UNITED MOTORS SERVICE

DIVISION OF GENERAL MOTORS CORPORATION

General Offices - Detroit

AUTO RADIO BULLETIN

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Delco	TUNER
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SUBJECT: SERVICE INSTRUCTIONS FOR SIGNAL SEEKING TUNERS

GENERAL:

Signal Seeking Tuners are used on the following radios:

Buick

Cadillac

Oldsmobile

Packard

The service bulletin for any radio using this tuner will refer to this bulletin for tuner servicing.

This bulletin covers the theory of operation, adjustments, replacements and trouble-shooting procedure.

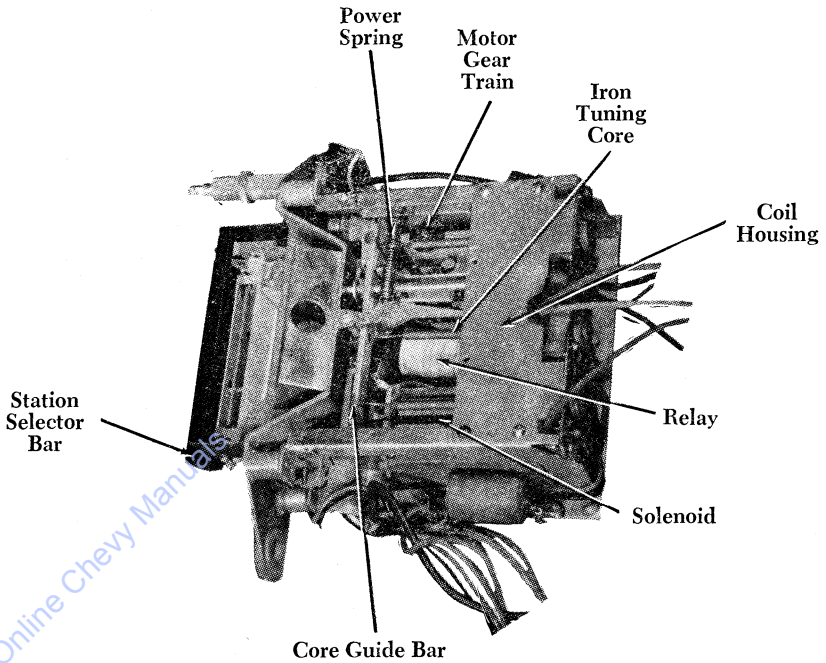


Fig. 1

THE SIGNAL SEEKING TUNER

The Signal Seeking Tuner is an electronically controlled automatic tuner by which the operator can change stations by merely depressing a single station selector bar on the radio or an auxiliary foot switch. The seeking operation is a uni-directional sweep of the broadcast band from low to high frequency with a nearly instantaneous return. The tuning mechanism is driven by a spring loaded mechanical motor which is stopped on station by a triggering circuit actuated by voltage developed from an incoming signal.

The number of stations on which the tuner will stop can be regulated by use of the Sensitivity Control. It is a step control which in the extreme clockwise position gives maximum stopping sensitivity, while it allows the tuner to stop only on strong local stations when in the minimum sensitivity or extreme counterclockwise position. This control is in the circuit only while the tuner is seeking and does not affect the "on station" sensitivity of the receiver.

THEORY OF OPERATION

This discussion of the operation of the Signal Seeking Tuner does not refer to any particular model radio. It covers the overall operation and the bulletin for the particular radio involved will give the details of the circuit used in the actual receiver.

Mechanical Operation

The motive force on the signal sweeping sweep of the tuner is provided by a constant speed spring driven gear train which is regulated by a nylon paddle wheel. This paddle wheel is the end gear in the gear train and acts as an air vane governor which tends to keep the speed constant. The entire gear train is stopped or started by the relay arm engaging or disengaging the paddle wheel. The nearly instantaneous return of the pointer and the cocking of the power springs is accomplished by a solenoid which is energized by a cam operated switch. The complete mechanical cycle is developed and outlined below.

Sweep and Return Cycle (See Fig. 2)

One Power Spring, which is fastened to the lower plate of the Planetary Arm, pulls this arm around its pivot. The Planetary Arm is linked to the Core Bar. Thus, as the spring contracts and moves the Planetary Arm it also pulls the core bar and its iron cores from the tuning coils thereby changing the tuned frequency of the radio towards the high end of the broadcast band. After the tuner has swept beyond the top broadcast frequency, the High Frequency Switch Operating Cam on the lower Planetary Arm trips the Tuner Return Switch which in turn energizes the Solenoid and this quickly returns the Planetary Arm to its original position with the cores inserted fully into the coils (low frequency) and the power spring is now under maximum tension. As the Planetary Arm returns, the Low Frequency Switch Operating Cam trips the Tuner Return Switch to its original position thus de-energizing the Solenoid and completing the cycle.

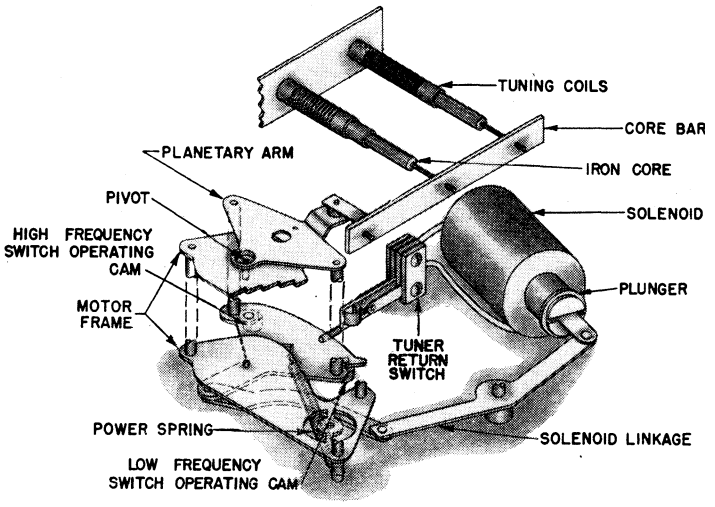


Fig. 2

Motor and Control (See Fig. 3)

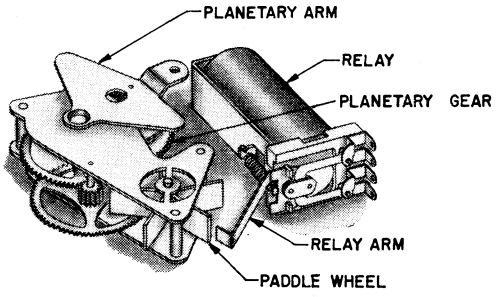


Fig. 3

The Power Spring tends to move the Planetary Arm about its pivot point thereby starting the Planetary Gear and its meshed train in motion. This motion is transferred through the gear train to the Paddle Wheel which acts as an air vane governor keeping the motion at a constant speed. This movement of the Planetary Arm is then controlled by merely freeing or blocking the Paddle Wheel with the Relay Arm. Thus, the movement of the Planetary Arm which moves the tuning cores is started or stopped by the action of the Relay Arm.

Manual Tuning Gear Operation (See Fig. 4)

Manual tuning is accomplished by turning the Manual Control Shaft which turns the Worm Gear in its bracket. The Worm Gear is meshed with the Manual Drive Gear which in turn is meshed with the Planetary Pinion Gear. During manual tuning the Paddle Wheel is held in place by the Relay Arm and this Pinion Gear is not free to rotate, thus effectively locking the Planetary Arm to the outer edge of the Manual Drive Gear. Therefore as the Manual Drive Gear turns, the Planetary Arm moves in unison with it and varies the frequency of the tuner by varying the position of the iron cores in the tuning coils. (Notice that when the set is being tuned automatically and the Paddle Wheel is rotating, the Manual Drive Gear is held securely in place by the Worm Gear while the Planetary Pinion Gear "walks around" the periphery of the Manual Drive Gear thereby causing the Planetary Arm to move and change the position of the tuning cores.)

On sets which have no manual drive, the Manual Drive Gear is secured to the Motor Frame and the Control Shaft and Worm Gear are eliminated.

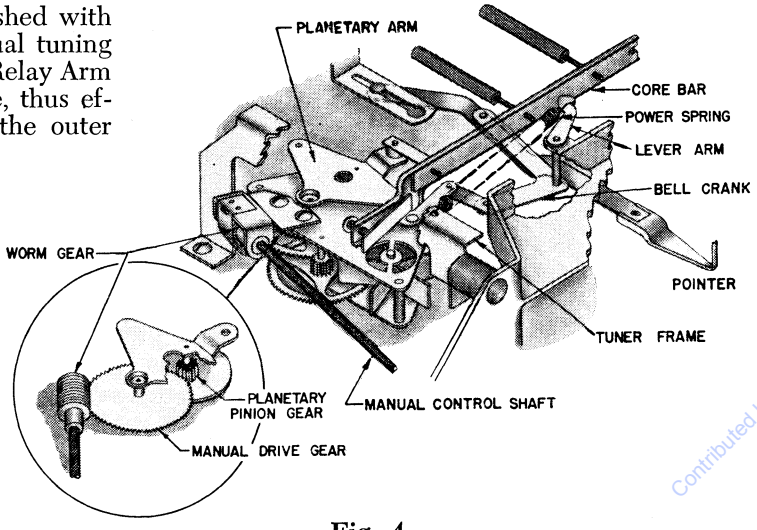


Fig. 4

Pointer and Core Bar Linkage (See Fig. 4)

The second power spring is shown in this view. It has a dual purpose, serving both as a power spring and an antibacklash spring. The primary linkage is from the tuner frame to the Lever Arm which is securely staked to the Bell Crank. At the Bell Crank the linkage splits, with one arm linked to the core bar at the extreme left end, and the other arm linked to the pointer. Thus, this spring helps pull the core bar in the high frequency direction when it is free to move and provides a spring loaded linkage between the core bar and the pointer preventing any tendency for backlash.

Clutching Operations (See Fig. 5)

The Ratchet Pawl and Wheel are used so that the Solenoid can cock the power springs without running the entire gear train in the reverse direction during the return sweep. Notice that the Ratchet also is used when the dial pointer has reached the high end of the band while tuning manually. Then the Planetary Arm has reached the end of its tuning arc and so the planetary pinion tends to be rotated by the Manual Drive Gear (see Fig. 3). This turns the Ratchet Wheel out of the Pawl and allows the pinion gear to turn freely without exerting further force on the Planetary Arm and thereby eliminates any possible damage to the mechanism.

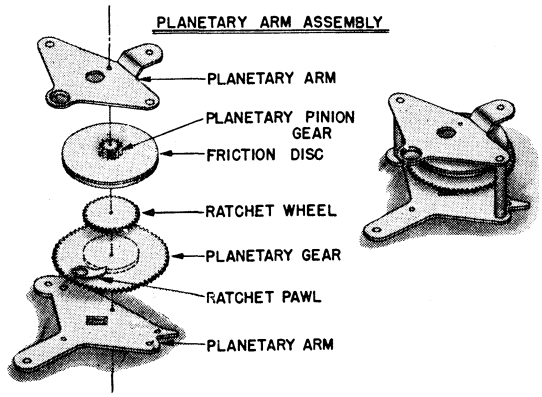


Fig. 5

The purpose of the Friction Disc is to prevent damage to the mechanism when manually tuned past the low frequency stop. This is accomplished because the disc slips before excessive pressure is exerted when the Pinion Gear tends to rotate the Planetary Gear. The Friction Disc is not found on radios without a manual drive.

Tuner Sweep Cycle Outline (Fig. 6)

I. Tuner is started by removing Relay Arm from Paddle Wheel
   - A. Spring driven gear train begins to sweep. (Fig. 3)
   - B. Planetary Arm moves. (Fig. 2)
   - C. Tuning cores are moved toward higher frequency by core bar linkage to Planetary Arm.
   - D. Spring loaded dial pointer scans dial. (Fig. 4)

II. Signal actuates relay causing arm to stop paddle wheel
   - A. Gear train stops. (Fig. 3)
   - B. Planetary Arm is stopped.
   - C. Core bar movement is stopped.
   - D. Dial pointer sweep is stopped.

III. When tuner reaches high end of dial after last stop.
   - A. The High Frequency Switch Operating Cam trips Tuner Return Switch. (Fig. 2)
   - B. Solenoid is energized.
   - C. Plunger is pulled into the Solenoid.
   - D. Planetary Arm and pointer are returned to low end of dial.

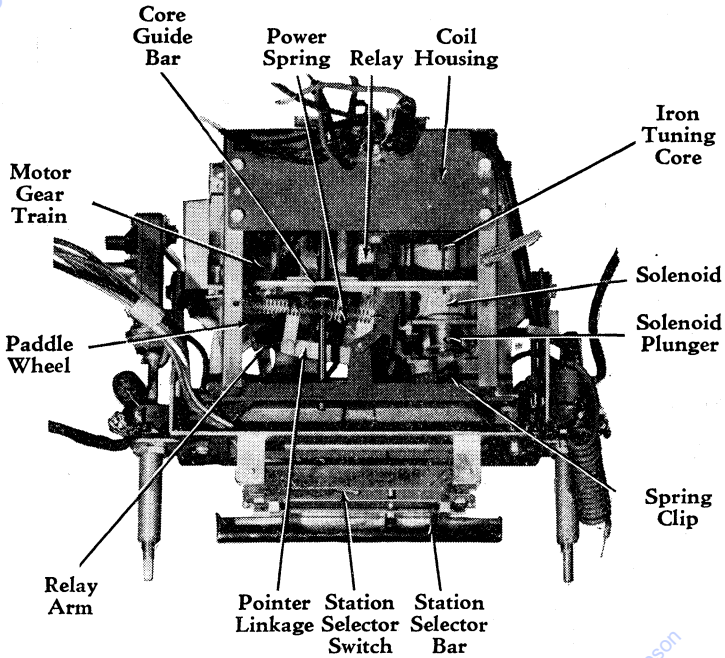


Fig. 6

- E. The Low Frequency Switch Operating Cam trips the Tuner Return Switch in the opposite direction. (Fig. 2)
- F. The Solenoid is de-energized and the sweep starts from the low frequency stop.

ELECTRICAL OPERATION

The purpose of the electrical components associated with the tuner is to control the relay so the operator may start the tuner sweeping cycle by merely depressing the station selector bar and so that the sweeping operation will continue until a signal is received. At that time it is the function of this circuit to accurately tune to the frequency of the selected station. It also provides the necessary conditions to keep the tuner on the station until a change is desired. The operational cycle of the electronic control system of the signal seeker tuner is outlined below.

The Electrical Cycle Outline (Fig. 7)

I. Starting the Tuner Seeking (Energizing the Relay)—The Station Selector Bar (27) is momentarily depressed.

A. Contact #2 of the Station Selector Switch opens first, ungrounding secondary of the output transformer therefore muting the set as contact #1 closes.

B. Contact #1 closes and provides a circuit from B+ through the relay winding, the 15,000 ohm resistor (30), the Selector Switch contacts, and the delay circuit resistor network to ground.

C. The current through this circuit energizes the Relay and removes the Relay Arm from the Paddle Wheel—thus starting the tuner, opening contacts #2 and #4, and grounding relay contacts #1 and #3.

II. Keeping the Tuner Seeking after the Selector Bar is released (Keeping the Relay Energized)

A. Relay contact #3 is closed providing a path to ground for the cathodes of the R.F. and I.F. amplifier tubes. This path is through the Sensitivity Control so the sensitivity of the set can be controlled during the sweeping operation.

B. Relay contact #1 is grounded thus lowering the cathode to ground resistance of the Relay Section of the Trigger Tube by putting the 6,800 ohm resistor (24) in parallel with the 47,000 ohm cathode resistor (26).

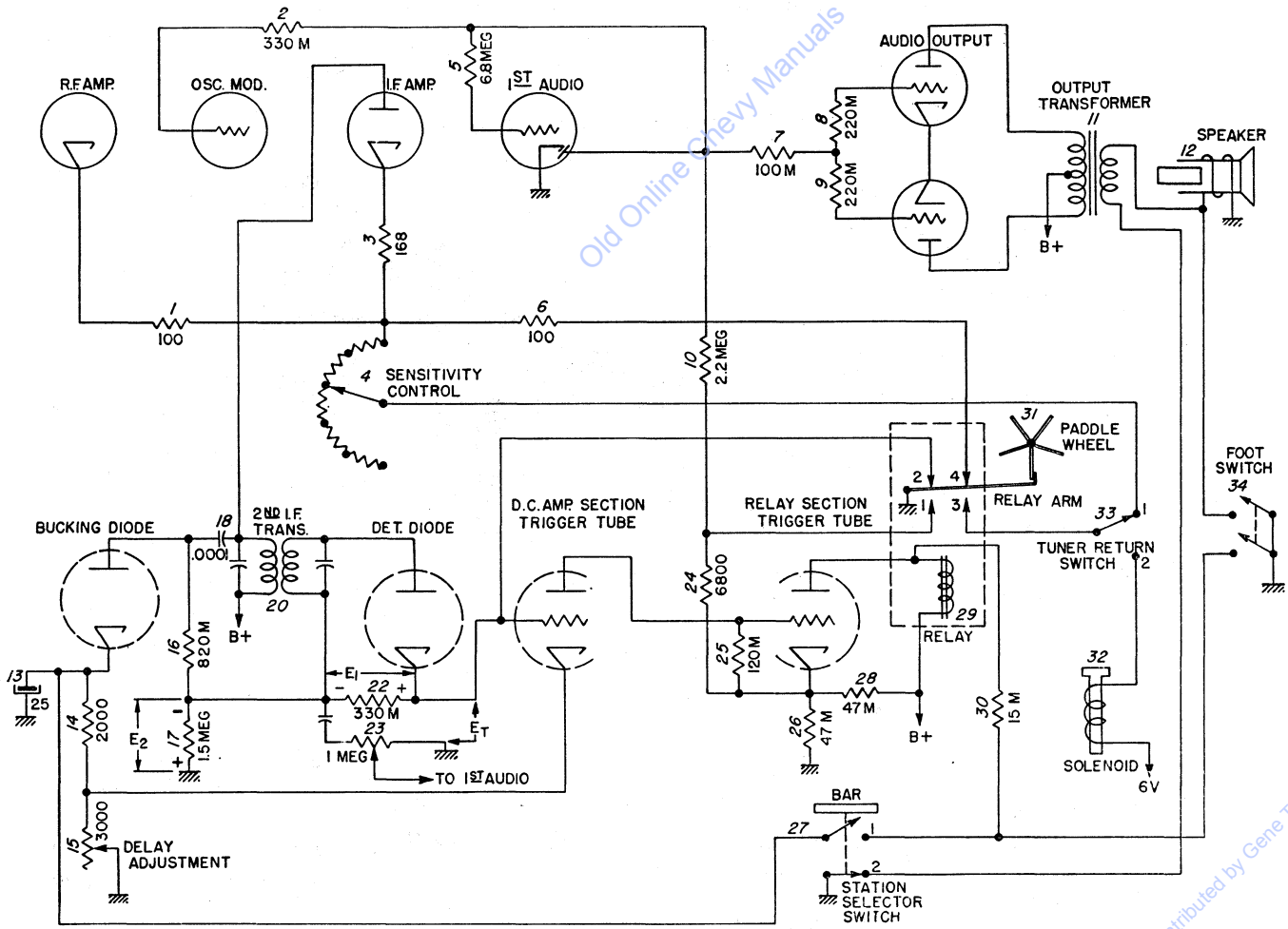


Fig. 7

This Diagram Does Not Refer to Any Particular Radio Model

The Electrical Cycle Outline (Continued)

This causes a lowering of the cathode voltage thereby causing an increased plate current flow which is sufficient to keep the relay energized and the tuner seeking.

III. Stopping the Tuner on Station with an Incoming Signal (De-energizing the Relay)

A. A voltage from the incoming signal is developed in the primary and secondary of the 2nd I.F. transformer (20).

B. The voltage in the secondary of the I.F. coil is rectified by the Detector Diode developing a D.C. voltage across the 330,000 ohm resistor (22).

C. The voltage in the primary of the I.F. coil is rectified by the Bucking Diode developing a D.C. voltage across the 1.5 megohm resistor (17).

D. The voltage developed by the Bucking Diode across the 1.5 megohm resistor (17) opposes the voltage developed by the Detector Diode across the 330,000 ohm resistor (22). The resultant voltage is applied to the grid of the D.C. Amplifier Section of the Trigger Tube. This triggering voltage gives a substantially constant tuning accuracy for all signals.

E. When the resultant triggering voltage on the grid of the D.C. Amplifier becomes positive it causes the tube to conduct.

F. The plate current flow in the D.C. amplifier section develops a biasing voltage across the 120,000 ohm resistor (25) which is between grid and cathode of the Relay Section of the Trigger Tube, making the grid more negative than the cathode thus reducing the plate current.

G. The decrease in plate current flow causes the relay to be de-energized and the Relay Arm again engages the Paddle Wheel thereby stopping the tuner sweep on a station, opening contacts #1 and #3 and grounding relay contacts #2 and #4.

IV. Holding the Tuner on Station until a new Station is Desired (Holding the Relay De-energized):

A. Relay contact #1 is opened, ungrounding the 6800 Ohm Resistor (24), thus preventing any appreciable current flow in the relay.

B. Relay contact #4 is grounded and this grounds the cathode circuits of the R.F. and I.F. amplifiers effectively by-passing the sensitivity control (4), which is now ungrounded, and leaving the set at normal sensitivity.

C. Relay contact #2 is grounded thereby grounding out the grid of the D.C. Amplifier. Any voltage now developed across the 330,000 ohm resistor (22) keeps the Bucking Diode from conducting by applying a negative voltage to its plate and the Detector Diode now functions as a conventional detector.

The Tuner Detection Circuit (See Figs. 7 and 8)

The purpose of the tuner detection circuit is to take input signal voltages of varying strength and trigger the relay tube so that the tuner will stop accurately on the station frequency. A positive voltage developed by the signal on the grid of the D.C. Amplifier Section causes the tuner to trigger and stop. This is accomplished by using the Detector Diode and Bucking Diode to develop voltages of opposite polarity (E_1 and E_2) between grid and ground of the D.C. Amplifier Section of the Trigger Tube, thus effectively applying the algebraic sum of these voltages (E_t) to this signal grid. (Note that contacts #2 and #4 of the relay are open.) These relative voltages plotted against frequency are shown in Fig. 8 using a station frequency of 1200 KC. Notice that the response curve of the voltage (E_2) across the 1.5 megohm resistor (17) is broader and not as large as the voltage (E_1) developed across the 330,000 ohm (22) detector load. This is because the detector voltage has benefit of one more tuned circuit which gives the narrower curve. Also there is a positive voltage appearing at the

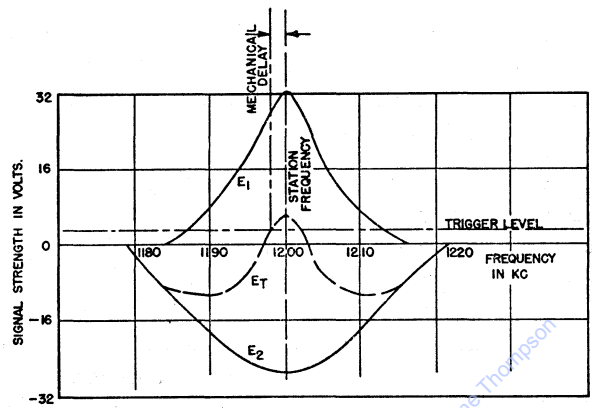


Fig. 8

The Tuner Detection Circuit (Continued)

cathode of the Bucking Diode which will have the effect of lowering the voltage (E_2) across the 1.5 megohm resistor (17) because it will introduce a delay before the Bucking Diode will begin to conduct. This delay can be controlled by the Delay Adjustment in the cathode of the Bucking Diode. This Delay Adjustment also controls the trigger level so that the mechanical delay is compensated for and the tuner stops exactly on station. It is a factory adjustment and SHOULD not be adjusted unless it is proven faulty.

Since the two diodes obtain their voltages from the same incoming signal, the strength of both voltages will vary directly with the strength of the incoming signal. Therefore, while they both rise and fall with variation in signal strength, their difference (E_t), which is effectively the trigger pulse, will tend to remain constant. Thus, a station will be tuned in with the same degree of accuracy whether it is a strong or weak signal.

Tuner Muting (See Fig. 7)

Various methods of muting are employed in the signal seeker tuner operated radios. To prevent a click in the speaker as the station selector bar energizes the relay, the output transformer circuit is opened (contact #2 of Station Selector Switch (27), before contact #1 is made. Or, in the case of the foot switch, the speaker voice coil is grounded and the set muted before the relay energizing contact is made.

The receiver is also muted when the solenoid is energized during the return cycle of the tuner. This is accomplishd because when the tuner return switch (33) is mechanically tripped to position #2 it ungrounds the Sensitivity Control which is the cathode return for the R.F. and I.F. amplifier tubes thus momentarily disabling the set.

The receiver also may be muted during the sweep cycle of the tuner by applying the negative oscillator voltage to the grids of the audio tubes to cut them off during the sweep time. Then, when the relay stops the paddle wheel on station and contact #1 is ungrounded enough positive voltage is applied through the 2.2 megohm resistor (10) to counteract the negative voltage from the oscillator and return the output tubes to normal operation. Any excess positive voltage will leak off through the diode to ground in the 1st audio tube.

Sensititivity Control

The sensitivity control is a step resistor which is inserted into the cathodes during the tuning sweep when relay contact #3 is grounded and is the means by which the operator controls the number of stations on which the tuner will stop.

ADJUSTMENTS

All illustration numbers in this section can be used in conjunction with the bulletin for the radio involved and do not refer to the Theory of Operation portion of this bulletin.

All adjustments on Signal Seeking Tuners are made accurately at the factory and do not require further adjustment unless it is definitely proven they are wrong or tuner parts are replaced. These adjustments are readily accessible and can be made without removing the tuner from the radio. All adjustments are made with the antenna disconnected from the radio. All adjustments can be reached by removing the front and rear covers of the radio and the adjustment cover on the top of the radio. The correct procedures for making these adjustments are as follows:

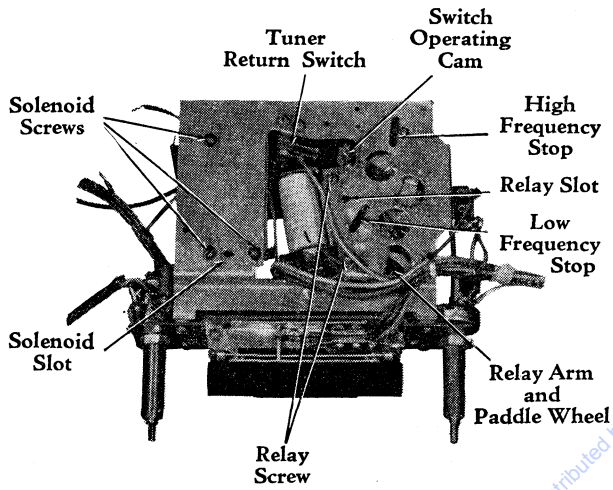
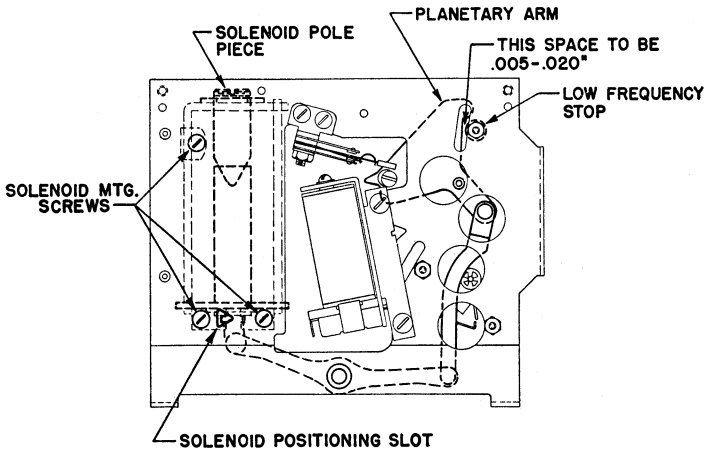


Fig. 9

Solenoid Pole Piece Adjustment (Fig. 10)

This adjustment should be made whenever the Solenoid or Solenoid Plunger is replaced. Its purpose is to obtain the correct amount of force from the Solenoid and to prevent the Solenoid Plunger from sticking.

1. With a screwdriver back the Solenoid Pole Piece out of the Solenoid.
2. Bottom the Solenoid Plunger in the Solenoid. The plunger is bottomed when the "C" washer collar on the plunger hits the frame of the Solenoid.
3. Screw the Solenoid Pole Piece into the Solenoid until it just touches the plunger.
4. Back the pole piece off exactly 1½ turns.
5. Tighten the hex locking nut and seal with glyptal or shellac.



SOLENOID POSITIONING ADJUSTMENT

Fig. 10

Solenoid Adjustment (Fig. 10)

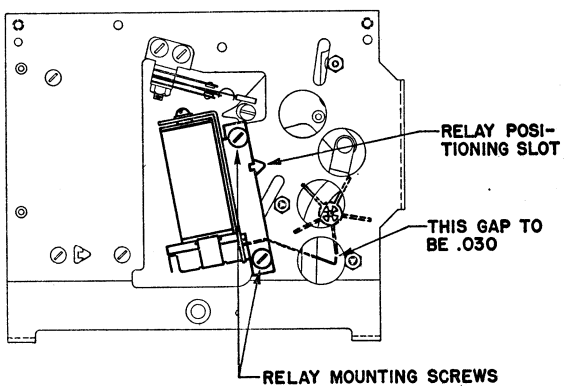
The Solenoid adjustment should be made whenever solenoid or Solenoid plunger is replaced. Its purpose is to provide the correct amount of solenoid plunger movement to move the tuner to the low frequency end of the broadcast band.

1. With the radio turned off, connect a jumper wire across the 0.5 mfd condenser, Illustration #43, on the cold side of the Solenoid. This is the only paper condenser found on the tuner.
2. Turn the radio on. (This energizes the Solenoid.)
3. Energize the Relay by momentarily depressing the Station Selector Bar.
4. Loosen but do not remove the three solenoid mounting screws.
5. Using a screwdriver in the Solenoid Positioning Slot, turn the screwdriver and move the Solenoid until there is a 0.005 to 0.020 inch gap between the Planetary Arm and its Low Frequency Stop.
6. Tighten the three Solenoid Mounting Screws.
7. Turn the radio off and remove the jumper wire from the condenser.

Relay Adjustment (Fig 11)

This adjustment should be made whenever the relay is replaced. This is the only adjustment of the relay that should be attempted in the field. The adjustment of the relay is to position the relay arm to have the correct engagement and clearance with the gear train paddle wheel.

1. With the radio turned off, connect a jumper wire across the 0.5 mfd condenser, Illustration #43, on the cold side of the Solenoid. This condenser is found on the tuner.
2. Turn the radio on. (This energizes the Solenoid.)
3. Energize the Relay by momentarily depressing the Station Selector Bar.
4. Loosen but do not remove the two Relay Mounting Screws.
5. Using a screwdriver in the Relay Positioning Slot, turn the screwdriver and move the relay until there is a gap of approximately 0.030 or 1/32 inch between the top of the Relay Arm and the tip of the blades on the Paddle Wheel.
6. Tighten the two Relay Mounting Screws.
7. Turn the radio off and remove the jumper wire from the condenser.



RELAY POSITIONING ADJUSTMENT

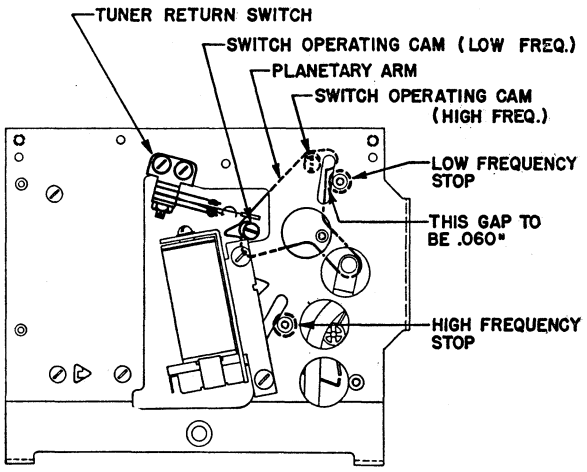
Fig. 11

Switch Operating Cam Adjustment (Fig. 12)

This adjustment should be made whenever the Motor Gear Train or the Tuner Return Switch is replaced. Its purpose is to set the timing of the Tuner Return Switch.

1. With the radio turned off, insert a 0.060 inch feeler gauge through the slot against the Low Frequency Stop. Number 14 bare wire is a satisfactory gauge.
2. Position the Planetary Arm against the feeler gauge. This can be done with the manual tuning control or on radios without this control the Planetary Arm can be moved directly or by moving the core guide bar to the low frequency end of the broadcast band (tuning cores all the way in the coils).

   CAUTION: ON RADIOS HAVING NO MANUAL TUNING CONTROL, THE PLANETARY ARM CAN BE MOVED ONLY TOWARD THE LOW FREQUENCY STOP WITHOUT DAMAGING THE MOTOR GEAR TRAIN.
3. With a small screwdriver, move the Low Frequency Switch Operating Cam to a position furthest from the Tuner Return Switch.
4. Trip the Tuner Return Switch so that its operating arm is toward the cam.
5. Turn the Low Frequency Switch Operating Cam in a counter clockwise direction until it trips the switch.
6. Insert a 0.060 inch feeler gauge through the slot against the High Frequency Stop.
7. Position the planetary arm against the feeler gauge. CAUTION: DO NOT USE DIRECT FORCE TO MOVE THE PLANETARY ARM. The Planetary Arm can be positioned either by using the manual tuning control or on radios without a manual control as follows:
   (a) Turn the radio on and depress the Station Selector Bar.
   (b) Turn the radio off very close to the high frequency end of the broadcast band.
   (c) With a screwdriver turn the Switch Operating Cam to the position furthest from the Tuner Return Switch.
   (d) Turn the radio on and depress the Station Selector Bar.
   (e) Allow the Planetary Arm to run against the feeler gauge.
   (f) Turn the radio off.
8. Turn the Switch Operating Cam to the position furthest from the Tuner Return Switch if this has not already been done.
9. Trip the Tuner Return Switch so that its operating arm is towards the cam.
10. Turn the High Frequency Switch Operating Cam in a clockwise direction until it trips the Tuner Return Switch.



SWITCH OPERATING CAM ADJUSTMENTS

Fig. 12

Cathode Delay Adjustment

This adjustment controls the tuning accuracy of the radio and is carefully adjusted at the factory. It should not be made unless the part is replaced. It is adjusted as follows:

1. With the antenna disconnected turn the radio on. If the bulletin for the radio involved specifies the adjustment to be made with the radio "seeking" depress the station selector bar.
2. Adjust the input voltage to the radio to exactly 6 volts at the "A" connector or the spark plate.
3. Connect a meter from the cathode of the D.C. amplifier section of the trigger tube (pin 8 of the 12AU7 tube) to chassis and adjust the cathode delay rheostat, illustration 110, so the meter reads the voltage specified under "Adjustment Procedure" in the service bulletin for the model radio involved.

REPLACEMENTS

All illustration numbers in this section can be used in conjunction with the bulletin for the radio involved and do not refer to the Theory of Operation portion of this bulletin.

This tuner has been designed to provide a maximum of servicing efficiency. All service parts have been made very accessible and easy to replace. The wiring to the tuner has been made long enough so that the tuner can be dismounted from the radio case and worked on without disconnecting any leads. (NOTE: It may be necessary to remove some connections of bond straps.) For most replacements such as the relay, the tuner return switch, etc., no special instructions other than being sure the proper adjustments are made are necessary. However, to facilitate fast replacement of some parts, the following instructions are included:

Solenoid or Solenoid Plunger Replacement (Fig. 10)

1. Remove the radio rear cover and adjustment cover. (Note: It will be necessary to remove the front cover on some radios.)
2. Remove the three solenoid mounting screws found on the top of the tuner.
3. Disconnect the two leads to the solenoid.
4. Remove the solenoid and bracket from the rear of the tuner. (It will be necessary to disconnect one lead of a 0.5 mfd condenser on some radios to give sufficient clearance.)
5. Remove the solenoid plunger from its linkage by removing the spring clip holding this linkage to it.
6. Place the plunger in the solenoid and make the **Solenoid Pole Piece Adjustment.**
7. Install the solenoid plunger and solenoid in the tuner.
8. Fasten the solenoid plunger to its linkage with the spring clip.
9. Solder the leads to the terminals from which they were removed. (If the 0.5 mfd condenser lead was removed, solder it in place).
10. Mount the solenoid to the tuner with the three screws and make the **solenoid adjustment.**

Station Selector Switch Replacement (Fig. 13)

1. Remove the escutcheon from the front of the radio.
2. Remove the Station Selector Bar and switch assembly which is held in place with two screws through the mounting plate.
3. Remove the switch and disconnect the leads.
4. Connect the leads to the new switch and assemble to mounting plate.
5. Adjust the position of the Switch Operating Ring so that it overtravels the opening and closing of the switch contacts in both directions about .030 or 1/32 inch. This adjustment is made by inserting a screwdriver in the slot on the ring and sliding on the selector bar shaft.
6. Return the selector bar and switch assembly to the radio and fasten with the two screws.

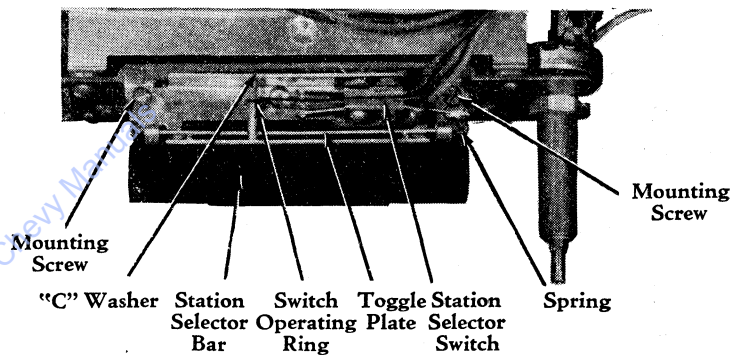


Fig. 13

Station Selector Bar Replacement (Fig. 13)

1. Remove the station selector bar and switch assembly from the radio as described in steps 1 and 2 of **Station Selector Switch Replacement.**
2. Remove the small "C" washer from the end of the station selector bar shaft.
3. Remove the two springs that hold the station selector bar and toggle plate to the mounting plate.
4. Assemble the new station selector bar and toggle plate with the two springs to the mounting plate as shown.
5. Place the "C" washer on the shaft and secure.
6. Adjust the position of the switch operating ring as described in step 5 of **Station Selector Switch Replacement.**
7. Return assembly to the radio and mount with the two screws.

Motor Gear Train Replacement (Fig. 14)

1. Remove the front and rear cover of the radio.
2. Dismount the tuner from the case and move it out of case far enough so that it can be worked on.
3. Divide the tuner into two parts by:
   (a) Removing the spring clip holding the gear train planetary arm to the core guide bar linkage.
   (b) Removing the four tuner assembly screws. (Some tuners have two additional screws.)
   (c) Separating the two halves of the tuner.
4. On radios having a manual tuning control, remove the worm gear and bracket from the gear train.
5. Disconnect the motor gear train from the solenoid plunger linkage by removing the spring clip holding them together.
6. Remove the three nuts mounting the motor gear train.
7. Mount the new motor gear train to the tuner with the three nuts.

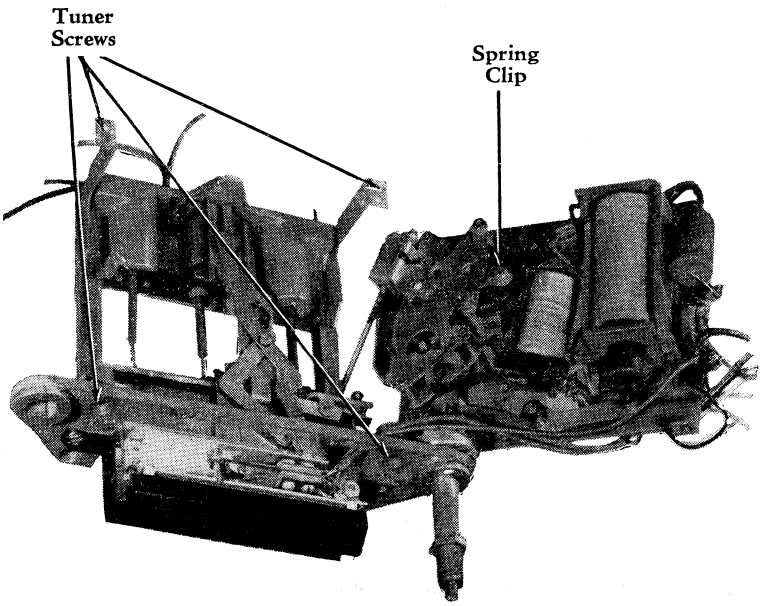


Fig. 14

8. Connect the gear train to the solenoid linkage with the spring clip.
9. On radios having a manual tuning control, remove the screw holding the manual gear of the gear train in position and mount the worm gear and bracket to the gear train. Be careful to get good gear mesh and do not lose the anti-squeak spring on the worm gear bracket.
10. Reassemble the tuner and make the **Switch Operating Cam Adjustment.**

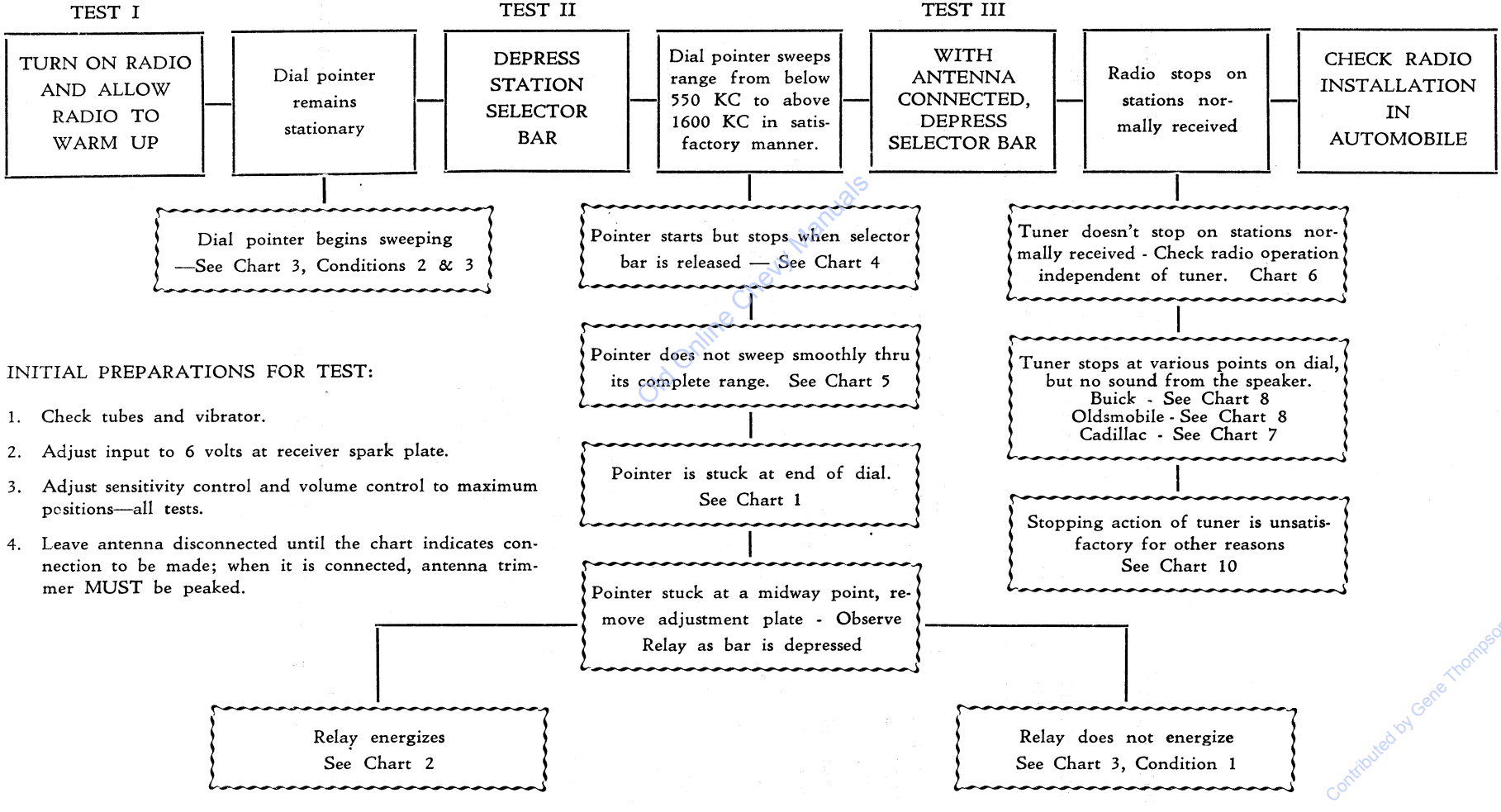
THE TROUBLE SHOOTER'S GUIDE

All illustration numbers in this section can be used in conjunction with the bulletin for the radio involved and do not refer to the Theory of Operation portion of this bulletin.

To facilitate rapid diagnosis of troubles which may develop in the Signal Seeking Tuner, those most likely to occur have been classified and listed in a trouble shooting chart. Three fundamental tests which are easily made on the radio are the basis for this chart. The normal indication for each test is shown just to the right of the test block in solid lines and if the indication is normal the next basic test should be made. However, if the normal indication does not apply to the radio under test, the various abnormal indications that could result from the check are shown in irregular line blocks below the normal condition. When the block which applies to the radio being checked is reached, a chart which will contain a simplified partial schematic will be referred to. The checks necessary to isolate the defective components will also be included in this chart and components common to all sets are assigned illustration numbers which are the same as those in the individual bulletins for each specific set. Thus, through the use of these charts, the vast majority of the troubles can be isolated in a very short period of time.

Initial Trouble-Shooting Tests

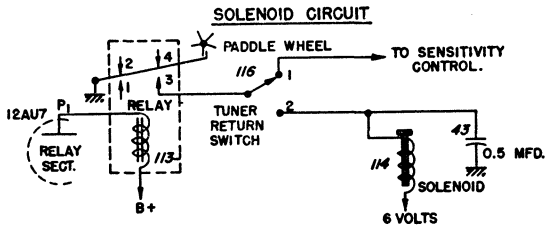
NOTE: Read the chart from LEFT to RIGHT until the specified condition does not apply to the radio being tested, then read down until the condition listed is identical to that of the radio under test. See the chart indicated for further analysis.



INITIAL PREPARATIONS FOR TEST:

1. Check tubes and vibrator.
2. Adjust input to 6 volts at receiver spark plate.
3. Adjust sensitivity control and volume control to maximum positions—all tests.
4. Leave antenna disconnected until the chart indicates connection to be made; when it is connected, antenna trimmer MUST be peaked.

CHART 1



Solenoid Circuit

CONDITION 1: TUNER WILL NOT START. POINTER STATIONARY AT END OF DIAL

IF STUCK AT HIGH END OF DIAL, momentarily short out the solenoid condenser, Illus. 43

IF THE TUNER RETRACES

Check

1. Adjustment of high frequency cam which closes tuner return switch at high end of the band. Illus. 116
2. Tuner return switch, Illus. 116, for sticking open.
3. Ground connection of relay armature.
4. Relay Contact #3 for open.

IF THE TUNER WON'T RETRACE

Check

1. Solenoid, Illus. 114, for open.
2. Solenoid for short. (Fuse blows when bar is depressed)
3. Voltage across solenoid with solenoid condenser, Iilus. 43, shorted out. Solenoid voltage should be at least 5.5 volts.
4. Solenoid positioning adjustment.
5. For mechanical bind by grasping planetary arm and cocking motor gear train by hand.

IF STUCK AT LOW END OF THE DIAL, make a visual inspection of the position of the tuner return switch, Illus. 116.

IF TUNER RETURN SWITCH IS CLOSED

(Position 2)

Check

1. Adjustment of cam which opens tuner return switch at low end of the band. (See Adjustment)
2. Tuner return switch for sticking closed.

IF TUNER RETURN SWITCH IS OPEN

(Position 1)

Check

1. Switch for possible shorted terminals.
2. Mechanical portion of tuner for a bind or a defective motor.
3. 0.5 mfd solenoid condenser, Illus. 43, for short.
4. Cold side of solenoid for short to chassis.

IMPORTANT: IF ABOVE CHECKS PROVE THE SOLENOID CIRCUIT TO BE SATISFACTORY GO TO CHART 2 AND CHECK FOR A MECHANICAL DEFECT.

CHART 2

Relay Energizes But Tuner Will Not Start

I. DEPRESS STATION SELECTOR BAR AND NOTICE WHETHER RELAY ARM DISENGAGES PADDLE WHEEL. IF IT DOESN'T—SEE RELAY POSITIONING ADJUSTMENT.

II. VISUALLY CHECK FOR CAUSE OF BIND. INSPECT TUNER FOR IMPROPERLY ROUTED WIRES FOULING MECHANISM.

III. REMOVE TUNER FROM THE RADIO. SEPARATE THE TWO HALVES OF THE TUNER.

A. CHECK THE TOP HALF OF TUNER FOR BIND BY MOVING THE CORE BAR WITH YOUR FINGER.

IF

Top half doesn't bind, check bottom half.

IF

Top half binds, remove clip from connecting link between core bar and pointer, and check each separately for bind.

B. CHECK BOTTOM HALF OF TUNER FOR BIND BY REMOVING CLIP FROM MOTOR SIDE OF SOLENOID LINKAGE.

CHECK

For bind in solenoid by moving solenoid linkage by hand.

IF

Bind occurs in solenoid linkage, remove clip from solenoid end of solenoid linkage to determine if bind is in solenoid plunger or linkage. If the solenoid linkage and solenoid are O. K., connect the gear train and soleniod together again.

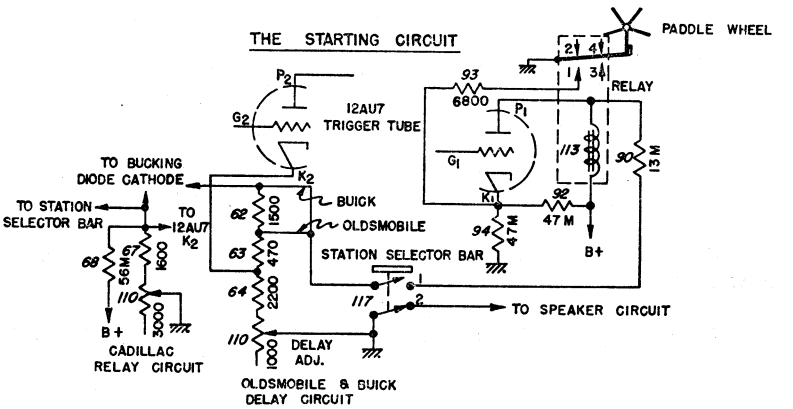
CHECK

Gear train for bind by pressing the plunger into the solenoid then carefully moving the relay arm out of the paddle wheel. The paddle wheel should start running.

IF

The paddle wheel doesn't begin running, the gear train is defective and should be replaced.

CHART 3



The Starting Circuit

CONDITION 1: THE TUNER WILL NOT START. RELAY DOES NOT ENERGIZE WHEN THE STATION SELECTOR BAR IS DEPRESSED.

MEASURE THE VOLTAGE BETWEEN THE CHASSIS AND THE SWITCH SIDE OF THE 13M OHM RESISTOR (ILLUS. 90)—(WITH RADIO ON AND AN INPUT OF 6 VOLTS, THIS VOLTAGE MUST BE AT LEAST 180 VOLTS FOR PROPER OPERATION OF THE RELAY.)

IF

VOLTAGE IS ZERO, check for

1. Open relay winding.
2. Open 13M ohm resistor.
3. Inoperative power supply or short in B voltage line.

VOLTAGE IS LOW check, for

1. Defect in power supply.
2. Low input voltage.

IF

VOLTAGE APPROXIMATES THE B VOLTAGE, depress the station selector bar and again note the voltage.

IF

THE VOLTAGE DROPS, (normal drop approximately 65 volts)

Check

1. Relay winding for short or partial short.

   (Normal relay resistance from 3200 - 3600 ohms.)
2. Resistor string from station selector bar switch to ground, for possible excessive resistance.
3. Relay Current. If relay doesn't energize with 9.5MA current relay is defective.

IF

THERE IS NO CHANGE IN VOLTAGE

Check

1. Station selector switch contacts, Illus. 117, for open.
2. Resistor string from station selector bar switch to ground for possible open.

CONDITION 2: THE POINTER COMMENCES SWEEPING ACTION IMMEDIATELY WHEN THE RADIO IS TURNED ON, WITHOUT PREVIOUS DEPRESSION OF THE STATION SELECTOR BAR.

Check for

1. Defective station selector bar switch, (Sticking closed) or a short at the switch terminals.
2. Short to chassis from either end of the 13M ohm resistor (Illus. 90).
3. Short to chassis at Plate (P1) terminal of the 12AU7 tube. (Pin 1)
4. Relay armature stuck in the energized position. (Should return to de-energized position when set is turned off.)

CONDITION 3: POINTER COMMENCES SWEEPING ACTION AFTER WARM UP PERIOD, WITHOUT PREVIOUS DEPRESSION OF THE STATION SELECTOR BAR.

Check for

1. Short from cathode (K1) of 12AU7 (Pin 3) to ground.
2. Contact #1 of the relay switch shorted to ground at all times.

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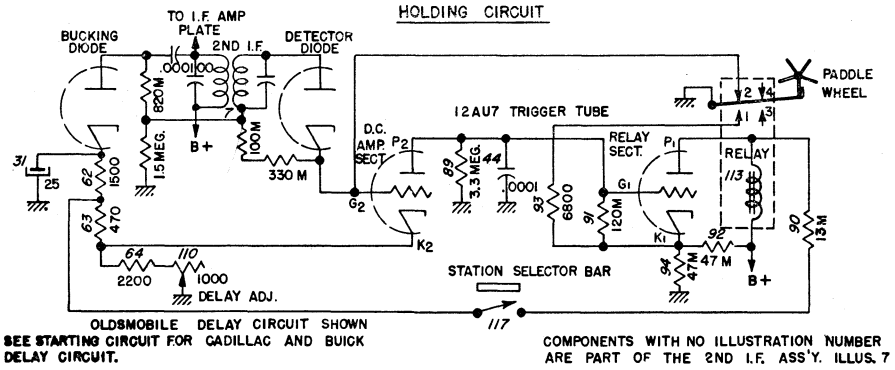
Supersedes pages 15 & 16 dated 1-1-50

CHART 4



Holding Circuit

CONDITION: DIAL POINTER STOPS INSTANTLY WHEN STATION SELECTOR BAR IS RELEASED.

I. CHECK TRIGGER TUBE (12AU7). IF OK GO TO NEXT CHECK.

II. MEASURE GRID (G_1) (Pin 2) TO CATHODE (K_1) (Pin 3) VOLTAGE AT 12AU7 TUBE WITH RADIO TURNED ON. (THIS VOLTAGE MUST BE MEASURED WITH A VACUUM TUBE VOLTMETER.)

IF VOLTAGE READING IS 25 VOLTS OR MORE NEGATIVE, CHECK:

1. Grid (G_1) to chassis resistance. If 110,000 ohms or less, check:
   a. .000100 mfd. condenser (Illus. 44) for short or leakage.
   b. P_2 (Pin 6) and G_1 terminals of 12AU7 for possible shorts to chassis.
2. D.C. amplifier cathode, (K_2) of 12AU7 (Pin 8), to ground resistance for possible short.
   a. Check at station selector switch terminals, Illus. 117, for possible short.
   b. Check at DC amplifier cathode terminal (K_2) for short to chassis or grid (G_2) terminal. (Pin 7).
3. 25 mfd. electrolytic, Illus. 31 for short.
4. Filter resistor in power supply for open.

IF VOLTAGE READING IS 25 VOLTS OR LESS NEGATIVE, CHECK:

1. 6800 ohm resistor (Illus. 93).
2. Continuity between P_1, and relay.
3. Continuity between contact #1 of relay and ground with bar depressed.
4. Check 6R8 or 6AQ7 (Substitution).
5. B+ voltage. Low voltage can cause this trouble.
6. Voltage at Bucking diode plate with a VTVM. This is the termination point of the orange lead out of 2nd IF. With radio turned on, the voltage between this point and B— should not exceed positive 3 volts. If it does, replace 2nd IF.
7. For oscillation in radio by grounding out G_2 of 12AU7. If tuner now holds—Find oscillation in radio.
8. Check relay. (Resistance should be 3200-3600 ohms.).

CHART 5

Miscellaneous Defects in the Sweep Action of the Tuner

CONDITION I. TUNER DOES NOT SWEEP THROUGH THE COMPLETE FREQUENCY RANGE.

IF	IF
Tuner retraces before high band edge is reached, adjust high frequency eccentric cam which closes tuner return switch so that retrace occurs at approximately 1620 KC. See adjustments.	Tuner starts sweeping before low band edge is reached, adjust low frequency eccentric cam which opens tuner return switch so that sweeping starts at a point below 550 KC. See adjustments.

CONDITION II. TUNER SWEEP ACTION IS SLOW, JERKY OR ERRATIC.

CHECK	CHECK	CHECK	CHECK
For pointer drag against escutcheon backplate. If this exists, see adjustments.	For broken or missing motor power spring.	For light mechanical bind - See Chart 2.	For defective gear train. See methods for checking outlined on Chart 2.

CONDITION III. TUNER SWEEPS NORMALLY UNTIL A CERTAIN POINT ON ITS DIAL IS REACHED, WHEN IT STOPS. DEPRESS STATION SELECTOR BAR.

IF	IF
Tuner can be started again by depression of selector bar, tuner is stopping on an oscillation or feedback in the radio circuit which occurs only at certain points on the dial. Check radio.	Tuner will not start when selector bar is again depressed, check for mechanical bind. See Chart 2.

CONDITION IV. TUNER RETURN ACTION ABNORMAL

IF	IF	IF
Tuner returns to a midway point and sticks there - check solenoid plunger for a bind.	Pointer rapidly goes back and forth between high end and midway point with a "Machine-gun" like effect. A. Manual worm unmeshed from manual drive gear. (On sets with manual). B. Screw which secures gear just below top plate of planetary arm to the planetary arm missing or loose. (On sets without manual tuning). C. Defect in planetary arm assembly. Replace motor gear train.	Tuner return action is slow — (About the same speed as sweeping speed)—the defect is in planetary arm assembly—replace gear train.

CHART 6

Procedure for Checking Radio Operation Independent of Tuner

CONDITION I. RADIO HAS MANUAL TUNING KNOB.

Tune radio manually and note number of stations received with listenable volume. Adjust sensitivity control to maximum and note number of stations selected automatically.

IF

Normal number of stations is received manually, but these stations are not received automatically, check tuner. See Chart 9.

IF

Normal number of stations cannot be received, TROUBLE-SHOOT RADIO PROPER.

CONDITION II. RADIO DOES NOT HAVE MANUAL TUNING.

Connect signal generator to antenna connector through a series condenser of the value specified in the service bulletin. Adjust generator output to a high level and tune the generator around the frequency indicated by the radio dial pointer until the signal is tuned in.

IF

RADIO PICKS UP SIGNAL, set the sensitivity control to maximum, peak antenna trimmer and depress the station selector bar.

IF

SIGNAL IS NOT PICKED UP BY RADIO, analyze the cause of radio failure.

IF

TUNER STOPS ON THE SIGNAL,

tune generator to frequency of weak station normally heard in the locality. Depress the station selector bar. When the tuner stops on the generator signal, plug in the antenna and again peak the antenna trimmer.

IF STATION CAN BE HEARD

Check the tuner - See Chart 10.

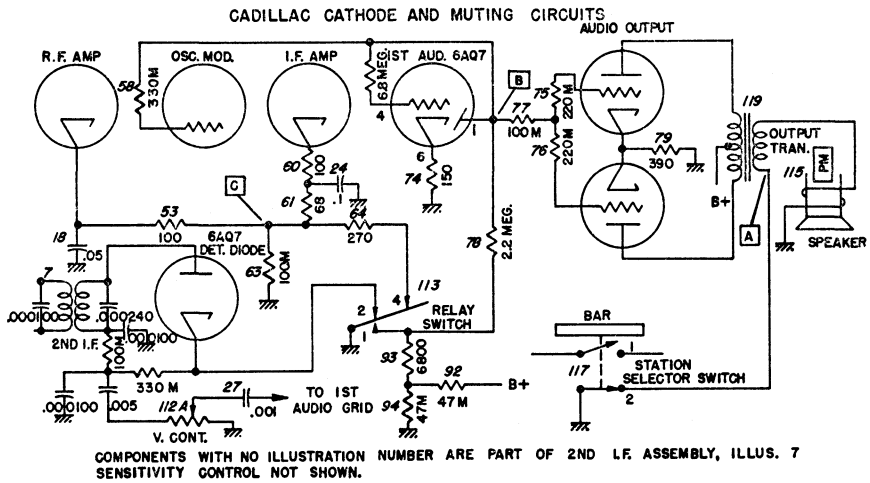
IF STATION CANNOT BE HEARD

Check the radio for defect causing it to be weak.

IF

TUNER DOES NOT STOP ON SIGNAL, see Chart 9.

CHART 7



Tuner Stops on Signals But No Sound From Speaker

I. SHORT OUTPUT TRANSFORMER SECONDARY LEAD. GOING TO SELECTOR SWITCH, TO CHASSIS. (POINT A).

- IF SOUND COMES FROM SPEAKER, find open between transformer secondary and ground end of muting section of station selector switch contact 2.
- IF RADIO IS STILL DEAD — go to check II.

II. SHORT PIN #1 OF 6AQ7 TUBE TO CHASSIS. (POINT B)

- IF SOUND COMES FROM SPEAKER, check for open between pin #1 at 6AQ7 and connect #1 of relay switch.
- IF RADIO IS STILL DEAD — go to check III.

III. SHORT RF AND IF CATHODE STRING TO CHASSIS. (POINT C)

- IF SOUND COMES FROM THE SPEAKER, check for open between cathode string and ground through relay contact #4.
- IF RADIO IS STILL DEAD, make usual radio checks to localize defective part.

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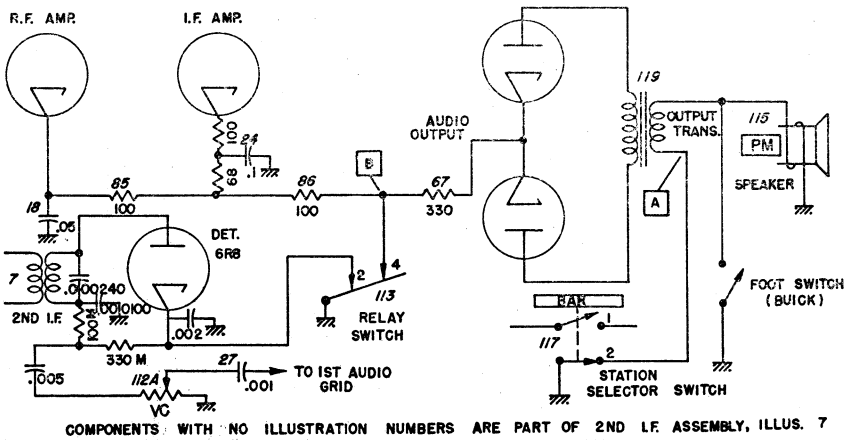
Supersedes pages 19 & 20 dated 1-1-50

CHART 8

BUICK & OLDSMOBILE CATHODE AND SPEAKER MUTING CIRCUITS



COMPONENTS WITH NO ILLUSTRATION NUMBERS ARE PART OF 2ND I.F. ASSEMBLY, ILLUS. 7
ONLY RECEIVER DISABLING SECTION OF BUICK FOOT SWITCH SHOWN.
SENSITIVITY CONTROL NOT SHOWN.

Tuner Stops on Signals But No Sound From Speaker

I. SHORT TO CHASSIS THE OUTPUT TRANSFORMER SECONDARY LEAD GOING TO SELECTOR SWITCH. (POINT A)

IF SOUND COMES FROM SPEAKER, find open between transformer secondary and ground end of muting section of station selector switch. Check for shorted foot switch (Buick)

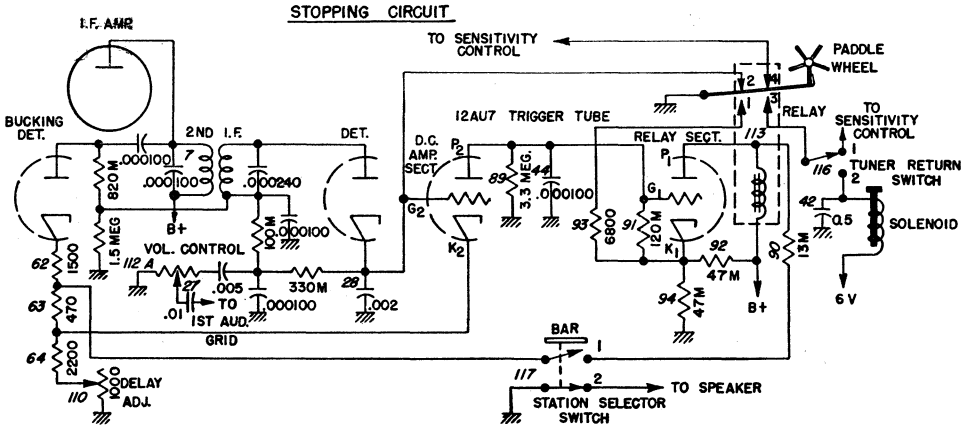
IF RADIO IS STILL DEAD — go to check II.

II. SHORT RF, IF, AND OUTPUT CATHODE CIRCUITS TO CHASSIS AT POINT B.

IF SOUND COMES FROM SPEAKER, check for open between cathode string and ground through relay contact #4.

IF RADIO IS STILL DEAD, make usual radio checks to find defective part.

CHART 9



COMPONENTS WITH NO ILLUSTRATION NUMBERS ARE PART OF 2ND I.F. ASSEMBLY, ILLUS. 7.
OLDSMOBILE DELAY CIRCUIT SHOWN.

Tuner Will Not Stop on Stations, Radio Otherwise Normal

I. WITH RADIO OFF, CHECK ENGAGEMENT OF RELAY TO PADDLE WHEEL.

IF Relay arm is missing — replace relay.

IF Relay arm does not engage paddle wheel—check relay positioning adjustment. **(Do not adjust engagement by bending relay).**

II. CHECK CATHODE DELAY ADJUSTMENT. (See bulletin for radio).

III. CHECK TRIGGER VOLTAGE AS FOLLOWS:
Block paddle wheel. Disable DC amplifier section at 12AU7 by removing heater voltage from pin 5 of 12AU7. (Alternate method of disabling DC amplifier section is by clipping pin 5 from a 12AU7 tube and inserting it in its socket.) Depress and release station selector bar. The voltage developed by a signal can now be measured with a VTVM between G_2 (Pin 7) of 12AU7 and B—. A positive value of trigger voltage should be obtained on the center frequency of the signal of 6.5 to 8 volts. On strong signals a negative voltage will be observed on both edges of the center frequency.

IF Trigger voltage normal, check.

1—12AU7 tube.

2—Continuity between G_1 and P_2 at 12AU7 socket.

3—Resistor between K_1 and B+ (Illust. 47).

4—Diode load filter capacitor (Illust. 28) for open.

IF Trigger voltage low or absent, check.

1—Diode load filter capacitor (Illust. 28) to leakage or other short from G_2 to B— (with relay energized).

2—Continuity from detector cathode to G_2 of 12AU7.

3—Continuity of sensitivity control circuit (See Page 4).

4—Sensitivity of radio in the seeking condition. Measure sensitivity with G_2 grounded and relay energized as outlined above. If radio is dead or insensitive trouble shoot under same conditions.

5—Replace 2nd IF assembly.

IF Trigger voltage negative, check.

1—Detector tube by substitution (6R8 or 6AQ7).

2—Continuity from orange lead of 2nd IF to B—. If open, replace 2nd IF.

XXXXX

Supersedes pages 21 & 22 dated 1-1-50

Miscellaneous Defects in the Tuner

I. TUNER DOES NOT STOP ON THE PEAK OF SIGNALS.

A. Check setting of delay adjustment—See set bulletin.
B. Check 6R8 or 6AQ7 by substitution.
C. Check relay drop out current. It should not drop out on current above 3.7 MA.
D. Go through step III of Chart 9. If no negative peak is noticed on edges of strong signal—Replace 2nd IF.

II. TUNER MOMENTARILY STOPS, THEN STARTS AGAIN OR WILL STOP ONLY ON STRONG STATIONS.

A. This can be caused by improper timing of the relay contacts. To check this, temporarily connect a 10 mfd electrolytic condenser of suitable voltage rating from the terminal on the sensitivity control to which the yellow lead connects, to chassis. If this cures the trouble the defect is due to improper relay point timing and the relay should be replaced.

III. TUNER STOPS ON STATIONS DURING THE TUNER'S RETURN.

A. The sensitivity control circuit is not being opened during the return cycle, because
(1) There is a short to chassis at the sensitivity control terminal of the tuner return switch, or at the sensitivity control.
(2) The cathode string is shorted to chassis elsewhere.

IV. THE TUNER WILL JAR OFF STATION ON ROUGH ROADS.

A. On sets having manual tuning this is due to a defective friction clutch in the planetary arm assy.—Replace the gear train.

V. THE RADIO DOES NOT MUTE IN BETWEEN STATIONS.

A. This is caused either by a lack of muting voltage appearing on the audio grids due to an open between the oscillator grid and the muting line or a defective audio tube. (Check the Cadillac muting circuit on Chart 7)

VI. TUNER STOPS ONLY ON STRONG SIGNALS AND THE RADIO IS OK., check:

A. Heater to cathode leakage of the 6R8 tube in case of Buick or Oldsmobile; the 6AQ7 tube in the case of Cadillac. This can be checked by increasing the "A" voltage. If situation gets worse with increased "A" voltage, change 6R8 or 6AQ7 tube, whichever applies.
B. Sensitivity control not at maximum sensitivity.
C. Illust. 28 for open.

VII. TUNER STOPS ON SIGNALS BUT THE SOUND IS DISTORTED.

Short pin 3 of 6R8 or pin 2 of 6AQ7 (Cadillac) to chassis. If distortion clears, find open between detector cathode and ground through relay contact #2.

The service part numbers shown below are identical for all Signal Seeking Tuners 1950 through 1952. The parts designated (See Radio Bulletin) are different for the various models and part numbers may be obtained from the individual bulletins.

SST

Service Parts List

Fig. No.	Part No.	Description
1	*(Description and Model)	Coil Housing Assembly
	*7259109	Iron Sleeve
1	7259201	Core-Powdered Iron
1	7259178	Core Guide Bar
	(See Radio Bulletin)	Dial Light
	(See Radio Bulletin)	Escutcheon Assy.
	(See Radio Bulletin)	Dial
	(See Radio Bulletin)	Dial Backplate
4	(See Radio Bulletin)	Manual Drive Shaft Assy.
3	1219610	Motor Gear Train Assy.
4	*(Description and Model)	Pointer Assy.
4	(See Radio Bulletin)	Pointer Tip Package
	(See Radio Bulletin)	Pointer Backplate
3	7259009	Relay
11	*7259314	Dust Cover—Relay
11	*7259315	Spring Clip—Relay
3	*7259109	Spring—Relay Arm
6	*(Description and Model)	Rod—Core Guide Bar Support
2	7259010	Solenoid
2	*7259171	Solenoid—Motor Gear Train Linkage
14	6047	Spring Clip
6	7259055	Spring—Motor Power
4	(See Radio Bulletin)	Spring—Worm Anti-Rattle
13	(See Radio Bulletin)	Station Selector Bar Pkg.
13	*(Description and Model)	Station Selector Bar
13	7259125	Switch Operation Ring
13	*(Description and Model)	Toggle Plate
13	7259111	Spring (2)
13	7256121	"C" Washer
2	7259011	Switch—Tuner Return
13	7259012	Switch—Station Selector
4	(See Radio Bulletin)	Worm—Gear and Brkt. Assy.
	*† 147481	Bearing—Worm Gear Thrust
	*† 120614	Lock nut
	*†7258600	Set Screw—Worm Gear

*These parts are not required normally for service but may be ordered by specifying part number or model number and description of part as shown in this parts list.

†These parts are same as used in Push Button Tuner Model Radios.