



National Association of

WATCH & CLOCK
Collectors, Inc.

NAWCC Chapter 52 - Los Padres

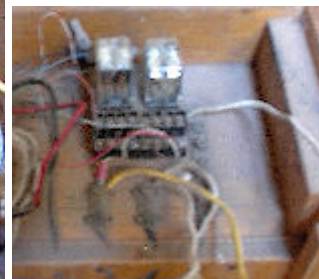
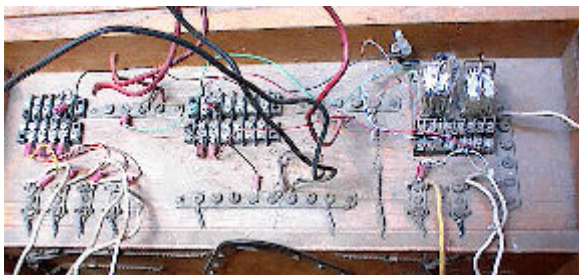
Standard Electric

Needs the front glass but I think its all there. I have the hands in an envelope inside the case.

Scroll down to see Flexchron Synchronous Clock and Programming System Operation and Maintenance manual

I don't believe the manual has anything to do with this clock. Just something I had in my library that I thought might be helpful to post.





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APPENDIX

I. GENERAL THEORY

A. During normal system operation the secondary clocks run on their own individual 1 RPM synchronous motors.

Note: A synchronous motor operates on the principle of changing magnetic fields. Its speed depends on the input power's "cycles per second" rate. Small changes on voltage do not affect the motors.

A second synchronous motor (60 RPM) is used in each secondary movement to synchronize the secondary clocks with the Master Clock. Provision is made (in the Master Clock) for two types of correction.

1. ~~During~~ ^{Following} a short power failure, the secondary clocks will advance up to 55 minutes on the hour following the power failure. This is accomplished by electrical and mechanical means. A notch in the minute and seconds drive wheels of the secondary clock ("dead-spot") prevents the reset mechanism from resetting beyond the hour. Therefore, when the drive motors stop, the reset motors can only advance the minute and second hands to the next hour.
2. Since it is possible for the clocks within the system to be more than one hour apart Twelfth Hour Correction ("scatter correction") is provided twice each day. By running both the drive and reset motors, the clocks advance rapidly to the next hour, where they "slow down" while the drive motor moves the hands past the "dead stop". This continues until a special mechanism in the secondary clock prevents further rapid advancing. This brings all of the secondary clocks to within one hour of each other, independent of the time they previously indicated.

All "on-time" clocks are at the position where rapid advancing is locked-out, and therefore continue to function normally.

To fully synchronize the minute and second hands another correction, as described in par. #1. above, is sent to all secondary clocks on the hour following the Twelfth Hour Correction.

B. A spring driven reserve assembly keeps the Master Clock in operation during power failures. Key wound units (~~model with the reserve~~) continue to run for 12 to 15 hours; Motor wound units (~~model with the reserve~~) continue to run for 20 to 25 hours.

C. Program signals are operated by relays in conjunction with "Memory Tapes" and contact fingers in the Master Clock. The tapes are driven by a sprocket drum which is directly attached to the Master Clock movement.

II. MASTER CLOCK FUNCTIONS AND OPERATION.

The GRC Master Clock operates from a 120 volt, single phase power source. A synchronous motor keeps the Master Clock on time and drives the program tapes, the clock hands and the cams for operating the control switches.

A. Secondary Clock Control Assemblies. The following assemblies are utilized for secondary clock control.

1. The "T" relay (energized during Hourly Correction)
2. The "K" relay (energized during Twelfth Hour Correction)

THE 5 SECOND CONTACT (CLOSES EVERY MINUTE)

3. The 16 Minute Micro Switch (closes 16 minutes of each hour) *
4. The "N" Relay (Power Failure Relay) *
5. The 12th Hour Micro Switch (Closes once every 12 hours). *
6. The One Hour Acro Switch (Closes once every hour). *
7. The 35 Second Contact (Closes once every minute). *
8. The 1 Second Contact (Closes once every minute). *
9. Vertical Terminal Strip "T"*

*See Appendix Drawing #4 for location.

Note: Micro switches are capable of handling only small currents. They are actuated by very little mechanical pressure or travel. Acro switches are similarly actuated, but are capable of handling relatively higher currents.

B. Secondary Clock Driving Operation. The 120 volt input power is fed through a 15 Amp. circuit breaker (mini-breaker) bridged with a neon lamp which glows when the breaker is tripped. Power is fed through an on-off switch to operate the secondary clocks. This same switch controls the 24 volt current limiting transformer which provides energy to the coils of the control relays in the Master Clock relay compartment.

The 120 vac power to operate the secondary clock drive motors (black wire) is supplied to terminals 10, 20, and 30 through the normally closed

--- through the normally closed contacts of the de-energized "T" relay. The circuit to the reset motors (red wire) is open because of the normally open contacts of the de-energized "K" relay. The other side of the 120 vac power is connected directly to both motors (white wire) via the \pm terminals, (common.)

FIGURE 1
"NORMAL OPERATION" DRAWING

C. Secondary Clock Hourly Reset Operation. An hourly reset can only occur after a short power failure (secondary clocks correct up to 55 minutes) or during the Twelfth Hour Reset.

1. Operation. During Hourly Correction, the drive motors of the system are stopped and the reset motors are started. If the minute and second hands are on the hour - the correct time - they are not affected. However, if the minute and second hands are not on the hour, they advance until they reach the next hour. They remain stationary on the hour until the reset motor is stopped and the drive motor re-started. A reset duration of 35 seconds is required to advance both hands one hour.

2. Circuitry. During normal operation the "N" relay is energized and "locked-in" by its own left-hand contact. The right-hand contact controls the circuit to the coil of the "T" relay, which is open during normal operation, thereby preventing resetting of the secondary clocks.

If a power failure occurs:

- a. The "N" relay de-energizes due to loss of 24 volt power.
- b. When power is restored, the secondary clocks still continue to drive since the "T" relay is still de-energized.
- c. On the 59th minute, 12th second of the same hour, the Hour Switch actuates. This does not affect the system until the 35 Second Contact closes.

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d. At the 59th minute, 20th second, both the Hour Switch and the 35 Second Contact will have actuated, allowing current to flow to the "T" relay. The Circuit is from the transformer via T-10, thru the 35 Second Contact, the Hour Switch, the de-energized contacts of the "N" relay, via T-11, thru the normally closed contacts of the Manual Reset Switch, thru the coil of the "T" relay, and back to the transformer.

e. As the "T" relay energizes, current flows from the 120 vac

source, thru the paralleled contact of the "T" relay, to 1R, 2R and 3R, and hence to all secondary reset motors. At the same time, energizing the "T" relay opens the circuit to all drive motors.

f. At the 60th minute, 0 second, the 1 Second Contact closes, allowing current to flow to the coil of the "N" relay. The circuit is from the transformer, via T-10 to the 35 Second Contact, the Hour Switch, and the 1 Second Contact, thru the coil of the "N" relay and via T-9 to the transformer. This one second impulse momentarily energizes the "N" relay. The circuit is now complete from the transformer, via T-10, thru the 12th Hour Switch, the left-hand contacts of the "N" relay, thru the coil of the "N" relay, via T-9 to the transformer, thereby locking-in the "N" relay by means of its own contact.

g. At the 60 minute, 1st second, the 35 Second Contact transfers, opening the "T" relay coil circuit, returning the system to normal "drive".

During the above 35 Seconds all clocks advance up to 55 minutes.

FIGURE 2

"HOURLY RESET CIRCUIT" DRAWING

D. Secondary Clock Twelfth Hour Reset Operation. Twelfth Hour Reset occurs once every twelve hours, between 5:00 and 6:00 o'clock.

1. Operation. The Master Clock synchronizes all secondary clocks that are fast or slow. During this time both drive and reset motors operate. Secondaries that are "on time" are not affected - due to a special lock-out mechanism. All other clocks advance one hour at a time until all read between 5:00 and 6:00 o'clock.

When a particular secondary reaches between 5:00 - 6:00 o'clock its lock-out mechanism stops the rapid advancing while the other clocks in the system continue to advance toward the 5:00 - 6:00 hour. All clocks reaching the 5:00 - 6:00 hour continue to drive at normal speed. A correction duration of sixteen minutes is required to advance a secondary clock twelve hours.

Since some of secondary clocks reach the 5:00 - 6:00 hour before others, there is a small time difference - always less than 55 minutes - between the various secondary clocks. At 6:00 o'clock an Hourly Reset synchronizes all of the second, minute and hour hands in the system.

2. Circuitry. Once every twelve hours - at 4:45 - the calendar advance lever rises on its cam and transfers the 12th Hour Switch, thereby breaking the circuit to the coil of the "N" relay. This action does not change the operation of system until the next contact sequence as follows:

- a. On the 59th minute, 12th second, of the 4th hour, the Hour Switch actuates. This action does not affect the system until the 35 Second Contact closes.
- b. At the 4th hour, 59th minute 26th second both the Hour Switch and the 35 Second Contact will have activated, allowing current to flow to the "T" relay, causing an Hourly Correction. The circuit is from the transformer via T-10, thru the 35 Second Contact, the Hour Switch, the de-energized right hand contacts of the "N" relay, via T-11, thru the normally closed contact of the Manual Reset Switch, thru the coil of the "T" relay, and back to the transformer.
- c. As the "T" relay energizes, current flows from the 120 volt source, through the paralleled contacts of the "T" relay, to 1R, 2R and 3R and hence to all secondary reset motors.
- d. At the 5th hour, 0 minute, 1st second, the 35 Second Contact deactivates, opening the "T" relay coil and returning the system to normal "drive".
- e. At the 5th Hour, 12th minute, the 16 Minute Switch closes, allowing current to flow to the "K" relay. The circuit is from the transformer via T-10, thru the actuated 12th Hour Switch, thru the actuated 16 Minute Switch and via T-8 to the coil of the "K" relay and back to the transformer.
- f. As the "K" relay energizes, current flows from the 120 volt source, through the paralleled contacts of the "K" relay, to 1R, 2R and 3R, and hence to all secondary reset motors. Since the "T" relay is still de-energized, current also flows to all secondary drive motors.

All clocks now advance to the 5:00 - 6:00 hour.

- g. At the 5th hour, 28th minute, 0 second, the 16 Minute Switch deactuates, opening the "K" relay coil and returning the system to normal "drive".

All clocks are now between 5:00 and 5:28.

- h. At the 5th hour, 59th minute, 26th second, both the Hour Switch and the 35 Second Contact will have actuated allowing current to flow to the "T" relay, thereby causing an Hourly Correction to occur, which brings all secondaries up to the correct time. The circuitry is as described in a. and b. above.
- i. At the 6th hour, 0 minute, 0 second, the 12th Hour Switch re-

closes setting up a circuit from the transformer via T-10, thru the 12th Hour Switch, to the left contact of the "N" relay.

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j. At approximately the same time, the 1 Second Contact closes, allowing current to flow to the coil of the "N" relay. The circuit is from the transformer, via T-10 to the 35 Second Contact, the Hour Switch, and the 1 Second Contact, thru the coil of the "N" relay and via T-9 to the transformer.

k. This one second impulse momentarily energizes the "N" relay. The circuit set up in i. above, will now be complete thru the left contact of the "N" relay, thru the coil of the "N" relay and via T-9 to the transformer, thereby locking in the "N" relay via its own contact.

The "N" relay remains locked-in until a power failure occurs, or until the next Twelfth Hour Reset.

FIGURE 3
"12TH HOUR RESET CIRCUIT" DRAWING

III. TESTING AND TROUBLESHOOTING THE DRIVE AND RESET CIRCUITS OF THE MASTER CLOCK.

(The Master Clock motor shall be left running unless otherwise specified.)

A. Hourly Correction Test:

1. Gain access to the terminal strips of the Master Clock by removing the plate on the front of the relay compartment. (Note that vertical terminal strip "T" is used only for connections between the relay compartment and the components on the door.)
2. Turn toggle switch "A" (located at the top-left of the relay compartment) to the left (the "off" position). This stops the secondary clocks and de-energizes all relays (including the "N" relay).
3. Remove all building wires from the terminals marked 1R, 2R and 3R.
4. Connect a voltmeter (120 volt A.C. range) between any of the terminals (removed in 3. above) and one of the \perp (common) terminals.
5. Manually set the Master Clock to 5 minutes before the next hour.

using the knurled knob on the calendar drum.

6. Turn toggle switch "A" to the "on" position.

7. Watch the voltmeter as the Master Clock approaches the hour.

a. There should be no reading on the meter during the 58th minute. Simultaneously with the closing of the 35 Second Contact on the 59th minute, a reading should appear on the meter. This reading should be constant.

b. During the time that the 35 Second Contact is closed, remove the voltmeter probe from the particular "R" terminal to which it was connected and momentarily touch it to one of the terminals marked 1C, 2C, or 3C. No reading should appear. Replace the probe

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on the "R" terminal to which it was originally connected.

c. On the 60th minute, the "N" relay on the Master Clock door should energize and lock-in via its own contact.

d. The "T" relay, which was energized for the 35 Second reset period, should de-energize and remove the voltage from the 1R, 2R, and 3R terminals.

e. Continue observing the voltmeter during the entire 60th minute. No voltage reading should appear on the meter.

8. Analysis of Hourly Correction Test: If the meter readings observed are different than those described above, further tests and adjustments should be made on

a. The Hour Acro Switch.

b. The Thirty-Five Second Contact.

c. The "N" Relay Contacts.

d. The "T" Relay Contacts.

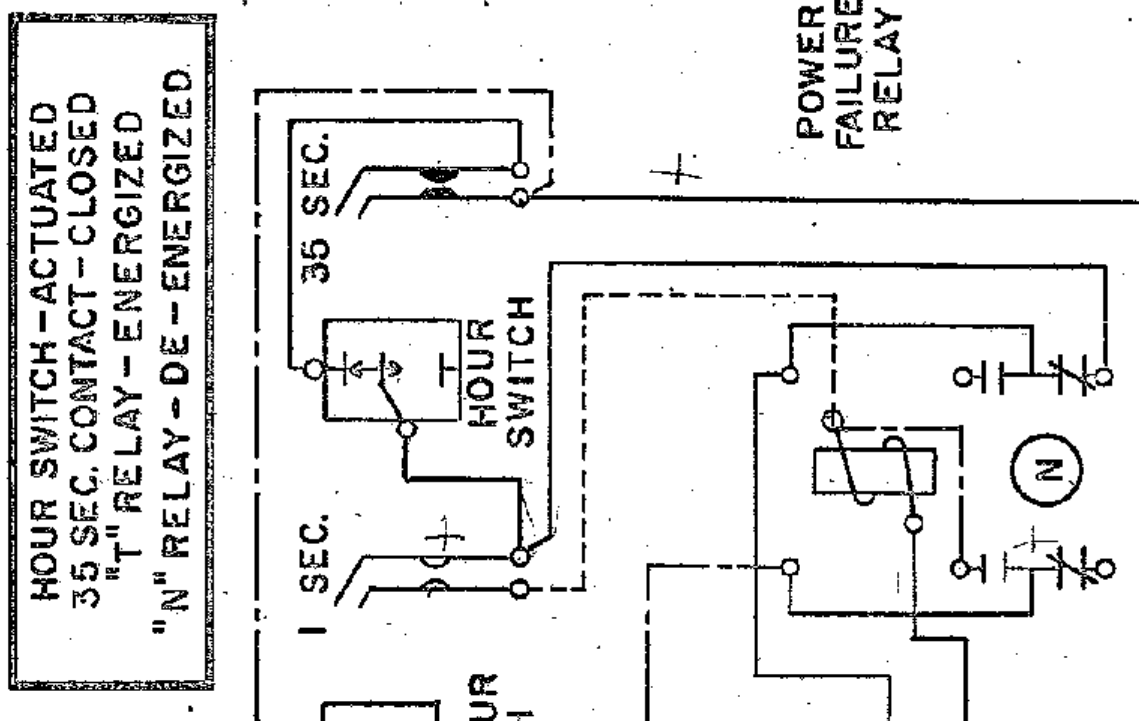
e. The One Second Contact.

All of these components affect the Hourly Correction circuit and must be working properly before further tests are made. Refer to the drawings in this manual to more clearly understand the circuits.

B. TWELFTH HOUR CORRECTION TEST:

1. Advance the Master Clock to 4:00 and slowly (!) continue advancing until the "N" relay on the door de-energizes. This should happen between 4:40 and 4:50 (ideal time 4:45). If the relay fails to de-energize, adjust the 12th Hour Micro Switch until the "N" relay opens at the proper time.
2. Advance the Master Clock to 5:10 slowly (!). At 5:12, relay "K" should energize and a reading should re-appear on the voltmeter. This is the start of the 16 minute reset cycle. During this time there should also be a reading between the T terminal and the 1C, 2C or 3C terminals.
3. Slowly advance the Master Clock to 5:27. At 5:28 the "K" relay should de-energize and remove the voltage from the 1R, 2R, and 3R terminals. Voltage should remain on 1C, 2C and 3C terminals.
4. Analysis of Twelfth Hour Correction: If the results of the observations of tests 2. and 3. above are different than those indicated, adjust the 16 Minute Micro Switch until the proper results are obtained. Repeat tests 2. and 3. several times. If the micro switches do not actuate at the same time during each test, a faulty micro switch is indicated.

NOTE: DO NOT USE A PENCIL OR SCREWDRIVER TO ACTUATE THE MICRO SWITCHES, AS THIS COULD CAUSE A "GOOD" INDICATION FROM A FAULTY OR INTERMITTENT MICRO. THESE SWITCHES MUST BE WORKED SLOWLY BY THEIR OWN CAMS AND SPRINGS TO OBTAIN A TRUE TEST.



HOURLY RESET CIRCUIT

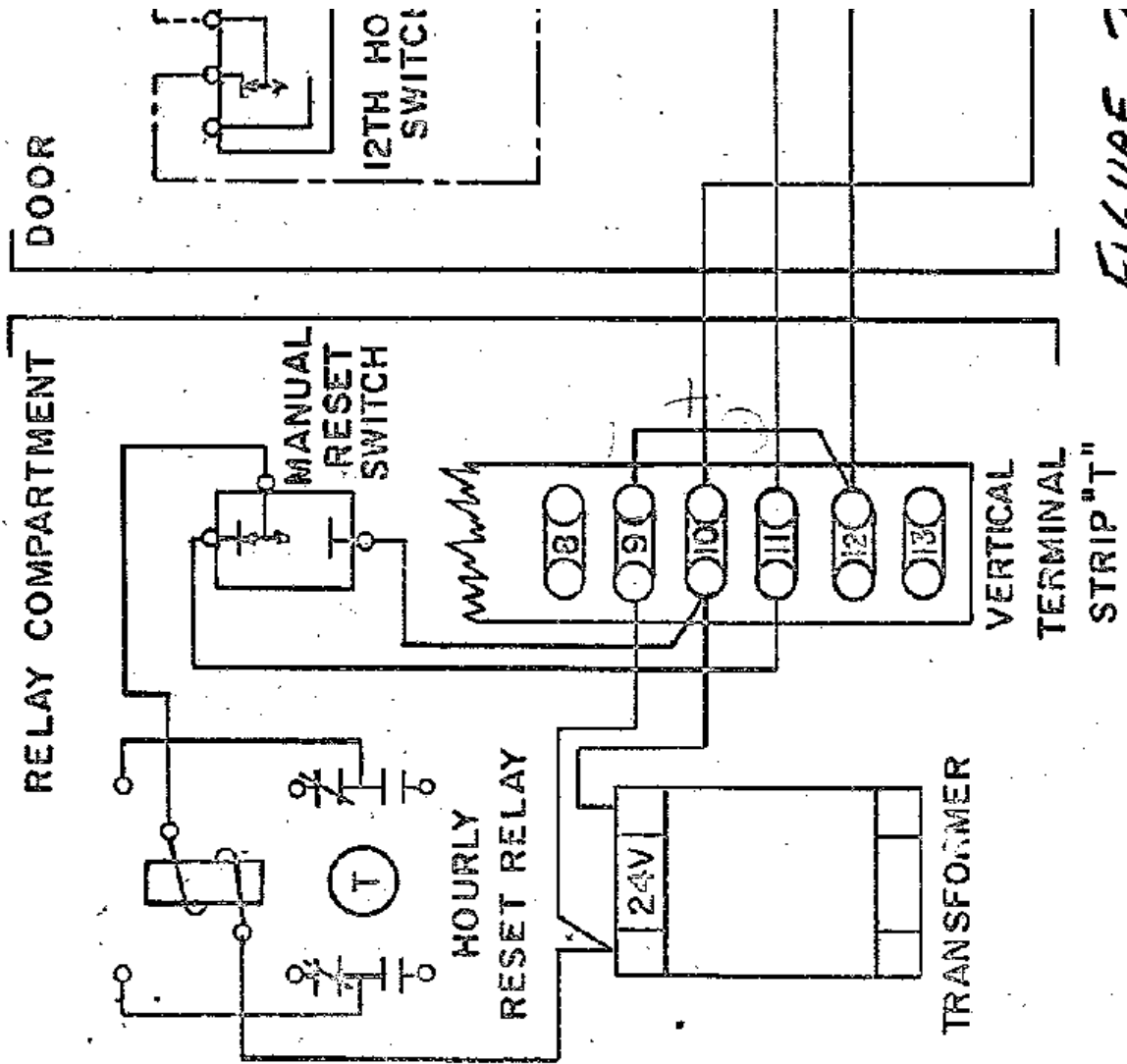
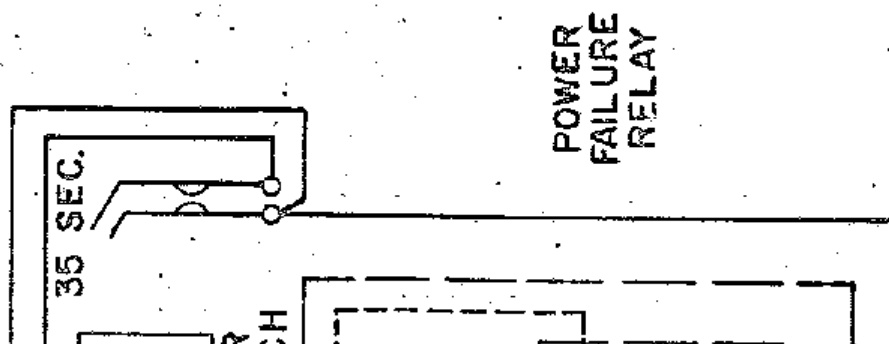
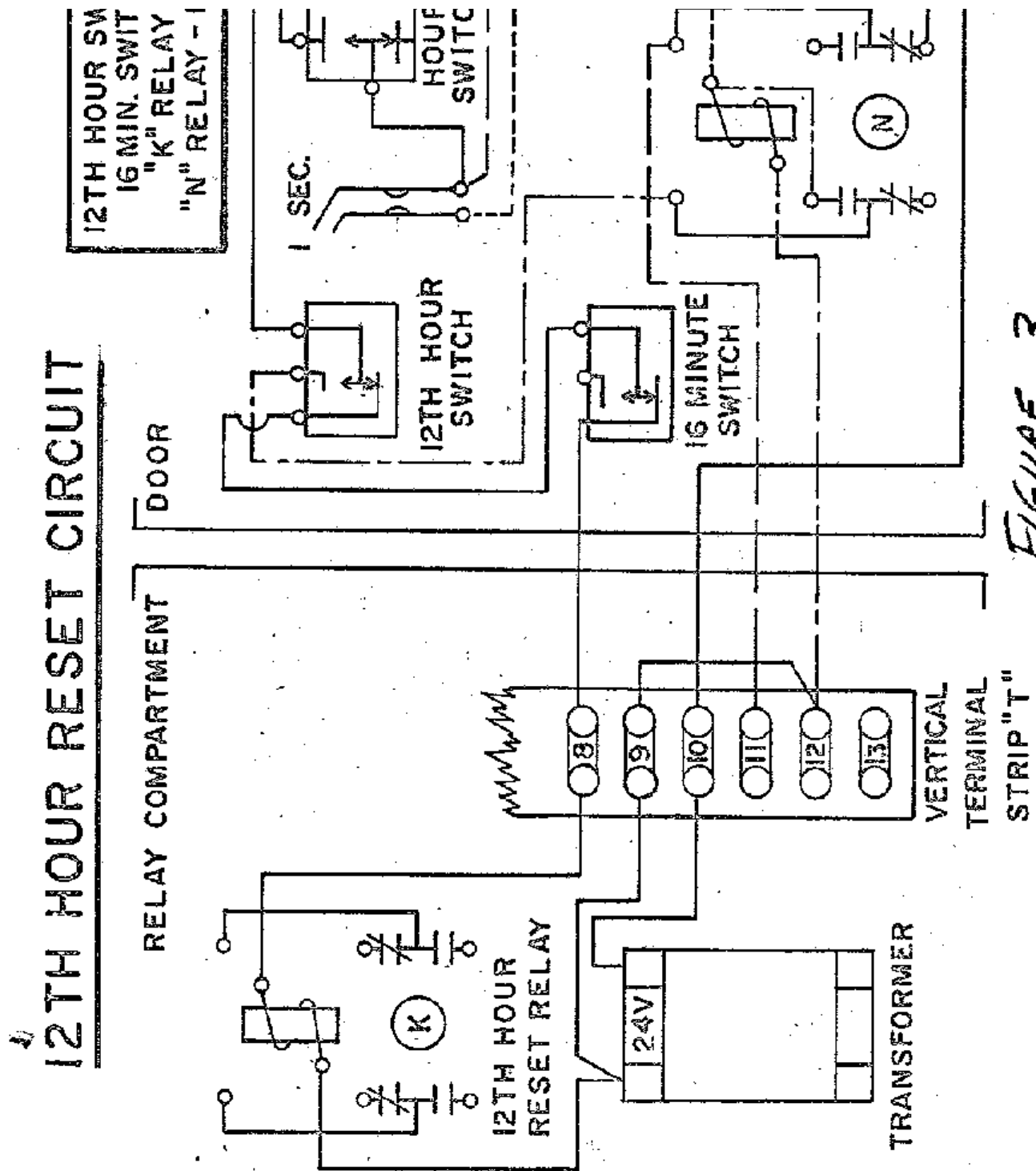


FIGURE 2

ITCH - ACTUATED
CH - ACTUATED
- ENERGIZED
DE - ENERGIZED





IV. MASTER CLOCK PROGRAMMING

A. Operation.

The function of the program circuit is to automatically actuate program signals at predetermined times and in different locations. This is done mechanically and electrically.

1. Mechanical. The program tapes are driven by the sprocket drum which makes one revolution per hour. The program fingers ride on the program tape, over the numbered "time rectangles". The tape is positioned so that the point of the program finger which touches the tape corresponds to the time shown on the face of the Master Clock.

A calendar drum (located above the sprocket drum) is divided into 14 day-night positions. It is rotated one position each 12 hours by a cam-operated calendar drum advance lever. When a pin is inserted in a particular position it will lift the program finger off the tape for 12 hours. In this way a complete 7 day schedule (A. M. and P. M.) can be programed using the tapes and pins on the calendar drum.

2. Electrical. A contact bar is positioned under the program tapes, at the point where the program tapes make contact with the program fingers. The tapes act as insulators between the fingers and the contact bar unless one or more of the numbered rectangles has been punched out. When a hole passes the contact bar, electrical connection is made for approximately 50 seconds. During this 50 seconds a cam-operated contact (which closes for 5 seconds each minute) in series with the program finger completes the circuit to the coil of one of the program relays. The contacts of the relay close the circuit to the signaling devices. Since the program tapes are constantly moving, the connection between the contact bar and the program finger is broken before the 5 Second Contact closes again (on the next minute).

A numbered selector switch and associated pushbutton, as well as an "All-Call" pushbutton, are provided on the front of the Master Clock for manual operation of the signaling devices. On-off switches for each program circuit permit a choice of automatic or manual program operation.

B. Testing the Program Circuits.

1. Manual Operation. Turn the numbered selector switch to each of the numbered circuits and push the button in its center. Each of the corresponding relays in the relay compartment (numbered from left to right) should energize as the button is pushed. A voltmeter connected across the appropriate terminals should indicate that power is being sent to the signals.

2. Automatic Operation.

- a. Turn all of the program toggle switches off.
- b. Remove the program tapes from the program machine.
- c. Be sure that the calendar drum pins allow all of the program fingers to touch the contact bar. (Rotate the calendar drum if necessary.)

d. Turn the program switches on, one at a time. The corresponding program relay should energize for approximately 5 seconds each minute. If not, check the contacts on the 5 Second Cam, and the program fingers where they make contact with the bar.

e. Replace the program tapes after all circuits have been tested.

f. Watch the 5 Second (duration) Cam. As soon as the contact closes, turn off the Master Clock motor and the secondary clocks.

The right-angle bend in the program fingers should be exactly in the center of the numbered rectangle on the tape. This number should agree with the reading of the face of the clock. If the fingers are not in the proper position, bend them slightly until they rest in the centers of the rectangles.

Note: The Master Clock motor switch is located on the motor plate, and the secondary clock on-off switch "A", is in the upper-left hand corner of the relay compartment.

C. Special Connections.

There are many ways to connect the program signals to the Master Clock. Listed below are some of the special connections frequently used.

1. Bell Power Voltages. Normally the Master Clock is connected to actuate 120 volt A. C. signals. However, it is possible to use other voltage sources to actuate signals. To do this:

a. Remove and tape the wire from terminal #3 (Bell Power) of the lower horizontal terminal strip. The other end of this wire is connected to a large wire nut over the 24 volt transformer in the relay compartment.

b. Remove and tape the wire from terminal #9 (Bell Power) of the lower horizontal terminal strip. The other end of this wire is connected to terminal #1.

c. Connect the new voltage source to terminals #8 and #9 (Bell Power).

2. Dividing The Bell Power To The Circuits. When desired, one or more of the program circuits can be used for special programming. "Dry contact" circuits, for sound console use, can be provided by following the instructions contained in appendix drawing #5 "Assigning Program Relays To Sound Console Service."

3. Cross-Connecting Program Circuits. As explained in IV. A. the function of the program circuits is to automatically actuate program signals at predetermined times and in different locations.

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It is sometimes necessary to set up two (or more) separate program schedules for the same location. As an example, a school may require the gym bell to ring at 12:00 on Monday, Wednesday and Friday; and at 12:15 on Tuesday and Thursday. Set up the cross-connections as follows:

- a. Determine, according to the circuits available, the number of different schedules required. Each different schedule will require one program circuit.
- b. Adjust the calendar drum pins so that each circuit will operate the signals on the proper day (night), while the others are lifted off the tape.
- c. Using a jumper wire, cross-connect the circuits on the vertical terminal strip in the rearmost compartment. (Program terminals are labeled 1-6/12.)

Note: DO NOT MAKE CROSS-CONNECTIONS AT THE BELLBOARD.
The bellboard pegs are used to determine the locations where the program circuits will actuate the signals.

D. Program Scheduling:

1. Preliminary Steps.

Turn all program circuit switches to "off" (making which were "on"). Turn the calendar drum until the pins lift the program fingers off of the tapes. The calendar drum should be rotated by means of the "calendar-drum-advance-lever" (or by hand if the advance lever is too high on its cam).

Note: Since one of the micro-switches is controlled by the action of the calendar-drum-lever, caution must be exercised in using this lever. The lever may be safely operated; when switch "A" located at the top left hand corner of the control box, is off (disconnecting secondary clocks).

The tape, mounted on the calendar drum, is used to determine the times at which the program signals will be actuated.

The tape removed from the movement is for circuit one and two. The next tape is for circuits three and four etc., as shown. The outermost tape will be removed first and replaced last. As the tapes are removed, write the circuit number that the tape controls in the margin of each tape at the 8 A.M. position. This will allow you to keep track of the different circuits while the tapes are off the machine. On the 24 hour memory tapes the hours from 6 P. M. to 6 A. M. have an "N" (night schedule) after the numeral on the tape.

FIGURE 4

"DRAWING"

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2. Removing The Tapes.

- a. Remove the outermost tape from the floating spools first.
- b. Now unwind the tape from the remaining fixed spools.
- c. Lift the tapes from the sprockets on the program drum and remove slowly.
- d. Repeat this procedure for the remaining tapes.

FIGURE 5

"DRAWING"

3. Punching A New Schedule.

The only punch that may be used on memory tapes is the one supplied with the Master Clock. This punch should not be used on material other than the tapes as the cutting edges will be damaged. This is important because the program fingers can fail to operate properly if punch holes are not cleanly cut.

On the 24 hour memory tape the hours from 6 P. M. to 6 A. M. have an "N" (night schedule) after the numeral on the tape.

- a. Select the desired hour and minute that the program signal is to be sounded.
- b. Holding the tape as shown, place the punch over the tape so that the rectangle to be punched out is visible and centered through the hole in the punch.

- c. With one motion punch out the hole.
- d. Repeat this operation until the entire new schedule is completed.

IF A SPACE IS PUNCHED OUT IN ERROR, DO NOT PATCH THE HOLE--
USE A NEW TAPE.

FIGURE 6

"DRAWING"

4. Replacing The Tapes.

Replace the tapes in the opposite sequence from which they were removed. Because the sprocket drum is attached to the hands of the clock, care must be taken not to move the sprocket drum while replacing the tapes. When properly installed, the time indicated at the contact bar should correspond with the time on the front of the Master Clock. If the sprocket drum has been moved, the Master Clock will be ahead of time. If the time is advanced by only a few minutes, the Master Clock should be stopped by throwing the switch located near the master drive motor on the clock door. If the master has been advanced a great deal it will be necessary to manually advance the Master Clock approximately 24 hours to the correct time. To do this;

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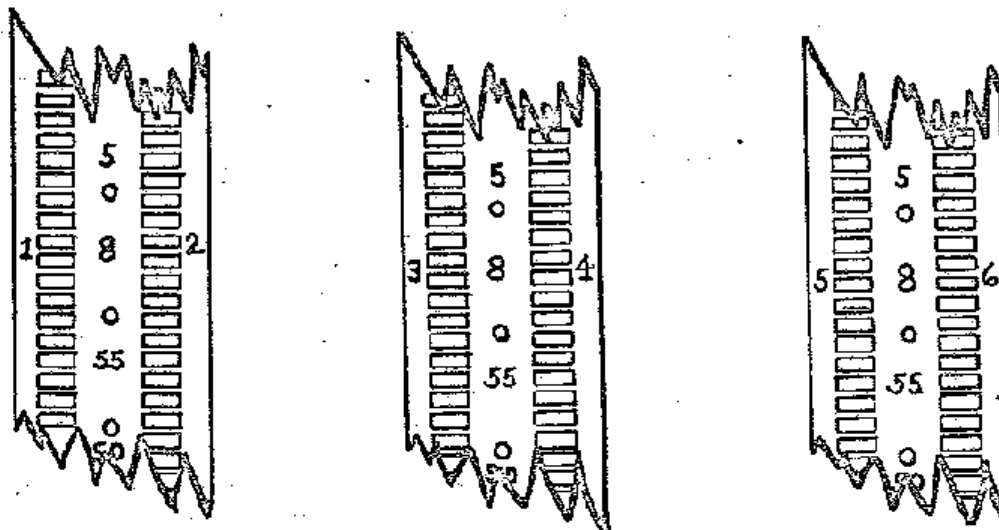


FIGURE 4

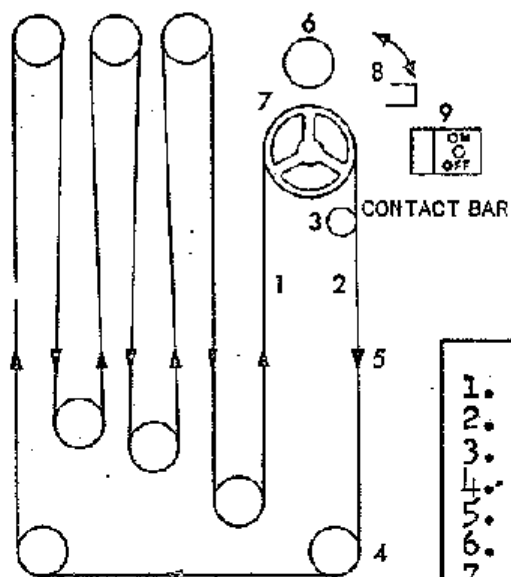


FIGURE 5

1. PROGRAM TAPE(S).
2. " "
3. CONTACT BAR.
4. FLOATING SPOOLS.
5. DIRECTION OF TRAVEL.
6. CALANDAR DRUM.
7. SPROCKET DRUM.
8. CALANDAR ADVANCE LEVER.
9. MASTER CLOCK MOTOR SWITCH.

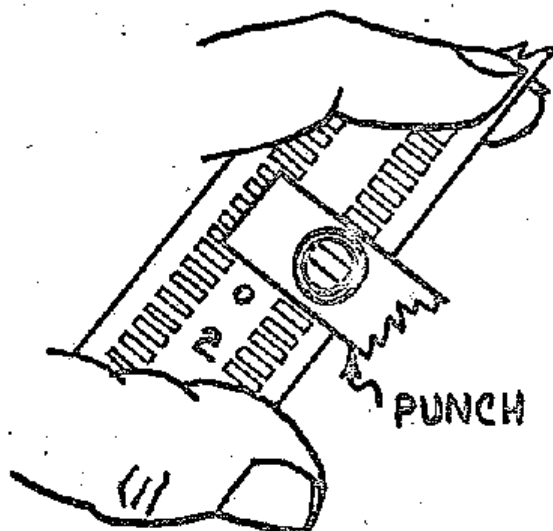


FIGURE 6

- a. Shut off secondaries by throwing switch "A" to "off".
- b. Advance the Master Clock by turning the small knob on the sprocket drum in a clock-wise direction (as you face the end of the drum).
- c. Since the calendar drum has been advanced (see 1. Preliminary Steps), you will have to reset the calendar drum to the correct day or night period by using the advance lever located to the right of the calendar drum.

Note: Since one of the micro-switches is controlled by the action of the calendar-drum-advance-lever, caution must be exercised in using this lever. The lever may be safely operated; when switch "A" located at the top left hand corner of the control box, is off (disconnecting secondary clocks).

d. Return switch "A" to the "on" position.

5. Final Steps.

Return the program circuit switches to the positions they were previously in.

If, during the replacement of the tapes there is any difference between the times of the master and secondaries, momentarily shut off switch "A". This will allow the secondaries to be re-set at the next hour.

V. SECONDARY CLOCK THEORY OF OPERATION.

Reference: Appendix Drawing 6: "Exploded View GRC Secondary Movement"
GR-456-D ed.1.

Appendix Drawing 7: "GRC Secondary Movement Gearing".

A. The Driving Mechanism

1. The voltage for the 1 RPM driving motor is supplied from the Master Clock (as described in Section II, MASTER CLOCK FUNCTIONS AND OPERATION).
2. The drive motor advances the second, minute, and hour hands through the various intermediate gears.
3. The drive motor runs continuously except during an Hourly Correction (after a power failure) and during parts of the Twelfth Hour Correction cycle.

B. The Reset Mechanism (One Hour).

1. When the Master Clock transfers voltage from the secondary drive motors, the reset motor is activated for 35 seconds, and during this period the elliptical cam (Figure 7) on the motor shaft - rotates continually.
2. The elliptical surface of the cam rides against the rounded surface of the nylon roller (B) causing the spring-loaded reset lever (C) to move with an oscillating motion, (Figure 7).

-11-

(Par. # 3-6 Refer to Figure 8.)

3. Reset pawl assembly (E) oscillates with the same action as (C) Fig. #7 because of the common shaft (D).

4. Nylon pawl (F) therefore,

FIGURE 7
"SECONDARY DRAWING"

advances both the seconds ratchet wheel (G), minute ratchet wheel (not shown), and the corresponding hands.

5. When both ratchet wheels have advanced to the point where pawl (F) falls into the missing tooth space (H), the second and minute hands stop. The position of both hands should be on the hour.

6. The reset pawl assembly (E) continues to oscillate until the end of the 35 second reset period, but the depth of the missing tooth space (H) prevents pawl (F) from reaching the next tooth on the ratchet wheels.

FIGURE 8
"SECONDARY DRAWING"

Note: If the secondary clock is "on-time" when the reset cycle begins, pawl (F) will be in the missing tooth space of the minute ratchet wheel, and only the second hand will advance.

C. Twelfth Hour Correction Mechanism (Every 12 Hours).

The Twelfth Hour Correction assemblies in the Master Clock (see section II.), synchronize the entire system twice per day. This occurs between 5:00 and 6:00 o'clock. The Twelfth Hour Correction has a duration of 16 minutes, beginning at 5:12 and ending at 5:28.

1. On-Time Secondaries.

If a secondary clock is "on-time" it automatically ignores the 12th hour corrective reset as follows:

FIGURE 9
"SECONDARY DRAWING"

a. At the end of the Hourly Reset at 5:00 the corrective lever (I), the hour gear (J), and its pin (K) are in the position shown. (Figure 9).

b. Between 5:02 and 5:10 the hour gear (J) and its pin (K) have advanced far enough to permit the flat surface of the corrective lever (I) to be lifted by the pin (Figure 10).

c. In this position nylon roller (B) does not touch elliptical cam (A) when the "high side" of the cam is nearest the roller.

This clearance - shown as (N) - must be between $1/32$ and $1/16$ on an inch. (Figure 10).

Note: The clearance (N) must be evident by not later than 5:10 so that rapid impulsing of the "on-time" secondary is prevented.

FIGURE 10
"SECONDARY DRAWING"

2. "Off-Time" Secondaries

At 5:12 the sixteen minute "Twelfth Hour Correction" begins by starting all of the secondary clock reset motors.

a. The reset motor drives the secondary's hands to the next hour. At this point the reset pawl drops into the missing tooth space (see Fig. #2) thus preventing further advancing of the hands.

b. Since both drive and reset motors are running. (See Section II, Par. D, above) the drive motor advances the gears (and hands) past the missing tooth space, enabling the rapid resetting to take over again.

c. This alternating drive and reset sequence continues until the secondary clock has reached a position between 5:02 and 5:10 where the reset is dis-engaged by the corrective lever and the pin on the hour gear.

Note: There may be a slight difference in the time indicated on the face of the various (scattered) secondaries. This happens because each secondary reaches the dis-engaging point at a different time after the beginning of the Twelfth Hour Correction cycle.

d. All secondaries will have reached the correct hour (between 5:12 and 5:28) when the sixteen minute, Master Clock controlled, reset ends at 5:28. At this point, all of the reset motors stop and the normal drive continues.

Note: All of the secondaries are now indicating the correct hour, but can be several minutes slow.

e. At 5:59:25 the Hourly Reset (described in Sec. V, Par B) brings all of the secondaries up to the correct time.

VI. SECONDARY CLOCK OPERATIONAL TESTS.

A. General

Secondary clocks may be tested for proper operation by removing them from the clock system. The only equipment required for this testing is a power

cord that can be plugged into a regular wall outlet. This cord should

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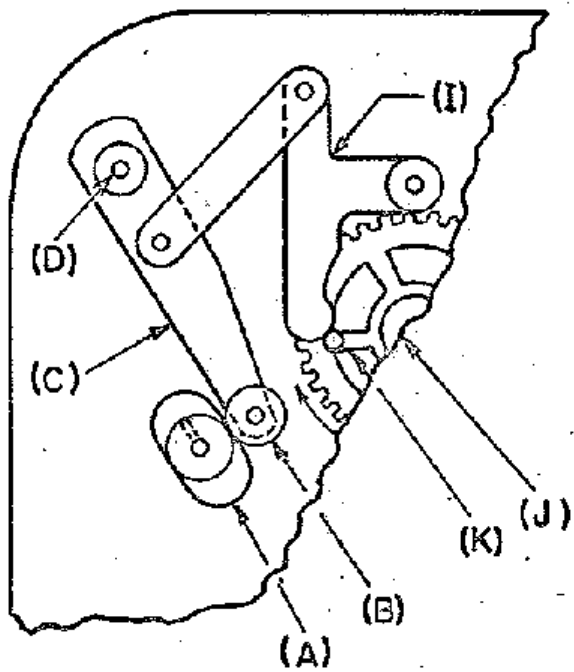


FIGURE 9

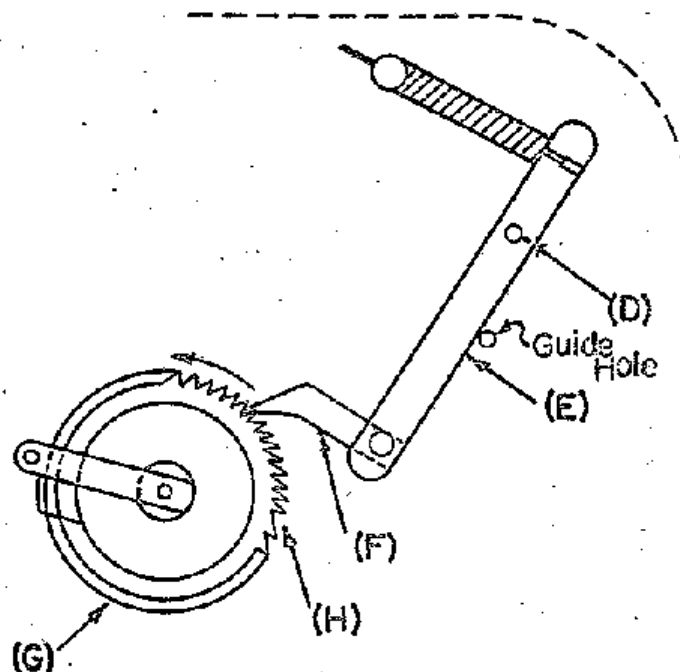


FIGURE 8

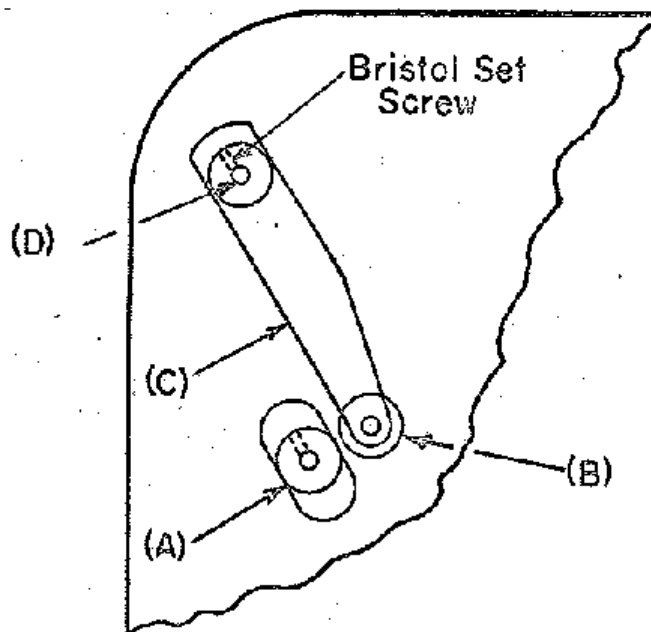
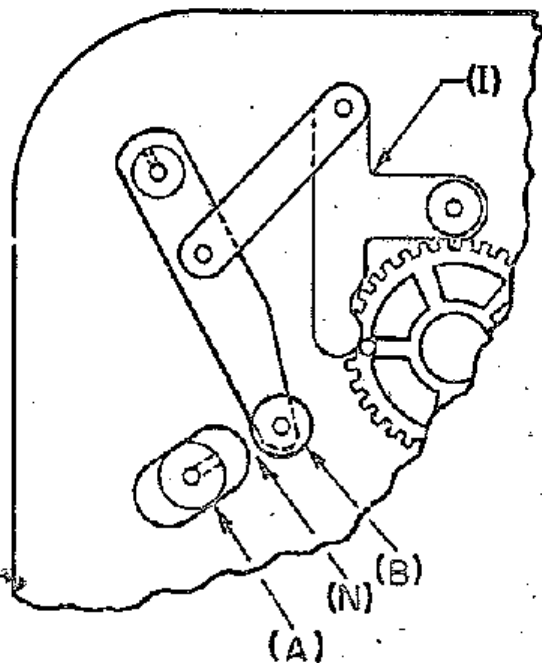


FIGURE 10

FIGURE 7

have two alligator clips on the opposite end for connection to the wires of the secondary clock.

1. Removal From The System.

When removing a secondary clock from the system, power should be shut off by moving switch "A" (on the top of the Master Clock relay panel) to the "off" position. However, the clock may be removed while the power remains on by following the steps below. (Reverse for Reconnecting).

- a. Disconnect the black (drive) wire.
- b. Disconnect the red (reset) wire.
- c. Disconnect the two white (common) wires.

B. Hourly Correction Test.

1. Connect the power cord to the red and white wires (the two white wires may be left connected together). Holding the clock in an upright position, plug the power cord into a wall outlet (120 volts). In the case of 24 volt systems, a 24 volt stepdown transformer is necessary to lower the line voltage. The minute and second hands should advance at a rapid rate until they reach the next 60th minute (and second). At this point they should stop advancing.

2. Analysis of Results

- a. If the hands stop moving, but not at the 60th minute (and second), adjust either or both hands to the proper position (rotate clockwise only) without moving any of the gears in the movement.
- b. If the hands do not advance at the rapid rate, adjust the reset lever assembly (below).
- c. If the hands advance at the rapid rate, but do not stop, examine the reset lever assembly adjustment, the reset arm itself, the missing tooth space in the minute ratchet wheel assembly (GR-137) and the missing tooth space in the seconds ratchet wheel assembly (GR-115) for any irregularities that would indicate replacement.

C. Twelfth Hour Correction Test.

1. Connect the black (drive) and red (reset) wires together. Connect the alligator clips of the power cord to the black-red and two white wires (still connected together). Keeping the clock in an upright position, plug the power cord into a wall outlet. This causes both the drive and reset motors to run simultaneously. The minute and second hands advance to the 60 minute (second) and momentarily stop (approximately 30-90 seconds for the minute hand; 1 second for the second hand), due to the action of the missing tooth space. Because the drive motor is running, the minute ratchet wheel is driven past the missing tooth space. This action continues to repeat itself until the clock has passed 5:00. Sometime before 5:10, the rapid advancing stops (the drive motor continues to advance the hands at the normal speed).

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2. With the power still applied and the same connection as used in C. 1 above, manually advance the minute hand to 25 minutes past 5:00. (If the clock has not been disassembled, remove the dust cover and move the minute hand by turning the GR-111 Internal Wheel.)

Let the drive motor continue to advance the hands at the normal rate. The minute and second hands should not resume advancing at the rapid rate prior to 5:30.

3. Remove power, disconnect the alligator clips, and disconnect the black and red wires (connected together earlier.)

4. Analysis of Results:

a. If the test performed in Par. 1., above, did not take place at the times indicated, readjustment of the Twelfth Hour Reset Assembly is indicated.

Tolerance: The rapid advancing of the minute and second hands may stop anytime from 5:03 to 5:10, but all oscillating motion of the hands must have ceased by 5:10.

b. If the test in Par. 1 shows that the movement is out of adjustment, the test outlined in Par. 2 should not be attempted.

c. If the timing of the test in Par. 1 is proper and the timing of the test in Par. 2 is off; replacement of the Lift Lever (GR-276) and/or the Hour Gear (GR-281) is necessary.

VII. ADJUSTMENT OF SECONDARY MOVEMENTS.

A. Reset Lever And Shaft Assembly.

If the secondary clock has not been disassembled, the reset lever assembly adjustment can be made after the dust cover has been removed. (On "surface" type clocks the adjustment is made after the dust cover has been removed.)

The outer case (rim) may have to be removed before the adjustment can be made.)

Procedure For Secondaries Manufactured After February 1968.

1. Rotate the elliptical cam until the nylon roller on the reset lever assembly rests against a "low point" of the cam.

Note: The low point is that point nearest to the motor shaft. (The cam is visible from the right side of the movement, facing it from the rear.)

2. Loosen the Bristol set screw. The reset pawl lever is adjusted to rest firmly against the surface of the pillar (between the front and back plates) while the nylon roller is resting on the low point of the elliptical cam.

3. Tighten the Bristol set screw. (Be sure that the adjustment is correct by rechecking the position of the reset pawl lever and the nylon roller.

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Procedure For Secondaries Manufactured Before February 1968.

1. Rotate the elliptical cam until the nylon roller on the reset lever assembly rests against a "low point" of the cam.
2. Slide a #31 drill (or similar size metal rod) from the rear of the movement, into the guide holes.

Note: DO NOT EXTEND THE DRILL BEYOND THE OUTSIDE SURFACE ON THE FRONT PLATE, SINCE THIS PREVENTS OPERATION OF THE RESET LEVER (See Fig. #11).

3. Loosen the Bristol set screw. Adjust the reset pawl lever to rest firmly against the drill surface while the nylon roller still rests on the low point of the cam.

FIGURE #11
"SECONDARY DRAWING"

4. Tighten the Bristol set screw. (Be sure that the adjustment is correct by checking the position of the reset pawl lever and the nylon roller.

B. Twelfth Hour Correction Assembly

The following adjustment procedure is to be used when it has been determined that the Twelfth Hour Correction Assembly is out of adjustment or if any of the parts listed below have been replaced.

The Hour Gear and Sleeve (GR-281)

The Internal Wheel Assembly (GR-111)

The Minute Sleeve (GR-138)

The Minute Drive Pawl Gear Assembly (GR-134)

The Minute Ratchet Wheel Assembly (GR-137)

1. Remove the dust cover from the movement.
2. Remove the rim and glass (See Section VIII).
3. Look down into the movement from the top. Be sure that the nylon roller of the Reset Pawl Assembly is on the flat side of the elliptical motor cam. If it is not, rotate the cam by hand to one of the "low points".
4. Manually advance the minute hand in a clockwise direction while watching the Reset Pawl Assembly. Within twelve rotations, the minute hand of the Reset Pawl will move toward the nylon spacer. Continue advancing the minute hand, only it must be done very slowly! Stop when the Reset Pawl returns to its original position (a slight click can be heard).
5. Lock the GR-137 and GR-115 gears (shown in the attached drawing "GRG Secondary Gearing") by placing the index finger of the left hand on the teeth and pressing toward the center shaft.

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6. With the gears still locked, slip the minute hand on its shaft in a clockwise direction to the 34th minute. Release the gearing.
7. Advance the minute hand (clockwise) to the next hour (vertical position). This is the 6:00 o'clock reference point. The hour hand may now be adjusted for 6:00 o'clock by rotating it clockwise to the 6:00 o'clock position.
8. Manually advance the minute hand (clockwise) until the Bristol set screw in the GR-137 Minute Ratchet Wheel is visible (and reachable) from the top of the movement. Loosen this set screw.
9. DURING THIS PORTION OF THE ADJUSTMENT IT IS VERY IMPORTANT THAT THE MINUTE HAND REMAIN STATIONARY.

Note: The minute hand is slip-fitted over the minute shaft, therefore, be sure that the fit is tight before making adjustment.

- a. Manually advance the minute hand to the next hour.
- b. Turn the elliptical cam (on the reset motor) until the nylon roller of the reset linkage rests on the high point of the cam.
- c. Prevent the minute hand from turning by holding the internal wheel (GR-111). Note: When the minute hand turns clockwise, the GR-111 turns counterclockwise. Rotate the minute ratchet wheel until the nylon reset pawl just falls into the missing tooth space.
- d. Tighten the Bristol set screw.

Note: If the movement develops a slight bind after the Bristol set screw is tightened (in the GR-137), loosen the set screw and gently move the GR-137 minute ratchet wheel toward the rear of the movement (approximately 1/32 inch) without rotating it on the shaft. Retighten the set screw and recheck for binds and accuracy of adjustment.

10. Test the accuracy of the adjustment by conducting tests (under power) for the Hourly Correction and the 12th Hour Correction. See section VI. "Operational Tests".

- a. If the minute hand does not stop "on the hour" in the Hourly Correction test, repeat steps 8. and 9. above (using any hour).
 - b. A tolerance is allowed in the Twelfth Hour Correction settings (see VI. C.). If the results indicate the tolerances have not been met, repeat the entire adjustment above.
11. Reassemble the clock after all adjustments and tests have been made.

VIII. DISASSEMBLING THE SECONDARY CLOCK

A. RMT-(SURFACE MOUNTED) CLOCKS. The RMT (Surface Mounted) clock consists of a FMT (Flush Mounted) clock and a snap-on case. The RMT case is secured to the FMT case by means of four crimping ears, located mid-way between the clips (WC-487) used to retain the glass and rim on the FMT case.

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Caution ! Rest the clock on a padded surface, while removing RMT case. Do not remove the stationary RMT clips securing the glass and FMT rim, until the RMT case has been removed.

FIGURE 12
DRAWING

To remove the RMT Case:

1. Insert two spare clips under the lip of the RMT case. Each spare clip should be located approximately half-way between the "Crimping ear" and the stationary clip. The hooking end of the clip should just catch under the lip of the RMT case, with the bent portion of the clip resting on the clock backplate.

2. Exert equal downward pressure on both clips with your thumbs. If the case does not snap loose, re-insert the clips at another point, and re-exert pressure.

The instructions for disassembly of the FMT clock should be followed after the RMT case has been removed.

B. FMT (FLUSHED MOUNTED) CLOCKS.

1. Cut away the four speed nuts (FU-452) securing the retaining clips (FC-487) to the backplate.

DO NOT ATTEMPT TO RE-USE THE SPEED NUTS

2. Remove the clips, rim and glass.

3. Remove the two dust cover screws, and the dust cover.

4. Remove the second hand by grasping the second and minute ratchet gears (with missing-tooth space) firmly with the index finger or thumb on one hand, and twisting the second hand **CLOCKWISE** with the other hand.

Caution: Do not twist the hand counter clockwise or the bronze ratchet spring will be damaged.

Grasp the second hand as close to the hub as possible. One to three revolutions of the hand on its shaft may be necessary before it comes loose.

If the above procedure is unsuccessful, use the clips (FC-487) as levers under the second hand hub to lift it from the shaft.

5. Using the same procedure, remove the minute hand and then the hour hand. (Again, do not twist hands counter-clockwise).

6. Remove the two dial mounting screws and the dial.

7. Remove the three screws securing the movement to the dial back plate. Remove the movement.

IX. RE-ASSEMBLING THE SECONDARY CLOCK

A. Mount the movement on the dial back plate using the three counter-sunk screws.

B. Mount the dial using the two dial screws.

C. Place the hour and minute hands on the shaft using the same procedure in removing. DO NOT TWIST THE HANDS COUNTER-CLOCKWISE.

D. Place the clock face up with the tail end of the center shaft resting on a hard surface.

E. Place the second hand on the center shaft. Using a small block of wood, or wood pencil, over the hub of the second hand, tap gently until the hand is flush with the end of the center shaft. Test the fit by gently moving the hand clockwise (while holding the ratchet gears).

Note: If the second hand is loose, remove it and gently peen the surface of the hub, which will slightly close the hole.

F. After the movement has been tested and adjusted as necessary, position the minute and second ratchet gears in the missing tooth space. Turn the minute and second hands clockwise, (while holding the gears) until they point to the "12" on the dial, turn the hour hand to the correct hour.

Note: The "correct" hour is established by following the procedure in section VII B, steps 4 and 7.

G. Install the glass, rim, (RMT case) on the movement using new PU-452 speed nuts.

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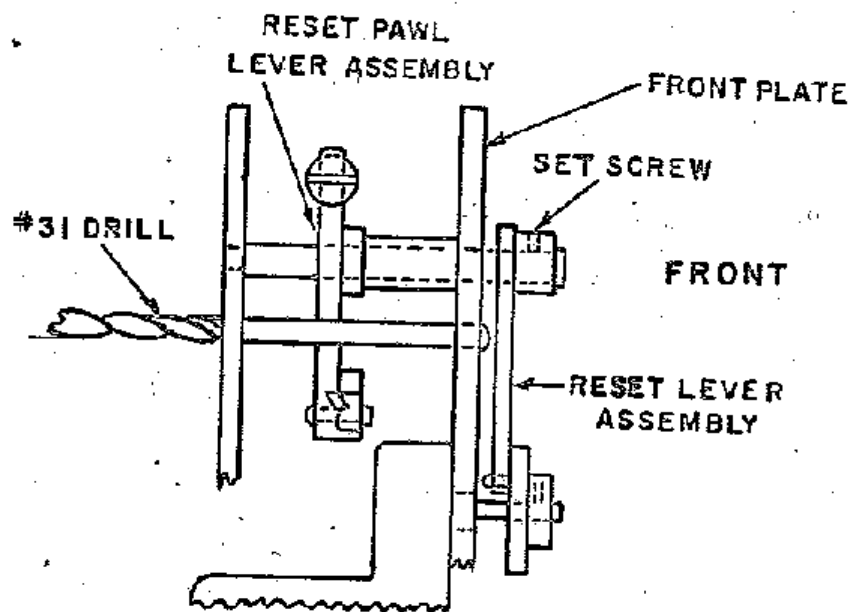
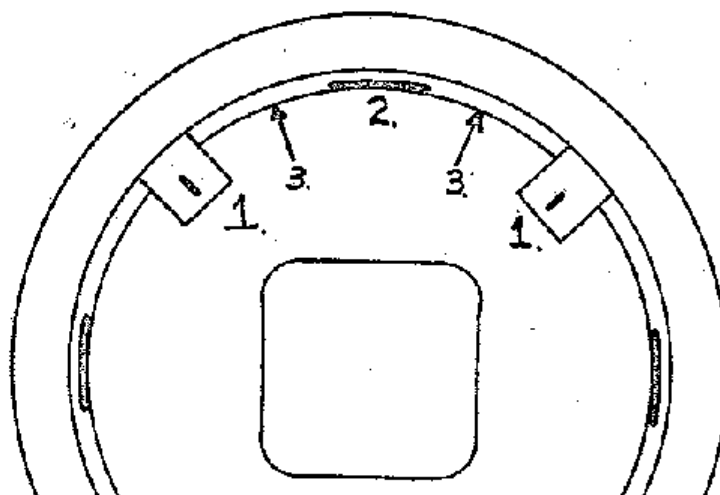


FIGURE II



- 1. RMT CLIPS
- 2. CRIMPING EARS
- 3. SPARE CLIPS USED AS PRY LEVERS

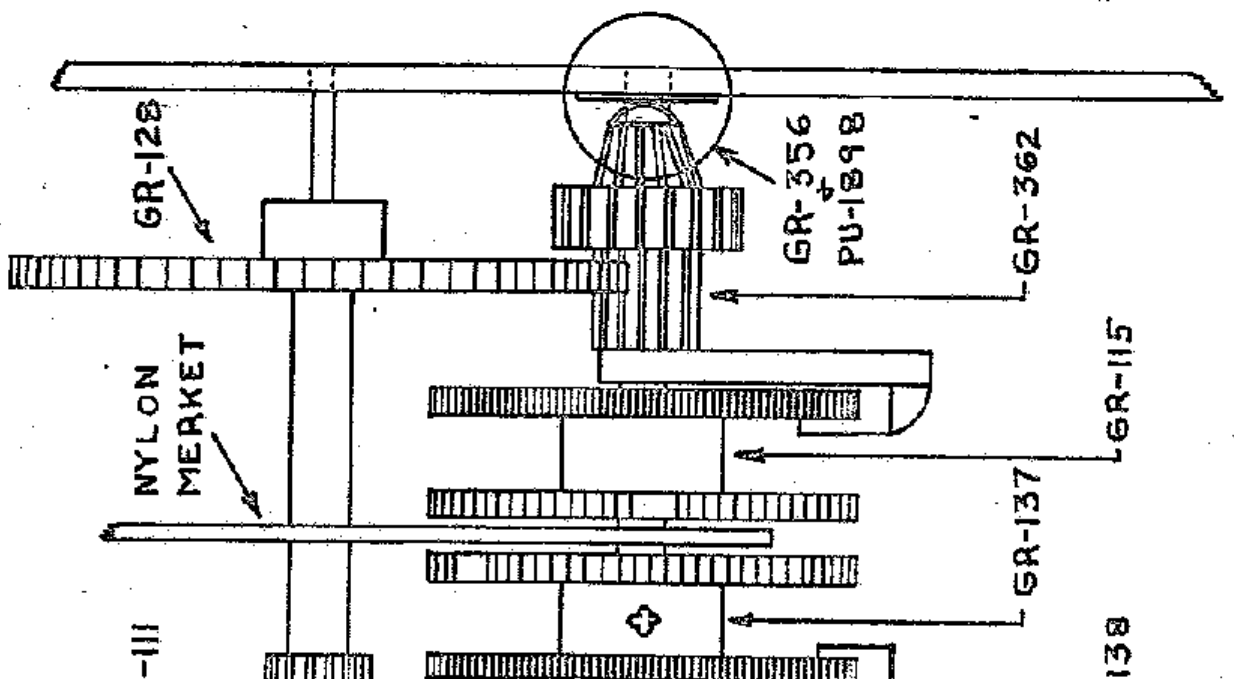


FIGURE 12.

SECONDARY CLOCK

REAR VIEW

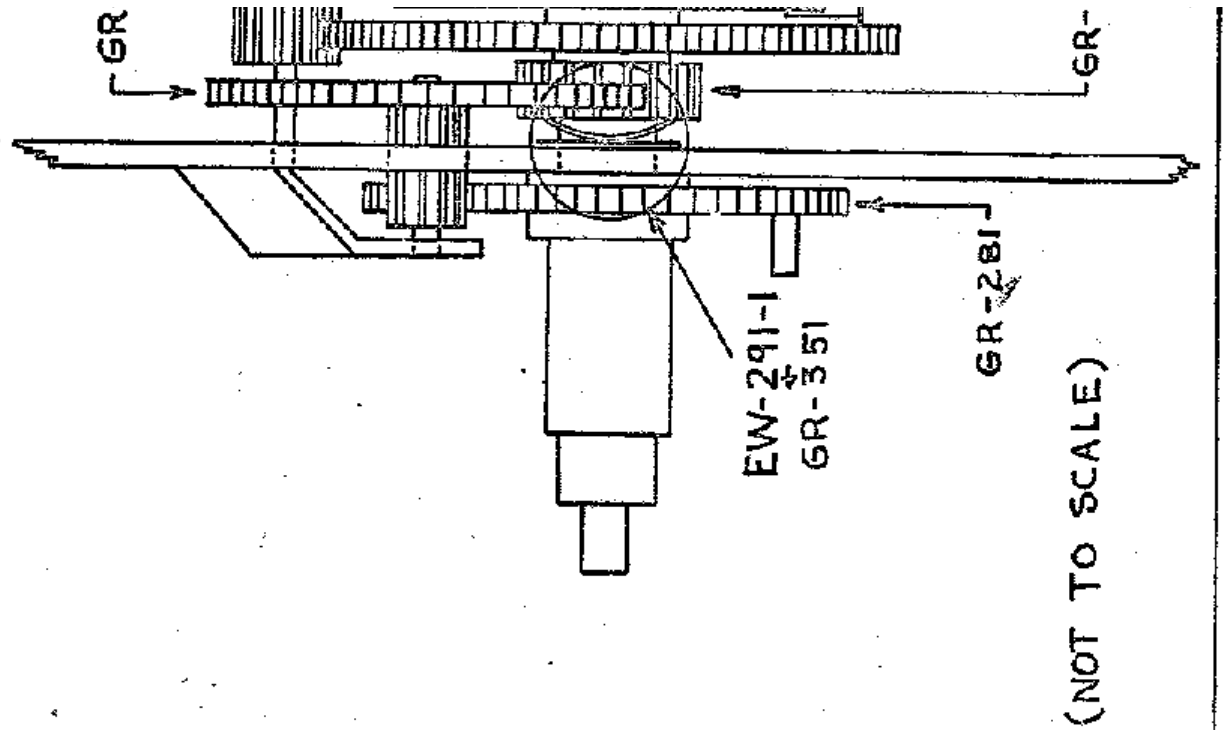
SECONDARY GEARING



DESCRIPTION

EW-291-1	FRICTION SPRING (FRONT).
GR-III	HOUR INTERMEDIATE GEAR.
GR-115	SECONDS RATCHET WHEEL & STAFF ASSMBLY.
GR-128	MINUTE INTERMEDIATE SHAFT ASSBLY.
GR-137	MINUTE RATCHET WHEEL ASSEMBLY.
GR-138	MINUTE SLEEVE ASSBLY.
GR-281	HOUR GEAR ASSBLY.
GR-351	NYLON WASHER (FRONT).
GR-356	FRICTION SPRING (REAR)
GR-362	SECONDS DRIVE PAWL ASSBLY.
PU-1898	NYLON WASHER (REAR)

G.R.C. Seco



QTY	PART NO.	PART NAME
1	00144	RESET MOTOR - HANSEN
1	00145	RESET MOTOR - HANSEN
1	00146	RESET CAM ASSEMBLY
1	00147	* 4-10 SET SCREW 1/8" LONG - 3/16" DIA.
1	00148	RESET PAUL LEVER SPRING
1	00149	RESET PAUL SHAPT ASSEMBLY
1	00150	RESET LEVER ASSEMBLY
1	00151	RETAINING RING * 1/8" DIA. * 1/2" THICK
1	00152	TIMING PLASTIC WIRE CLAMP

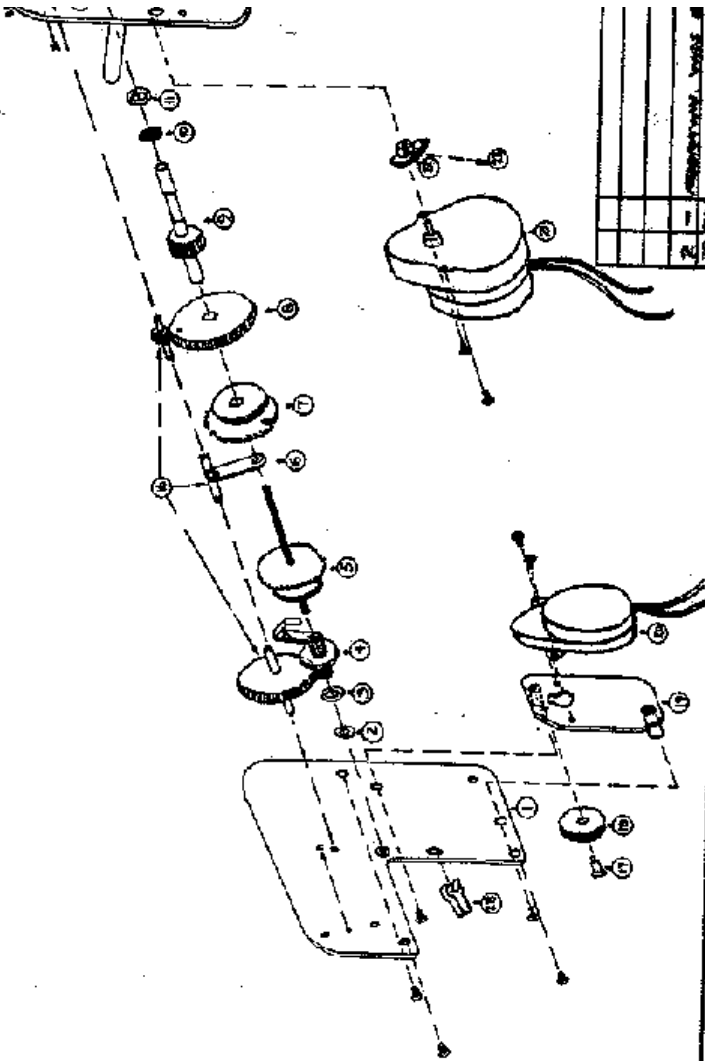
THE STANDARD ELECTRIC TIME CO.		EXPLODED VIEW OF GRC SECONDARY CLOCK ASSEMBLY	
DATE	BY	DATE	BY
10/1/72	ION	10/1/72	ION

PART NO.	PART NAME
1 GR-104	BACK PLATE
2 PU-1699	NYLON WASHER
3 GR-354	REAR FRICTION WASHER
4 GR-362	SECONDS DRIVE PAWA ASSEMBLY
5 GR-115	SECONDS RATCHET WHEEL & STAFF ASSEMBLY
6 103587	SPRINGER PLATE
7 GR-137	MINUTE RATCHET WHEEL ASSEMBLY
8 GR-24	MINUTE DRIVE PAWA GEAR ASSEMBLY
9 GR-138	MINUTE SLEEVE ASSEMBLY
10 GR-28-1	FRONT FRICTION SPRING
11 GR-351	NYLON WASHER
12 GR-101	FRONT PLATE
13 103627	INTERMEDIATE WHEEL STUD
14 GR-111	INTERMEDIATE WHEEL ASSEMBLY
15 GR-281	HOOR WHEEL & SLEEVE ASSEMBLY
16 GR-128	MINUTE INTERMEDIATE WHEEL & PINION ASSEMBLY
17 103613	TOLER GEAR STUD
18 GR-310	TOLER GEAR ASSEMBLY
19 GR-328	DRIVE MOTOR PLATE
20 001444	DRIVE MOTOR (see Part 19) HINSEN 1/2" VOLT - 60 Hz - 1800 RPM
21 FU-2257	DRIVE MOTOR (see Part 19) HINSEN 240VOLT 60 Hz - 1800 RPM

FRONT PLATE ASSEMBLY

FRONT SLEEVE ASSEMBLY

DRIVE MOTOR PLATE ASSEMBLY



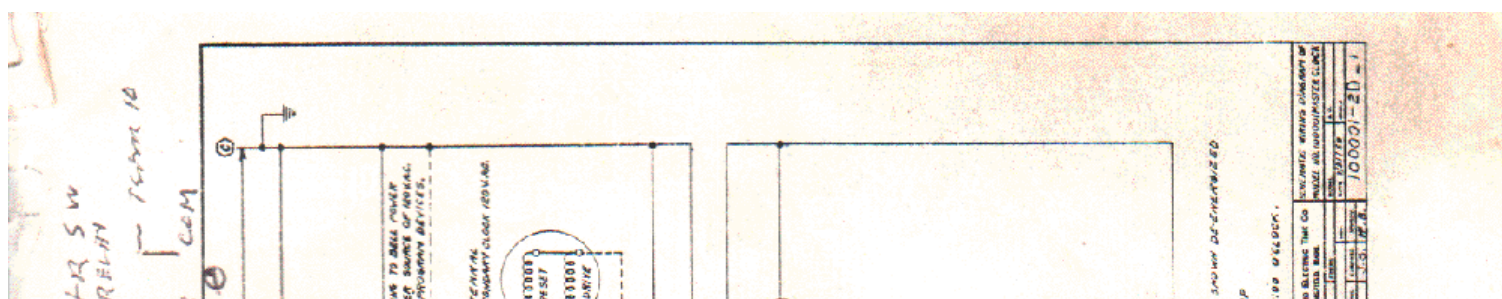
ACT OPERATION

BETWEEN		IDEAL OPENING TIME		
		HOUR	M	SEC
EACH	EACH	EACH	EACH	EACH
1.5	1.5	1.0	8	1.0
8.5	8.5	1.0	12.0	0.0
1.5	1.5	0.0	45TH	0.0
19.0	19.0	4TH	45TH	0.0
30.0	30.0	4TH	45TH	0.0
0.0	0.0	4TH	45TH	0.0

MODEL	S.O.
ADD. MOD.	SCALE
DATE	ED

MASTER CLOCK, SEQUENCE OF CONT

CONTACT	CLOSES BETWEEN						IDEAL CLOSING TIME			OPENS B		
	HOUR	MIN	SEC	HOUR	MIN	SEC	HOUR	MIN	SEC	HOUR	MIN	SEC
1 SEC.	EACH	EACH	0.0	EACH	EACH	0.0	EACH	EACH	0.0	EACH	EACH	0.5
5 SEC.	EACH	EACH	2.5	EACH	EACH	3.5	EACH	EACH	3.0	EACH	EACH	7.5
35 SEC.	EACH	EACH	26.0	EACH	EACH	28.0	EACH	EACH	26.0	EACH	EACH	0.5
HR. SWITCH	EACH	59TH	5.0	EACH	59TH	19.0	EACH	59TH	12.0	EACH	60TH	5.0
16 MIN. SW.	EACH	12TH	0.0	EACH	12TH	30.0	EACH	12TH	0.0	EACH	27TH	30.0
12TH HR. SW.	5	59TH	10.0	6TH	0	0.0	6TH	0	0.0	4TH	30TH	0.0

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This last page of schematics was loose in the manual, with no binder markings and may not have any relationship to anything that has gone before

MASTER CODE FIRE ALARM SYSTEM

