein each of the secondary clocks includes a ratchet and pawl mechanism driven by its re-set motor to drive it at the said fast rate, said improvement further defined in that said cut out means comprises an actuating arm connected to the ratchet and pawl mechanism, said actuating arm being adapted to prevent operation of said ratchet and pawl mechanism when said arm is actuated by said control means.

8. The improvement of claim 7, wherein the ratchet and pawl mechanism includes a pawl-actuating rocker arm, and means driven by the re-set motor for rocking said arm, said improvement further defined in that said actuating arm is connected with the rocker arm and moves it out of range of said rocking means when said actuating arm is moved by said control means.

9. The improvement of claim 8, wherein said control means is a pin rigidly projecting from a face of the twelve hour wheel near the rim thereof.

10. The improvement of claim 9, wherein said actuating arm is rigidly affixed directly to said rocker arm intermediate the length of the latter.

11. In a master clock including means for energizing a drive circuit, and means for periodically de-energizing

the drive circuit and energizing a re-set circuit to effect minute synchronization of a plurality of secondary clocks connected to the drive and re-set circuits: the improvement comprising hour synchronization means for periodically energizing the re-set circuit for an extended period of time while the drive circuit is energized, said extended period being greater than that required for minute synchronization.

12. The improvement of claim 11 further defined in that said hour synchronization means energizes the re-set circuit for a period of time at least equal to the number of hours between said periods multiplied by the time in minutes that the re-set circuit is required to be energized to effect minute synchronization.

13. The improvement of claim 11 in a master clock which effects minute synchronization once each hour during substantially a one minute period; said improvement further defined in that said hour synchronization means energizes the re-set circuit once every twelve hours for a period of at least twelve minutes while the drive circuit remains energized.

14. In a secondary clock mechanism including a drive circuit and a reset circuit, an electrically powered drive means connected to the drive circuit for driving the clock at a normal rate to maintain proper time indications, an electrically powered reset means connected to the reset circuit for driving the clock at an accelerated rate until a predetermined minute indication is attained, the secondary clock mechanism including an hour wheel; the improvement providing for hour scatter correction upon simultaneous energization of the drive and reset circuits comprising, in combination, a normally closed switch connected in said reset circuit in series with said reset means, and switch actuating means mounted at a predetermined position on the hour wheel, said switch actuating means opening said normally closed switch for an indicated period of time less than the period of time between said predetermined minute indications, and said indicated period terminating prior to one of said predetermined minute indications.

15. In a secondary clock mechanism including a drive motor which when energized drives the clock at a normal rate to maintain proper time indication, a reset motor, a mechanical linkage normally engaged with the reset motor and the clock mechanism for driving the clock mechanism at an accelerated rate until a predetermined minute indication is attained when the reset motor is energized, the clock mechanism including an hour wheel; the improvement providing for hour correction upon simultaneous energization of the drive and reset motors comprising, in combination, means for disengaging the mechanical linkage from the reset motor for an indicated period of time less than the period of time between said predetermined minute indications and terminating prior to one of said predetermined minute indications, and actuating means mounted on the hour wheel controlling the operation of said disengaging means.

16. The combination defined in claim 15 in a secondary clock mechanism wherein the mechanical linkage includes a cam driven by the reset motor and a cam follower driven by said cam, said disengaging means comprising means connected to said cam follower for disengaging the cam follower from the cam.

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