Nov. 22, 1955 D. F. COLE 2,724,233

DEVICE FOR CORRECTING CLOCKS FOR ERRORS OF MORE THAN ONE HOUR

Filed April 7, 1953 3 Sheets-Sheet 1

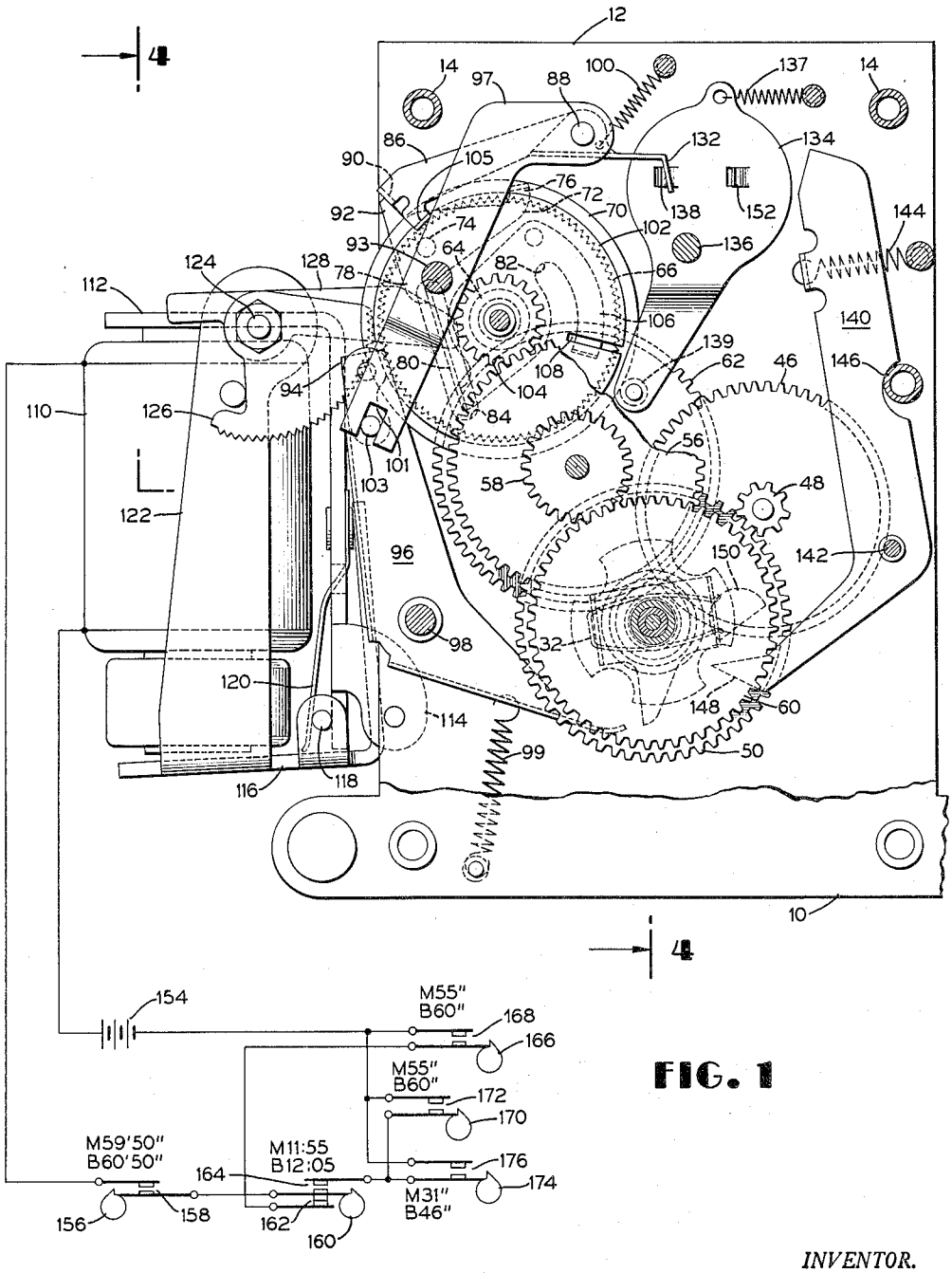


FIG. 1

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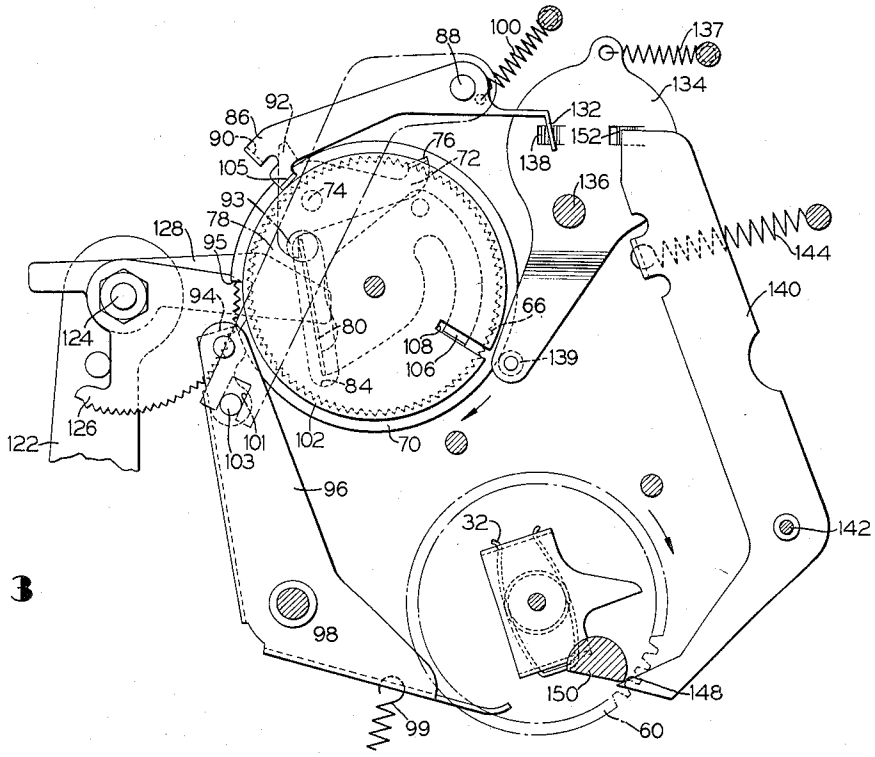


FIG. 3

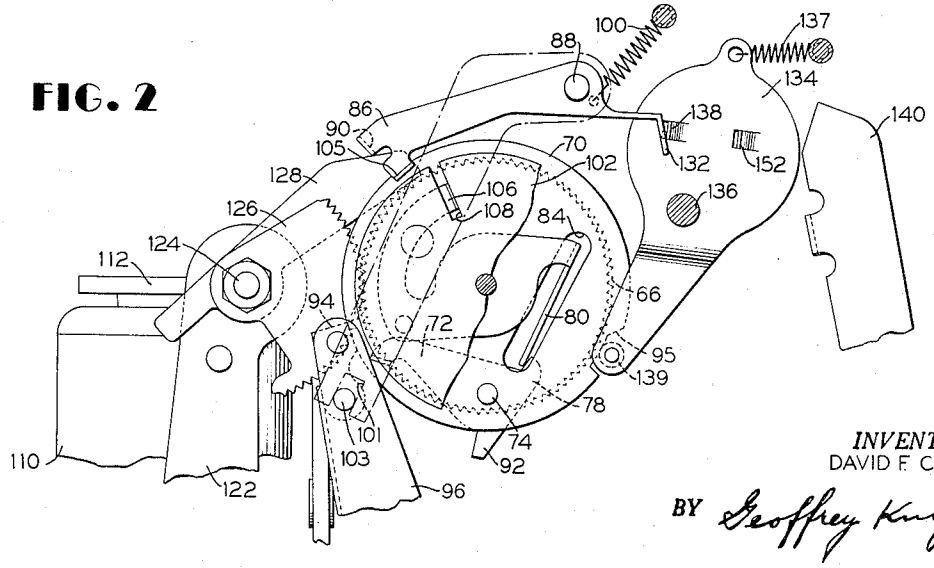


FIG. 2

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Filed April 7, 1953 3 Sheets-Sheet 3

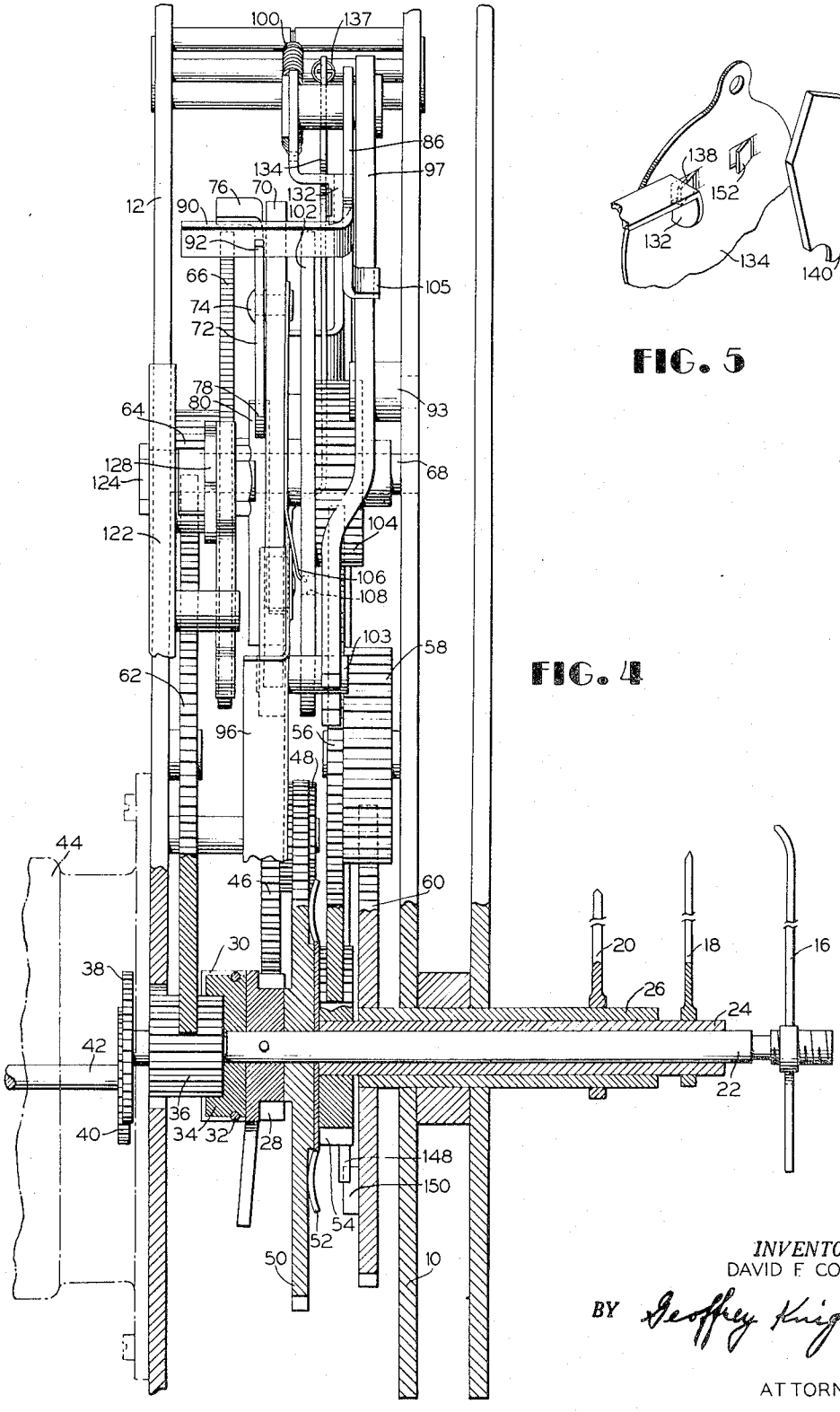


FIG. 4

FIG. 5

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DEVICE FOR CORRECTING CLOCKS FOR ERRORS OF MORE THAN ONE HOUR

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Application April 7, 1953, Serial No. 347,314

11 Claims. (Cl. 58—35)

This invention relates to clock correcting means of the type which is capable of bringing a clock to correct time when in error by more than one hour. Such a correction means may be capable of making a 12 hour correction of a standard clock, for example, or a 24 hour correction of a 24 hour clock.

One scheme for accomplishing the objective indicated has been to correct the clock by acting directly on the hours shaft, to bring it to a predetermined hour position, the minutes shaft being revolved once for each hourly advance of the hours shaft, through the normal reduction gearing of the clock. This has the disadvantage that the reset position of the minutes hand cannot be determined as exactly as if the resetting means acts directly on the minutes shaft.

Accordingly, one object of the invention is to provide a correcting means for a clock which will reset the clock through a plurality of hours, but which will determine the final reset position by direct action on the minutes shaft.

Another previously known scheme for making corrections of more than one hour utilizes separate means acting on the hours shaft and minutes shaft, the gearing between these two shafts including slip friction means.

Another object is, therefore, to provide an hourly correction mechanism for a clock with supplementary means acting through said hourly correction means, to correct the clock for an error of more than one hour.

Another object is to provide a clock correcting means of the kind last mentioned, in which the supplementary means for making corrections of more than one hour is very simple and economical.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a front elevation of a clock embodying the invention, with parts broken away,

Figs. 2 and 3 are elevational views of portions of the mechanism shown in Fig. 1, with the parts in different positions.

Fig. 4 is a section substantially on the line 4—4 of Fig. 1.

Fig. 5 is a detail perspective view of the latch mechanism.

In the drawing the invention is shown embodied in a synchronous motor secondary clock rather similar in its general construction to the one shown in Larrabee patent, No. 2,569,815. The clock mechanism is mounted between two plates 10 and 12 connected into a rigid frame by pillars such as 14. The seconds hand 16, the minutes hand 18, and the hours hand 20 are mounted, respectively, upon nested shafts 22, 24 and 26. At its rear end the shaft 22 has pinned to it a pinion 28 which is an integral part of a cage 30. A U shaped spring 32 mounted in cage 30 bears frictionally in a groove of a round clutch collar 34 revolvably mounted on the inner end of shaft 22. The clutch collar 34 has an internally toothed socket which receives a pinion 36 driven at the rate of one revolution per minute through gears 38 and 40 by the shaft 42 of a synchronous motor 44. Gears 38 and 40 are merely diagrammatic representations of a reduction gearing which provides the proper rate of revolution of the pinion 36.

The seconds shaft 22 drives the minutes shaft 24 through a conventional gear train consisting of gears 46, 48 and 50. The latter gear turns at the rate of one revolution per hour, its rotation being transmitted through a spring spider 52 to a gear 54 rigidly fixed to the minutes shaft 24. In a similar way the hours shaft is driven from the minutes shaft through gearing consisting of the gears 56, 58, 60, the latter being rigidly fixed to the hours shaft 26.

An idler gear 62 meshing with the pinion 36 drives another pinion 64 rigidly fixed to a serrated disc 66, called the reset drive ratchet. This disc rotates continuously at the rate of one revolution per minute on a shaft 68. Coaxial with the reset drive ratchet 66, and mounted on its same shaft 68, is a stop disc 70. A clutch dog 72 pivotally mounted at 74 on the disc 70 has an ear 76 which overhangs the reset drive ratchet 66. A tail portion 78 of the clutch dog bears against a spring extension 80 of a formed sheet spring member 82 (see also Fig. 2). This spring member is riveted to the opposite side of the stop disc 70 from the dog 72 and its spring extension 80 extends through an elongated slot 84 of the stop disc. By the spring extension 80 the pivoted clutch dog is urged in clockwise direction, tending to engage the reset drive ratchet 66. However, the clutch dog is normally held disengaged by a trigger 86 pivoted at 88 on a bar 97 which is rockably mounted on a stationary pin 93 projecting rearwardly from the front plate 10. A spring 100 urges the trigger counterclockwise on its pivot, so that an ear 105 of the trigger rests on the bar 97. The trigger is also provided with an arm 90 (Fig. 4) extending rigidly rearward from the trigger across the path of an arm 92 on the clutch dog. The stop disc is held forward in the latched position by a square shouldered detent 94 on a lever 96 pivoted at 98 in the frame plates and urged clockwise by a spring 99. The detent block 94 engages in a notch 95 of the disc 70, while a pin 103 on the lever 96 engages in a notch 101 of the bar 97, to determine the position of the latter. If the trigger 86 is rocked slightly clockwise to release the arm 92, in a manner to be described presently, the clutch dog is released and engages the continuously running reset drive ratchet 66.

The stop disc 70 starts a rotation at the rate of 1 R. P. M. with the ratchet 66. The detent block 94 is cammed out of notch 95, rocking clockwise the bar 97 and moving the trigger 86 slightly forward to the position shown in Fig. 3. The trigger remains in the slightly forward position shown in Fig. 3 while the detent block 94 rides on the periphery of stop disc 70. At the end of the revolution of the stop disc the detent block 94 drops into the notch 95 suddenly, just as the tail 92 of the clutch dog arrives in front of the arm 90. The bar snaps counterclockwise and the arm 90 strikes the tail 92 of the clutch dog, knocking the latter out of engagement with the ratchet disc 66.

Revolvably mounted on the shaft 68 adjacent stop disc 70 is a slotted disc 102, which may be called the "minute hand setting disc." This disc has fixed to it a gear 104 which meshes with the gear 56. The slotted disc 102 is thereby driven at the normal rate of one revolution per hour. The spring plate member 82 has a spring arm 106 the end of which stands outward against the disc 102, for coaction with a slot 108 therein.

When the clock is on time the slot **108** and the spring arm **106** have the positions shown in Fig. 1 at the time a correction signal is received. When the clutch dog **72** is engaged the stop disc **70** makes a revolution in one minute, the end of the spring arm **106** traveling in clockwise direction in a circle and bearing upon the disc **102**. By the time the spring arm **106** has completed this circuit the slot **108** has moved down to a position such that the end of the spring arm just comes into contact with the lower edge of the slot as the stop disc **70** is latched up. On the other hand, if the clock is slow the slot **108** will be at some higher position than that shown in Fig. 1 and the end of the spring arm **106** will engage the lower edge of the slot and move the disc **102** forward at the rate of 1 R. P. M., instead of the rate of 1 revolution per hour, at which it is driven by the normal clock gearing. This accelerated motion of the disc **102** is transmitted through the gears **104**, **56** and **54** to the minutes shaft and through the gears **58** and **60** to the hours shaft, restoring the minutes and hours hands to correct time.

The correction signal is received by a correction magnet **110** mounted by its yoke **112** and ears **114** upon the frame plate **12**. An armature **116** is mounted on the yoke **112** by its pin **118** engaged by a spring **120**. An arm **122** of the armature carries at its upper end a pivot pin **124** on which is mounted a toothed rocking sector **126**. When the magnet **110** is energized the armature rocks clockwise and the toothed sector **126** engages the continuously rotating reset drive ratchet **66**, being rocked thereby in counterclockwise direction in Fig. 1. If the toothed sector **126** is held in engagement with the toothed disc **66** for a period of say 3 seconds of continuous signal an arm **128**, called the "delay cam," rigidly but adjustably connected to the toothed sector, is raised far enough to engage arm **90** of the trigger **86**. Thereby the trigger is lifted and the clutch is released for engagement.

12 hour correction

The mechanism described so far is rather similar to that disclosed in the above-mentioned Larrabee patent and is sufficient to correct the clock for errors within a single hour. In accordance with the present invention means are provided to enable the same mechanism to be used for correction of the clock for greater errors. By the additional means now to be described errors up to 12 hours can be corrected.

The trigger **86** has a tail **132** which extends parallel to a reset latch in the form of a spring plate **134**. This reset latch is fixed to a shaft **136** rockably mounted in the side plates **10** and **12**. The reset latch is pulled by a spring **137** so that a roller **139** on its lower end rests against the stop disc **70**. With the latch plate in this position the movement of the trigger **86** by the delay cam **128** is not sufficient to make its tail **132** pass over the end of a lug **138** and become latched thereby. However, when the stop disc is turning in response to a correction signal and the notch **95** allows the roller **139** to move to the left (see Figs. 2 and 5), the lug **138** moves to the right and a movement of the trigger **86** by the delay cam in response to a signal at this time will cause the tail **132** to latch behind the lug **138**. When this occurs the trigger **86** will not be moved to release the clutch dog at the end of one revolution, but will remain clear of the clutch dog arm **92** until the trigger is released from the lug **138**. In this way the slotted disc **102** can be made to rotate continuously for a plurality of revolutions by the stop disc **70** and the spring arm **106**, driving the minute and hour hands forward through a corresponding number of hours.

The latch plate **134** is flexed to release the tail **132** of the trigger **86** by a so-called 12 hour latch reset arm **140** pivoted on a fixed pin **142** on the frame plate **10**. The arm **140** is normally held by a spring **144** against a stop **146**. Its lower end **148** extends leftward into

the path of a pin **150** on the gear **60** which is fixed to the hours shaft **26**. As the pin **150** travels around it cams the reset arm **140** counterclockwise (Fig. 3), causing its upper end to deflect the latch plate **134** backward, by camming against an outstanding lug **152**.

The operation of the device will now be described with reference to the circuit diagram shown in Fig. 1, also to the operational views shown in Figs. 2, 3 and 5.

Fig. 1 shows the circuit of magnet **110** powered by a battery **154** and controlled by the following cams:

1. Cam **156**, which closes its contact **158** once an hour at 59′ 30″ and opens it at 60′ 30″.

2. A cam **160**, which transfers its contact spring to close contact **164** at 11 o'clock, 55 minutes, each 12 hours and transfers the contact spring back to close contact **162** at 12 hours 5 minutes. These contacts thus remain in the position shown for all but the 10 minute period from 11:55 to 12:05 of each 12 hours.

3. A cam **166**, which closes its contact **168** from 55 seconds to 60 seconds of each minute.

4. A cam **170**, which closes its contact **172** from 55 seconds to 60 seconds of each minute.

5. A cam **174**, which closes its contact **176** from 31″ to 36″ each minute.

With the contact **162** in its normally closed position, at 59′ 30″ of the hour contact **158** closes, preparing a circuit which will be closed by contact **168** at 55 seconds of that minute, to the correction magnet **110**. The correction magnet will remain energized for five seconds, a period long enough to trip the trigger **86**. The stop disc **70** will thus go through one cycle and will be latched up at the end of one minute. This will correct the clock for slowness up to one hour.

At 11 hours 55 minutes contact **164** closes and contact **162** opens. At 59′ 30″ after 11 contact **158** prepares a circuit which is completed by the closure of contact **172** at 55 seconds. This contact remains closed for 5 seconds, causing the trigger to be lifted and the clutch to be engaged. At 12:00′ 31″ contact **176** closes and another 5 second signal is sent to the magnet **110**. The delay cam begins to rise and about 4 seconds later releases the trigger. At the same time, 00′ 35″, the roller **139** drops into notch **95** and the latch **134** is moved slightly counterclockwise, shifting lug **138** a little to the right. In this position of the lug **138** the tail **132** of the trigger is latched behind it, as shown in Figs. 2 and 5.

Let it be assumed, now, that the clock is one hour, 20 minutes slow, due to power outage. The pin **150** is slightly above the position shown in Fig. 1. The spring arm **106** engages in the slot **108** and brings the clock into a position within one hour of correct time at the end of the first revolution of the stop disc **70**. The clutch dog is not disengaged by the trigger **86**, which has been latched up by the time the clutch dog passes the trigger arm **90** on its first revolution. After this pin **150** cams the reset arm **140** and deflects the latch plate **134**, releasing the tail of trigger **86**. The trigger drops onto bar **97**. At the end of the second revolution of the stop disc **70** detent block **94** drops into notch **95** and the clutch dog is disengaged. The clock has been restored to within one minute of correct time, the lateness of one minute which remains being due to the fact that the correction for more than one hour took an extra minute. In fact, the number of minutes which the clock will remain slow after the 12 hour correction will depend upon how many hours the clock was slow when the 12 hour correction signal was received. At 12:05 the cam **160** transfers the contact **162** to closed position and the next hourly correction signal through contact **168** will restore the clock to correct time.

If the hour hand of the clock is on time when the 12 hour correction signal arrives the latch **134** will be in the rearwardly deflected position, pin **150** being against the end **148** of lever **140**. The lug **138** will therefore not be in position to latch the tail of the trigger and the

correction means will respond as for an hourly correction signal.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a clock, minute and hour indicators geared together in a twelve to one ratio, means for driving said indicators at normal time rate, and regulating means for said indicators comprising reset driving means including a clutch to drive the same at an accelerated rate, means to arrest said reset driving means when said minute indicator arrives at a predetermined time indication, including a trigger for disengaging said clutch, latch means to hold said trigger in an ineffective position, and means including an element moved synchronously with said hour indicator for releasing said latch and restoring said trigger to effective position when said element reaches a particular one of all of its possible positions.

2. In a clock, minute and hour indicators geared together in a twelve to one ratio, means for driving said indicators at normal time rate, a rotary element geared to said minute indicator having a radial engaging edge thereon; regulating means including a rotary member having means to engage said edge, driving means to turn said rotary member in a direction to drive said indicators forward at an accelerated rate, clutch means to couple said driving means to said rotary member, and means urging said clutch means toward engagement; trigger means normally holding said clutch means disengaged, signal responsive means to release said trigger means from said clutch means, means to cause said trigger means to disengage said clutch at the end of a revolution, means to latch said trigger means in ineffective position, means responsive to a particular signal for causing said trigger to be latched by said latch, whereby said rotary member is made to execute more than one revolution, and means including an element moved synchronously with said hour indicator for releasing said latch means and allowing said trigger means to be restored to clutch disengaging position when said element reaches a particular one of all of its possible positions.

3. In a clock having minute and hour indicators geared together in a 12 to 1 ratio, means to correct the setting of said indicators for errors greater than one hour, comprising means to drive said minute indicator at an accelerated rate for a plurality of 60-minute cycles, means including an element moved in a fixed simple ratio to said minute indicator for terminating said accelerated drive when said element reaches a predetermined position, and means including an element moved synchronously with said hour indicator for delaying the action of said terminating means until said second mentioned element reaches a particular one of all of its possible positions.

4. In a clock having minute and hour indicators geared together in a 12 to 1 ratio, correction means to drive said minute indicator at a rate greater than the normal time rate for a plurality of 60-minute cycles, means to terminate the drive of said minute indicator by said correction means when said minute indicator reaches a predetermined indication, means adapted to be controlled by a correction signal for rendering said terminating means inoperative for a plurality of 60-minute cycles of said minute indicator, and means including an element moved synchronously with said hour indicator for restoring said terminating means to effective position during a particular one of said 60-minute cycles.

5. In a clock having a plurality of time indicators geared together to operate at a predetermined rate ratio, means for driving said indicators at normal time rates, correction means for driving at an accelerated rate one of said indicators having a higher normal rate, means for terminating said accelerated drive when said higher rate indicator reaches a predetermined position in any one of its cycles and means including an element moved synchronously with one of said indicators having a lower normal rate for delaying the operation of said terminating means for a plurality of cycles of said higher rate indicator.

6. Correcting means for a clock having minute and hour indicators geared together in a twelve to one ratio, comprising correction drive means, means including a clutch for coupling said correction drive means to said minute indicator, said correction drive means being adapted to drive said minute indicator at a rate many times faster than the normal time rate, disengaging means for said clutch adapted to operate when said minute indicator reaches a predetermined position in any cycle, and means including an element moved synchronously with said hour indicator for delaying the operation of said disengaging means through a plurality of cycles of said minute indicator, until said element reaches a predetermined position.

7. Correcting means as described in claim 6, wherein said clutch disengaging means is adapted to be conditioned to release said clutch for engagement for a single cycle or for a plurality of cycles under control of said delaying means.

8. In a clock, a timekeeping mechanism including minute and hour indicators, means to drive said minute indicator normally at the rate of one minute step indication per minute, driving means interconnecting said indicators whereby said hour indicator is normally advanced one hour step indication per hour, correcting means to drive said indicators at an accelerated rate, including means to terminate the accelerated drive of said indicators when said minute indicator arrives at a predetermined position in any cycle, and means to control the number of cycles of operation of said minute indicator by said correcting means before said terminating means is operated.

9. In a self-regulating clock system comprising a master clock, a secondary clock having minute and hour indicators geared together in a 12 to 1 ratio, and a signal channel interconnecting said clocks; means controlled by said master clock for transmitting over said signal channel to said secondary clock two differentiated types of signals, one type every hour and the other type every twelve hours; and correcting means in said secondary clock comprising means for driving said minute indicator, and thereby said hour indicator, many times faster than normal speed; means responsive to an hourly type signal for engaging said correcting means for a single cycle to drive said minute indicator to a predetermined position, said last means being responsive to a 12-hourly type of signal to engage said correcting means for a plurality of cycles; and means including an element moved synchronously with said hour indicator for determining the number of cycles during which said correcting means remains engaged, the disengagement of said correcting means being timed to occur when the minute indicator arrives at said predetermined position.

10. Clock correcting means as described in claim 9, characterized by the fact that said hourly type signal comprises a single pulse while said 12-hourly type signal comprises two distinct pulses, said means for engaging said correcting means including a trigger and a latch device therefor, and means for moving said trigger each time a signal pulse is received, a latch device normally out of position to latch said trigger when moved in response to a signal pulse, and means to move said latch device between the first and second pulses of a 12-hourly signal to a position to latch said trigger when it is moved in response to said second pulse.

11. In a clock, minute and hour indicators geared together in a normal ratio, means for driving said indicators at normal time rate, and regulating means for said indi-

cators including reset driving means to drive the same at an accelerated rate, means including an element moved in a fixed simple ratio to the movement of said minute indicator for arresting said driving means, said arresting means being operable during any revolution of said minute indicator to arrest said reset driving means when said minute indicator arrives at one certain position, means to disable said arresting means for one or more revolutions of said minute indicator, and means including an element moved synchronously with said hour indicator for

reenabling said arresting means when said last mentioned element reaches a certain one of all of its possible positions.

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