DUMONT

First with the Finest in Television

RA-109A

SERVICE NOTES

FOR

DU MONT TELESETS

ALLEN B. DU MONT LABORATORIES, INC.

Teleset Service Control Department

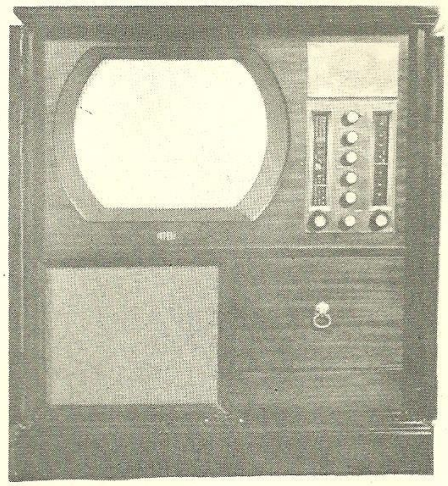
MARKET STREET **EAST PATERSON, N. J.**

DU MONT TELESETS*

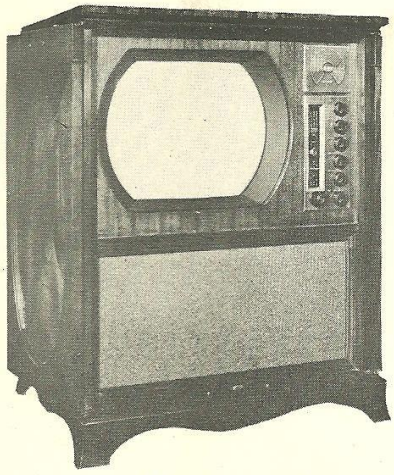
SERVICE INFORMATION

for

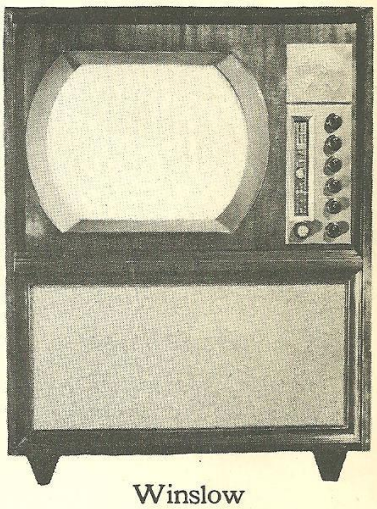
Model RA-109 A



Sherbrooke



Hanover



Winslow

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* TRADE MARK

INTRODUCTION

The Model RA-109A Teleset is produced in the following styles:

Name	Model No.	Cabinet	Services
Winslow	RA-109-A1	Mahogany Open Console	FM & TV
	RA-109-A5	Blonde Open Console	FM & TV
Hanover	RA-109-A2	Mahogany Console/Doors	FM & TV
	RA-109-A6	Blonde Console/Doors	FM & TV
Sherbrooke	RA-109-A3	Mahogany Console/Doors	AM, FM, TV, 3 speed phono.
	RA-109-A7	Blonde Console/Doors	AM, FM, TV, 3 speed phono.

	Picture Tube	Speaker
All Models	19"	10"

A single chassis, containing all the necessary circuits for outstanding television and FM reception is used in the Winslow and Hanover models.

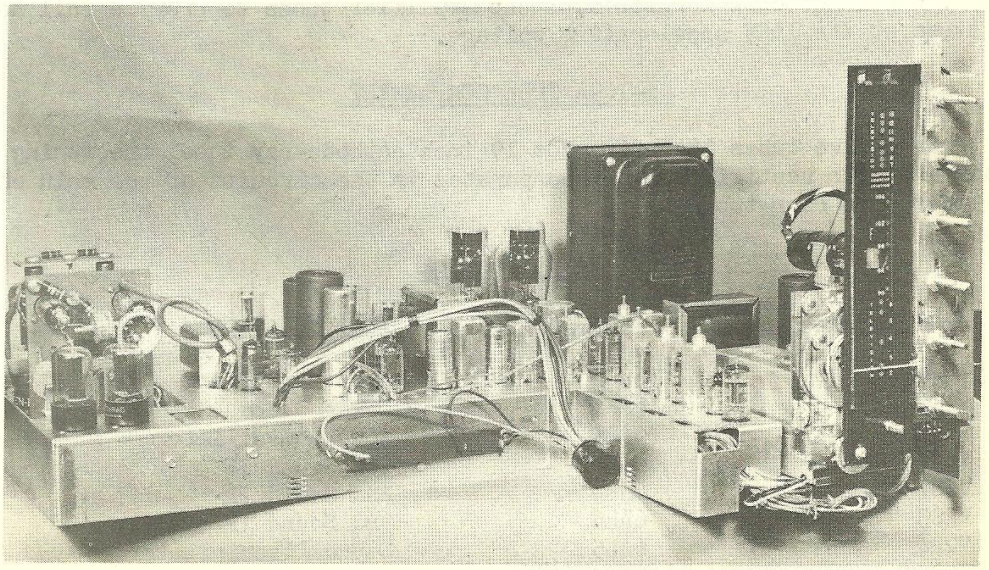


Figure 1. RA-109A Main Chassis

RA-109A Section

The Sherbrooke utilizes a separate AM tuner chassis in addition to the main chassis. The main chassis, however, supplies power to the AM chassis.

Although the Sherbrooke incorporates a three-speed record changer, all models are provided with a phono input jack to permit the use of an external record changer.

FEATURES

This new deluxe Du Mont Teleset contains several notable features including the following:

1. The new Du Mont Four Section Inputuner incorporating the spiral Inductuner and tuned input for improved selectivity plus higher gain.

2. A constant voltage power transformer to maintain the D. C. output voltage at a constant value despite line voltage fluctuations or changes in load.

3. An automatic gain control circuit to permit ease of tuning plus freedom from fading due to variations in signal level.

4. The famous Du Mont narrow band sync circuit for maximum noise immunity.

5. Four stages of video IF amplification plus two stages of video amplification for maximum picture quality plus high gain.

6. A voltage doubler power supply capable of developing 15KV for the accelerating anode of the CRT.

7. A pair of 6BG6 horizontal sweep amplifier tubes to provide full horizontal sweep at the 15KV accelerating voltage.

RA-109A TUBE COMPLEMENT

Thirty-five tubes including the 19 inch cathode-ray tube, the tuning indicator and four rectifiers are incorporated in the circuits of the main chassis. The AM tuner uses four tubes.

Main Chassis

Tube Symbol	Tube Type	Tube Function
V101	6J6	R.F. Amplifier
V102	6AK5	Mixer
V103	6AB4	V.H.F. Oscillator
V201	6AU6	1st Sound IF
V202	6AU6	2nd Sound IF
V203	6AU6	3rd Sound IF Limiter
V204	6AL5	Sound Discriminator
V205	6AL7-GT	Tuning Indicator
V206A	½ 12AU7	1st Sound Amplifier
V206B	½ 12AU7	2nd Sound Amplifier

V207	6V6-GT/G	3rd Sound Amplifier
V208	6AU6	1st Video IF
V209	6AU6	2nd Video IF
V210	6AU6	3rd Video IF
V211	6AU6	4th Video IF
V212A	½ 6AL5	Video Detector
V212B	½ 6AL5	D C Restorer
V213	6BA6	1st Video Amplifier
V214	6AQ5	2nd Video Amplifier
V215	19AP4	CRT
V216	6BA6	Narrow band sync amplifier
V217	6AL5	AGC and Sync Detector
V218	6AU6	Sync Clipper
V219A	½ 6SN7-GT	Sync Amplifier
V219B	½ 6SN7-GT	Vertical Saw Generator
V220	6SN7-GT	Vertical Sweep Amplifier
V221	5U4G	Low Voltage Rectifier
V222	5U4G	Low Voltage Rectifier
V224	6AL5	Sync Discriminator
V225	6AG5	Reactance Tube
V226	6AK6	Horizontal Oscillator
V227A	½ 6SN7-GT	Horizontal Saw Maker
V227B	½ 6SN7-GT	AGC Clamp
V228	6BG6-GT	Horizontal Sweep Amplifier
V229	6BG6-GT	Horizontal Sweep Amplifier
V230	1X2	High Voltage Rectifier
V231	1X2	High Voltage Rectifier
V232	6W4-GT	Damper
V233	6W4-GT	Damper

AM Tuner Chassis (Sherbrooke Only)

V501	6BA6	R F Amplifier
V502	6BE6	Converter
V503	6BA6	IF Amplifier
V504	6AL5	Detector and AVC

ELECTRICAL CHARACTERISTICS

Average Power Ratings (Line Voltage - 117 volts AC)

Television - 325 watts FM - 200 watts

CRT High Voltage - (Line Voltage 117 volts AC)

15.0 KV ± 1 KV Zero Brightness

Audio Power Output (At 400 cycles)

3 watts across 3.2 ohm resistive load in place of speaker.

Picture Size

Dimensions 13" X 17 3/8"

Area 208 square inches

PHYSICAL CHARACTERISTICS

Cabinet Size

	Height	Width	Depth
Hanover	40"	33 1/8"	25 1/4"
Winslow	40"	30 5/8"	22 5/8"
Sherbrooke	40"	36"	24 1/2"

2.0 CIRCUIT DESCRIPTION

(Reference Circuit Diagram in Envelope)

2.1 RF Tuning Assembly

The RA-109A Teleset incorporates the latest Du Mont Four Section Inputuner which provides continuous coverage of all VHF TV channels plus the standard FM channels. It employs the same inductive tuning principle which has won for the Du Mont Three Section Inputuner its reputation for trouble-free, reliable performance.

The circuits of this new Four Section Tuner are built around the latest Mallory-Ware miniature spiral type Inductuner, Figure 1.

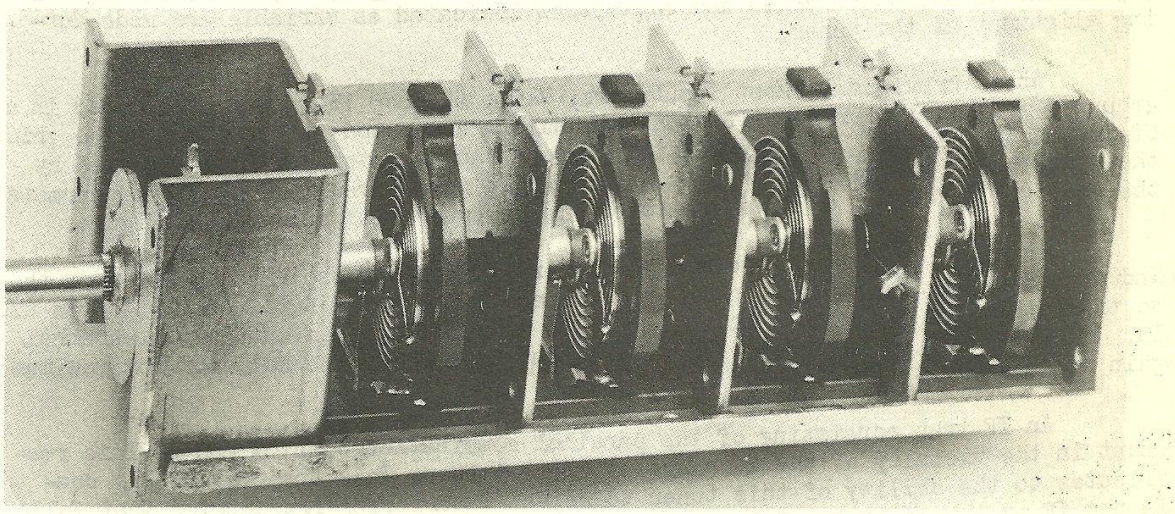


Figure 1. Mallory-Ware Spiral Inductuner

The use of this new spiral type Inductuner results in a smaller, more compact Inputuner. Improved selectivity and higher gain have been achieved by the additional tuned circuit and advanced circuit design.

The advantages derived from the higher-selectivity of this new Inputuner is freedom from interference by TV stations on channels adjacent to that being received as well as freedom from interference caused by FM broadcast stations.

The input impedance of this new tuner is 72 ohms unbalanced to ground. Therefore, for optimum results, co-axial cable must be used when installing Du Mont Telesets. The co-axial cable should be RG-59/U if the Teleset is to be installed in a strong or moderately strong signal area. For fringe locations, RG-11/U which also has a characteristic impedance of 72 ohms but has a much lower line loss, should be used.

The incoming signal is applied to the primary of T101 between one end of the winding and the center tap which is ground. This transformer utilizing a bifilar winding can be used for matching either 300 ohm balanced transmission line or 72 ohm unbalanced.

A 300 ohm balanced transmission line would be connected to the outside terminals of the primary. A 72 ohm unbalanced transmission line (co-axial cable) would be connected between either end of the primary and the grounded center tap.

In Du Mont Telesets, only the connections for the 72 ohm co-axial input are brought out to the antenna jack at the rear of the set. This is done to insure that only co-axial transmission line is used when installing Du Mont Telesets.

The four variable tuning inductors that are ganged together and comprise the Inductuner are identified on the schematic as L102A, L102B, L102C and L102D. Adjustment of the other coils and capacitors indicated as variable are made during alignment of the tuner.

As in previous Du Mont Inputuners, V101, the 6J6 RF amplifier is used in a grounded grid amplifier circuit with both halves connected in parallel. The grids of the tube are at rf ground potential whereas the dc potential is controlled by the AGC circuit in the main chassis. A grounded grid circuit of this type permits the use of a triode in an rf stage to provide a tuner with a low noise figure.

The grid circuit of the 6J6 amplifier is tuned by the first section of the Inductuner L102A in conjunction with the capacity in the circuit. Coil L103 is used to track the high television channels and is adjusted for maximum gain at channel 13. C100 is used to track the low television channels and is adjusted for maximum gain at channel 6.

An IF trap consisting of the parallel combination of L101 and C101 is resonant in the vicinity of the IF range of frequencies. This trap meterially contributes to the ability of this tuner to reject interfering frequencies that fall in the IF pass band of the Teleset.

A double tuned band pass circuit couples the plate of the RF amplifier V101 to the grid of the mixer tube V102. Within this circuit is a compensated system of bottom side coupling comprising circuit elements L105, C111, L107 and C113. This circuit provides correct band width and signal transfer over the entire tuning range (54 - 216 mc).

C110 and C112 are used to track the circuits over the lower television channels and are adjusted to balance the bandpass at channel 6. L108 and L113 track the circuits over the high television channels and are adjusted to balance the bandpass at channel 13. Further adjustment of the bandpass at channel 13 may be had by adjusting the inductance L107. This inductance although shown as a variable coil on the schematic, actually consists of a small metal strip one side of which is fastened with a screw to the chassis, thus making the ground connection. The bandpass may be changed by adjusting the position of this strip.

The oscillator circuit utilizing a 6AB4 triode is of the Colpitts type in which the feedback voltage from plate to grid is accomplished by means of the interelectrode capacitance of V103. The oscillator tuned circuit consists of the variable inductor L102D with series inductor L110 and shunt inductance L109. This combination being resonated by adjustable capacitor C118 and the tube capacitance.

The low television channels are tracked by C118. A 70 mc crystal controlled signal is fed into the tuner and C118 is adjusted to obtain a difference frequency of 21.9 mc. This 21.9 mc signal is then beat against a 21.9 mc crystal controlled signal fed into a test IF strip. The capacitor is properly adjusted when a condition of zero beat is observed on an oscilloscope used as an indicator.

Adjustable coil L110 serves to track the high television channels and is adjusted in the same manner as C118. A crystal controlled signal of 217.5 mc is fed into the tuner for this high end tracking adjustment.

Both the oscillator output and the incoming signal are fed to the control grid of the 6AK5 mixer tube. When properly tuned to a television channel these two signals beat together to produce an IF of 21.9 mc for sound and 26.4 mc for picture. It is understood of course, that the necessary sidebands accompany the two intermediate frequencies.

These new frequencies are available in the plate circuit of the mixer tube and in this Teleset they are applied to the primary of a transformer that is used in a link coupling circuit to couple the tuner output into the first video IF amplifier in the receiver proper.

All power necessary to operate the tuner is obtained from the receiver chassis. The gain of the tuner is controlled by the application of AGC voltage to the grids of both the RF amplifier and the mixer stage. This will be discussed in more detail in a later section on AGC.

Video IF Strip

Four stages of IF amplification utilizing 6AU6 tubes comprise the video IF strip. A four stage amplifier of this type will provide high gain with excellent stability and freedom from regeneration.

The gain of this strip is controlled by application of AGC voltage to the grids of the 1st and 2nd stages. R237 and C226 act as an IF filter in the grid circuit of the first video IF while R240 and C228 perform the same function in the second stage.

The first stage functions not only as the first video IF amplifier but also amplifies the 21.9 mc sound IF. The sound take-off point is in the plate circuit of this stage.

Undesired frequencies that would cause interference with the desired signal are attenuated both by special traps as well as the pass band of the IF strip. A 27.9 mc trap intended to attenuate the sound carrier of the lower adjacent channel to which the Teleset is tuned is contained within the transformer Z205. It consists of an absorption type trap coupled into the transformer secondary. The 27.9 mc signal is produced when the local oscillator beats with the sound carrier of the lower channel adjacent to that being received.

A second trap, consisting of C291 in parallel with the series combination of C290 and L207, is located in the coupling circuit between the third and fourth video IF stages. This combination is designed to attenuate the 21.9 mc signal that accompanies the picture. The series resonant circuit of C290 and L207 presents a low impedance to ground at the frequency of 21.9 mc. Above resonance this combination of C290 and L207 becomes inductive and the resultant inductance in parallel with C291 presents a parallel resonant circuit and thus, high impedance for frequencies in the IF range. A circuit of this type will attenuate the undesired signal without affecting the desired IF band.

Video Detector and Amplifier

The video IF signal is applied to the video detector V212A ($\frac{1}{2}$ 6AL5) through transformer Z209. The circuit is so connected that the polarity of the composite video signal is black negative. This term indicates that the "black" portion of the picture including blanking and sync extend in the negative direction.

C234 and L201 comprise an IF filter to eliminate all traces of intermediate frequencies in the video amplifier. High frequency compensation is also used in the detector output circuit in the form of L202.

Two stages of video amplification plus a dc restorer are used to provide optimum picture quality.

A 6BA6, which is a remote cut-off type tube is used as the first video amplifier. The use of this tube as the 1st video amplifier permits the application of large amplitude video signals to this stage without fear of compressing the whites in the picture. Variation of contrast is possible in this stage by using a potentiometer in the cathode circuit as a means of varying the bias and thus control the gain of this stage.

A shunt compensating coil L203 is used in the plate circuit of the first video amplifier for improved high frequency response.

The parallel combination of L204 and C236 form a trap resonant at 4.5 mc. This trap, often referred to as a "grain" trap is used to eliminate the 4.5 mc beat that occurs as a result of the 4.5 mc difference between the sound and picture carriers of each television channels.

A low frequency compensating circuit consisting of R255 and C235B is included in the plate circuit of this stage. A 10 mfd capacitor C235D is used as a screen by-pass condenser for improved low frequency response of this stage.

The 2nd video amplifier stage utilizes a 6AQ5 miniature beam power amplifier tube whose electrical characteristics are similar to those of the 6V6. A combination of fixed and cathode bias is used in this second stage. The grid leak resistor is returned to the negative bias supply whereas a cathode resistor of 33 ohms by-passed by C319 is used to develop the cathode bias. The use of a .005 mfd capacitor across the cathode resistor produces some high frequency peaking.

As in the 1st video amplifier, the screen grid of the 2nd video amplifier is by-passed with a 10 mfd capacitor for good low frequency response. Good high frequency response of this stage is maintained by the use of L205, a shunt compensating coil in the plate circuit of V214. Some additional low frequency compensation in the plate circuit is provided by the 10 mfd capacitor C235A in conjunction with the parallel combination of R365 and R374.

A dc restorer circuit is connected in the conventional manner in the grid circuit of the cathode-ray tube. All versions of the RA-109A Teleset use a 19AP4 cathode-ray tube for the picture tube.

Brightness is controlled by varying the dc voltage at the cathode of the picture tube. As in all other Du Mont Telesets except the RA-111A, the brightness control is connected in a voltage divider circuit across B+ with the arm of the brightness control connected to the cathode of the picture tube.

Another control in the cathode-ray tube circuit is the cathode-ray tube sensitivity control. The setting of this control determines the amount of composite video signal that must be fed to the grid of the picture tube to provide a picture of desired contrast. The adjustment of this control varies the B+ voltage applied to the second or screen grid of the picture tube. Normally, this is set so the cut-off voltage of the picture tube is -50 volts. (See the section on adjustments for more information.)

Sound IF Strip

Two straight forward IF stages V201 and V202 followed by a stage designed to provide the combined functions of an IF amplifier and limiter comprise the sound IF strip. These three stages use 6AU6's and are followed by a conventional FM discriminator using a 6AL5. The frequency of the sound IF in all Du Mont Telesets is 21.9 mc.

Since this Teleset is also used for the reception of standard FM broadcast stations using wide band FM, the circuits are designed to pass a bandwidth of at least 150 KC with a guard band of 25 KC each side. Thus, the amplifier strip must be designed for a bandwidth of 200 KC.

AVC voltage is developed in the grid circuit of V203, the third sound IF limiter stage. This voltage is developed when grid current flows through R210 and is filtered by R209 and capacitors C209 and C210. This AVC voltage is applied to the grid circuits of V201 and V202. IF filters for this voltage are located in the grid circuits of each of the stages controlled by AVC. When the Teleset is in the FM position, this AVC voltage is applied to the first video IF stage as well as the RF amplifier and mixer in the Inputuner.

The audio output of the discriminator appears as a differential voltage across R215 and R216. This signal is applied to the service selector switch through a de-emphasis circuit made up of R214 and C215. The purpose of this circuit is to de-emphasize or attenuate the high modulating frequencies. This is necessary since these frequencies are pre-emphasized at the FM broadcasting stations.

A 6AL7-GT tuning indicator is connected across the output of the discriminator circuit.

To prevent regeneration, due to feedback into the filament source, chokes L208 and L209 are inserted in series with the filament lines of the sound circuits.

Audio Amplifier Section

The Audio Amplifier section is composed of three stages of audio amplification utilizing both halves of a 12AU7 as separate cascaded voltage amplifiers driving a 6V6-GT/G as the power output stage.

The input to the 1st sound amplifier appears on a contact of the service selector switch. This permits application of phono output, AM tuner output or sound discriminator output to the amplifier as desired.

A compensated volume control is used in the grid circuit of the first sound amplifier. Capacitor C315 connected across one-half the control will give some treble boost when the arm of the control is located between the two lower taps. Resistor R219 and capacitor C217 between the center tap and ground are used to provide some bass boost when operating on lower settings of the volume control. An additional circuit consisting of R220 and C218 that performs a similar function is connected to the bottom tap. The amount of bass boost used may be adjusted by resistor R218A which shunts capacitor C217.

Fixed bias is applied to the grid circuit of the first sound amplifier from the negative 12 volt supply. The first sound amplifier is resistance coupled to the second sound amplifier and a two section treble boost filter is located between these sections. A potentiometer for controlling the amount of treble boost is connected across this filter and is identified on the schematic as R218B. R226 is the grid leak resistor and is connected to the grid of V206A through the treble tone control R218B. Cathode bias is used for the second sound amplifier and the 25 mfd capacitor by-passes the bias resistor to provide good low frequency response.

Negative feedback from the plate circuit of the third sound amplifier to the plate circuit of the second sound amplifier is accomplished by the combination of R229 and R231. Cathode bias is also used in the third sound amplifier with a 50 mfd capacitor used as the by-pass condensor. Screen grid is heavily by-passed with a 10 mfd capacitor in order to produce good low frequency response. The power output of this amplifier is rated at three watts as measured across a 3.2 ohm resistor in place of a loudspeaker at 400 cycles.

Composite Synch Section

In the block diagram (in envelope with schematics) of the RA-109A, one section block is referred to as the "composite synch section". This designation is used to indicate that if one of the stages contained within this section were to fail, both horizontal and vertical synch would be lost.

The stages contained in this section are referred to on the schematic diagram as V216, the synch amplifier, V217, the AGC and synch detector, V218, the synch clipper and V219A, the synch amplifier.

The first two tubes mentioned, namely, V216 and V217, comprise a special Du Mont circuit known as the narrow band synch circuit. The use of this same type circuit in the RA-105B and RA-108A Telesets gained for these receivers, a reputation, second to none because of their extreme immunity to noise. The term "noise immunity" as used in this text is meant to designate the ability of a Teleset to hold synchronism (both vertically and horizontally) despite the presence of interfering noise pulses.

The principle involved in this narrow band type of synch circuit is to eliminate these noise pulses before they arrive in the synch circuits. To accomplish this end result, a special narrow band video IF stage is used. This stage is referred to on the circuit diagram as V216, the synch amplifier.

The video IF signal is fed from the cathode of the video detector to the control grid of V216, the 6BA6 narrow band synch amplifier stage. The video IF signal is amplified by this 6BA6 which is a remote cut-off tube and used in this circuit to prevent the compression of the synchronizing pulses. Two cathode resistors are used but only one is by-passed. The degeneration resulting from the un-bypassed resistance also reduces the possibility of synch compression.

The output from the 6BA6 is coupled to the AGC and synch detector, V217, by means of a special narrow band transformer identified as Z210. The response of this transformer is such that when tuned to 26.4 mc, the bandwidth 3 db down from 26.4 mc is 700kc $\pm$ 50kc and 1 mc $\pm$ 50kc at 6 db down. This narrow band transformer will, therefore, exclude all the higher video frequencies as well as the noise pulses, most of which usually appear in the higher video ranges. The response of the transformer is adequate to pass those frequencies necessary to reproduce the synch pulses for proper synchronization of the receiver. (The method of adjusting this transformer is found on the alignment procedure sheet.)

One-half of V217 (pins 1 and 7) is used as the AGC detector. The AGC voltage is developed when this half of the tube conducts, developing a voltage across resistor R358, R357 and R271. The amount the tube conducts and thus, the resulting AGC voltage depends upon the setting of the AGC control and the strength of the incoming signal. The purpose of the AGC control is to bias the AGC diode such that weak signals will not develop AGC and thus, reduce the gain of the receiver.

Two AGC lines are used to feed AGC voltage to the controlled stages. One line connected across R271 is used to feed AGC to the grid circuits of both the 1st and 2nd video IF stages. RC decoupling circuits in the grid circuits of the 1st and 2nd IF stages prevent any of the IF signal from feeding back into the AGC line. The second line, connected across C311 is used to feed AGC to the Inputuner.

The circuitry involved here is somewhat different, however, from that of the AGC line fed to the video IF's. A delay circuit consisting of R355, a 10 megohm resistor connected back to the 150 volt line, will apply a low positive voltage to the AGC line. This positive voltage will oppose and cancel out, any AGC developed with weak signal input. The result is that on weak signals, AGC is applied to the 1st two video IF stages, whereas no AGC is applied to the Inputuner stages.

The purpose of this arrangement is to permit the tuner to operate at maximum gain with weak signal input. The signal voltage fed to the mixer grid will then be relatively high which is desirable. This condition will result in a higher signal to noise ratio to produce a picture with a lower noise content than could otherwise be obtained.

With a circuit of this type, it is apparent that the grids of the rf and mixer tubes would tend to go positive at low signal levels, since the positive voltage would be greater than the negative AGC voltage. To prevent this, a special AGC clamp tube is used to keep the grids at ground potential while the delay action is taking place. The tube, ($\frac{1}{2}$ 6SN7) is identified on the schematic as V227B.

The second half of V217 (pins 2 and 5) is used as the synch detector with the detected composite video signal appearing at pin 5. The setting of the AGC control has no effect on the operation of the synch detector, since both pins 2 and 5 will ride at the potential of the AGC control when no signal is applied. The composite video signal is then coupled to the grid of the synch clipper V218.

A 10K resistor R284, in series with C249 is used to attenuate any noise pulses that may still exist after coming from the narrow band circuit. The synch clipper stage, operating at low plate and screen potentials in conjunction with a long time constant grid circuit will result in the removal of the composite synch signal from the video signal.

This composite synch signal is then fed to the synch amplifier V219A. This stage functions to perform some additional clipping of the synch pulses and also inverts the polarity of the composite synch. The polarity of the synch pulses at the plate of the V219A is positive. This polarity is required for synchronization of the horizontal and vertical oscillators. The additional clipping is necessary in this stage to remove any irregularities from the synch pulses. To improve the clipping action, the grid is returned to + 215 volts. Although identified as an amplifier on the schematic diagram, there is actually a reduction in the amplitude of the synch due to the additional clipping.

The composite synch signal is fed to both the horizontal and vertical circuits from the plate of V219. We will consider the vertical circuits first and then return to this point and proceed through the horizontal circuits.

Vertical Sweep Section

The vertical sweep section is composed of V219B (½ 6SN7), the vertical saw generator and V220 (6SN7) the vertical sweep amplifier. The vertical saw generator stage functions both as a blocking oscillator and a discharge tube.

The composite synch signal is fed from the plate of V219A to the grid circuit of the vertical saw generator V219B, through what is known as an integrator circuit. This integrator is composed of R291, C253, R292, C254, R293 and C255. The purpose of this circuit is to derive a 60 cycle synch pulse from the composite synch signal fed into its input. Composite synch is so called because it consists of horizontal synch pulses, equalizing pulses and the serrated vertical synch pulse.

Six equalizing pulses, followed by the serrated vertical synch pulse, followed by six additional equalizing pulses, is a sequence that occurs at the end of each vertical scanning field (bottom of picture). The 60 cycle pulse mentioned above, is derived from the serrated vertical synch pulse sometimes referred to as the vertical synch pulse interval. This type of circuit also constitutes an effective noise filter since most noise pulses are high frequency in content and are by-passed to ground.

The vertical synch pulse output from the integrator is applied to the grid of the vertical saw generator through a winding of the blocking oscillator. This blocking oscillator circuit is slightly different from that used in previous Du Mont Telesets. The blocking oscillator transformer, for example, consists of two windings instead of the three windings used in previous vertical blocking oscillator circuits. Although the circuit arrangement is slightly different the desired end result which is the correct vertical sweep waveform remains the same as in all Du Mont Telesets.

This circuit oscillates because of the coupling from the plate-cathode circuit to the grid circuit through the transformer. The circuit blocks because of the grid current charging C256. This capacitor discharging through R295 and the vertical hold control, R294, developes sufficient negative bias to keep the tube beyond cut-off. The rate at which the capacitor discharges through R295 and the vertical hold control determines the blocking frequency of the circuit. Reducing the resistance in the circuit with the hold control increases the blocking frequency and increasing the resistance in the circuit decreases the frequency.

During the period the tube is cut-off, the vertical sawtooth signal is formed by charging capacitors C318 and C257 through resistors R296, the vertical size control, R298, and R297. When the tube goes into oscillation it conducts very heavily, discharging the parallel capacitors (C318 and C257) through the plate-cathode circuit of the tube and the resistance R297. The heavy discharge current flowing through this resistor will put a negative pulse on the return trace of this waveform. This pulse is necessary to speed up the vertical return trace.

The amplitude of the sawtooth portion of the waveform may be varied by adjustment of the size control, R298. Maximum size will be obtained when the size control is shorted out. Minimum size will be obtained when the entire resistance of the potentiometer is in the circuit.

The vertical sweep signal is applied to the vertical saw generator where the signal is amplified and inverted. Both halves of this 6SN7 are connected in parallel. The linearity control, R299, is located conventionally in the cathode circuit of this stage. The linearity control varies the bias and thus, the operating point of the tube. Any curvature in the vertical sweep waveform that could produce non-linearity can thus be eliminated by the opposite curvature in the tube characteristics. The low end of the grid cathode circuit is returned to the -12 volt line, which is the B- side of the low voltage power supply.

The amplified and inverted signal is applied to the primary of T207. This transformer is an output transformer designed to match the impedance of the yoke to the impedance of the 6SN7. The transformer does not change the polarity of the signal. The B+ voltage for the vertical deflection amplifier and saw generator is obtained from the horizontal output stage. A boosted voltage having better regulation is obtained at pin #1 of the horizontal output transformer. This higher voltage will insure that sufficient vertical size may be obtained under varying conditions.

Horizontal Synch and Deflection Circuits

The stages comprising the horizontal synch and deflection circuits resemble in many respects those found in other Du Mont Telesets.

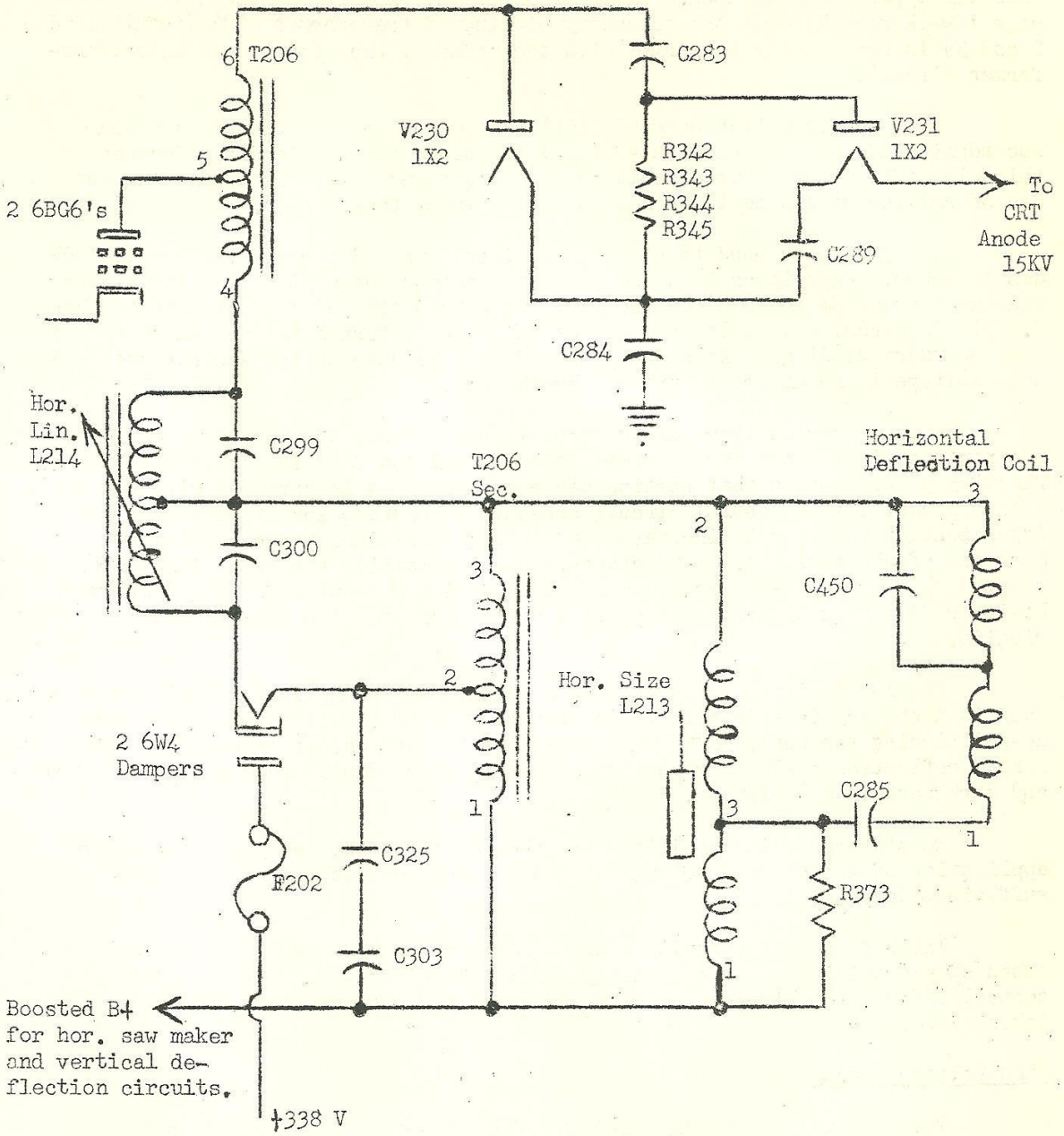
The stages responsible for the performance of the horizontal synch function are V224, the synch discriminator, V225, the reactance tube and V226, the horizontal oscillator. These three tubes comprise the AFC synchronizing circuit, which is for all practical purposes, identical to that used in other Du Mont Telesets. Perhaps the most noticeable difference between this and previous circuits used is the use of a 6AG5 instead of a 6AC7 reactance tube and a 6AK6 instead of a 6K6 horizontal oscillator.

The horizontal saw maker utilizing one section of a 6SN7 is also very similar to circuits previously used for this function. (A description of the operation of the synch circuit and saw maker will be found on pages 8 and 9 of the RA-105 Service Manual.)

The horizontal sawtooth signal which is developed across C280, R346 and R349 is fed to a pair of 6BG6 horizontal sweep amplifier tubes operated in parallel. Resistors used to prevent parasitic oscillation which could occur as a result of the parallel type operation can be found in the control grid, screen grid and plate circuits. These are R327 and R332 in the plate circuit, R329 and R330 in the screen grid circuit and R326 and R331 in the control grid circuits.

Screen voltage is supplied to the 6BG6's from the S338 (thru switch) voltage source, and the B voltage for the plate is supplied from the boosted voltage available in the secondary circuit of this stage. The cathode and grid circuits are returned to the -12 volt source which is the negative return for the low voltage supply.

To simplify the explanation of the horizontal output circuit, it has been redrawn and appears on the following page.



SIMPLIFIED SCHEMATIC OF HORIZONTAL OUTPUT STAGE

The horizontal output circuit used in this Teleset is somewhat different from the types formerly used. Examination of the simplified schematic shown on page 109-2K reveals that the secondary winding of transformer T206 (terminals 1, 2 and 3) is essentially in series with the primary, thus forming an auto-transformer circuit.

This configuration permits tighter coupling between the primary and secondary windings resulting in a highly efficient output circuit. Because of this high efficiency, this circuit requires less current, thus permitting the use of smaller wire size to produce a more compact transformer.

The 338 volts used to power this circuit is fed through the parallel 6W4 damper tubes. Capacitors C325 and C303 connected between pin #2 of the second and the boosted B+ are used to increase the return time of this circuit to about 7.5 microseconds. The filaments of the 6W4's are returned to the center tap of the secondary winding to keep the pulse voltage between heater and cathode to a safe voltage in an effort to prevent breakdowns.

A shunt series type size control is used across the secondary of T206. The portion of the inductance between terminals 1 and 3 is in series with the deflection yoke, whereas that portion between 2 and 3 is in parallel with the yoke. This horizontal size control circuit presents a constant load to the secondary. Adjustment of the slug to increase the parallel coil inductance results in a decrease of the series coil inductance, thus maintaining the total inductance constant. This arrangement permits variation of size without affecting linearity. Resistor R373 is used across the series portion of the size coil to prevent ringing.

The sweep signal is capacitively coupled to the horizontal deflection coil. This is necessary in this circuit to prevent DC from flowing through the yoke and de-positioning the beam. A 68 mmfd capacitor is used across one-half of the horizontal deflection coil to prevent yoke ringing which would produce vertical white and dark bars in the picture.

No static damping resistors are needed across the secondary since the application of the boosted voltage to the vertical deflection circuits provides sufficient damping.

The horizontal linearity control adjusts the point at which the damper tubes stop providing the sweep energy and the 6BG6's start. Therefore, this control affects the linearity at the center of the picture where this effect takes place.

High Voltage Supply

The high voltage supply used in this Teleset is a voltage doubler type using two 1X2 rectifiers in cascade. The method of operation is the familiar "kickback" type. The high voltage pulse that appears between the 6BG6 tap on the transformer and ground, is stepped up as in the conventional auto-transformer manner to a higher voltage pulse at terminal 6 of the transformer winding. These pulses are rectified and each 1X2 handles half of the total output high voltage of 15KV. The 15KV output appears across C289 and C284 in series to ground.

Low Voltage Power Supply and Focus Circuit

The low voltage power supply utilizes a special constant voltage power transformer similar to that used in the RA-108A Telesets. In this transformer, the five volt winding and the high voltage secondary winding are regulated. Because of this transformer, the serviceman should receive no complaints about picture "flicker" or change in picture size with line voltage variations, within the limits of the transformer specifications which appear below.

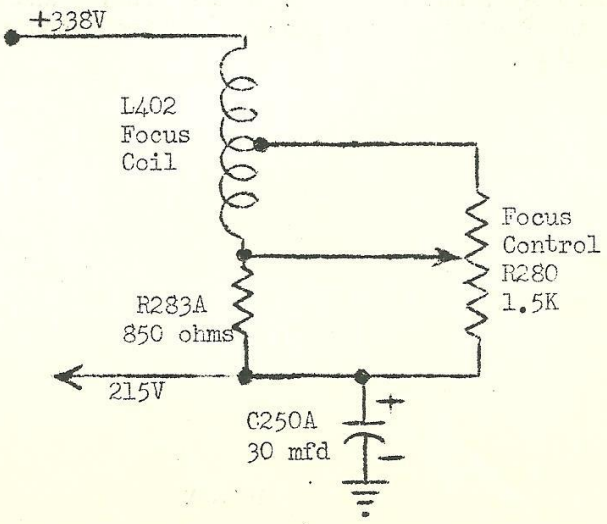
The inductance of the secondary is tuned to resonance with C310, the .2 mfd capacitor connected across the secondary terminals. Because of this resonant condition, a high circulating current flows in the secondary. This results in that portion of the core becoming saturated. Because of this saturation, the secondary voltage is practically immune to primary changes over a wide range of voltages. Specifically, this transformer is designed to maintain the DC voltage output constant within ± 2% for line voltage variations of ± 10% of 117 volts. Thus, if the line voltage is any value between 105 and 129 volts, satisfactory operation should result.

All tubes with the exception of the 5U4G rectifiers and the 6W4 dampers receive their filament voltage from the green winding of the transformer at terminals X1 or X2 to ground. The filament voltage for the 6W4's is obtained from a separate transformer, T204. This is necessary since the pulse voltage at the filaments of these tubes is very high.

The center tap of transformer T203 is returned to ground through R303A and R303B. The current flowing through R303B is sufficient to develop a negative 12 volts which is used for the bias supply.

R303A is shorted out by the switch S201 in the TV position. However, on FM, AM and phono positions, this 90 ohm resistor is in the circuit. Its purpose is to produce an additional voltage drop in the negative return circuit in an effort to stabilize the voltages in the circuits when less current is being drawn from the supply.

The focus circuit is different than any used previously in Du Mont Telesets. Therefore, it has been redrawn and is shown here in a form that is easy to follow:



The focus coil used is a center-tapped coil. As seen from the schematic, control of the focus is made by adjusting R280 to vary the current through one-half of the focus coil. All of the current flows through one-half of the coil whereas the adjustment of the focus control varies the amount of current flowing through the second half of the focus coil. The advantage of using a center-tapped focus coil is that it greatly improves the efficiency of the focussing system. It permits the use of lower current than would be necessary in the event an untapped coil were used.

AM Tuner

In the Sherbrooke version of the RA-109A, a separate AM tuner is used. The circuitry in this AM tuner is very similar to that which was used in the Colony version of the RA-105A Teleset.

The essential difference between this tuner and that used in the RA-105A other than the physical layout is the use of a 6AL5 for the detector and AVC instead of a 6BQ7.

A loop antenna is provided for use with the tuner if sufficient signal is available; if not, an outside antenna may be used.

Voltages necessary to power this unit are obtained from the main chassis of the Teleset. The AM tuner is plugged into the AM tuner socket, J207, located on a panel near the Inputuner dial.

The main chassis used in the Winslow and Hanover Telesets are identical to that used on the Sherbrooke. However, only four positions of the switch are used on the Winslow and Hanover models, whereas the fifth, or AM position, is available on the Sherbrooke. For information on how to obtain the additional switch position on a Winslow or Hanover chassis, see the Service Section of this manual.

Record Changer

A three-speed record changer is also included in the Sherbrooke model. A service manual for this changer will be available in the near future. An external record player may be used with the Winslow and Hanover if desired. A jack at the rear of the receiver chassis and the phono position of the switch makes this possible.

3. INSTALLATION

Du Mont Telesets are designed to simplify the installation problem for as many different types of locations as possible.

Despite all the features engineered into Du Mont Telesets to accomplish this purpose, carelessness, or lack of basic installation knowledge on the part of the installation man, can cancel out the effects of these features.

A breakdown of the various types of locations where these Telesets may be installed is important in order to point out the advantages to be derived from installing an RA-109A Teleset.

There are numerous types of conditions with which the serviceman is faced when installing a Teleset. Although not a complete list, the following represents with a fair degree of accuracy, the types of locations where Telesets are normally installed.

1. A fringe area (area of weak signal)
2. An area containing reflections which produce "ghosts"
3. An area which is extremely noisy, either due to automobile ignition interference or industrial machinery in the vicinity.
4. Areas of varying or fluctuating line voltages.
5. Areas of varying signal strength from the transmitter.
6. Areas where fairly strong FM interference is normally encountered.

In addition to the above, combinations of several of the above conditions are often found in one location.

Let us consider each of these areas and determine how the RA-109A Teleset makes for ease of installation.

1. Fringe Areas

The RA-109A due to its high sensitivity and excellent synch circuits will perform very well in the fringe areas, providing of course, that a good installation is made. For optimum results, coaxial type transmission line should be used when installing Du Mont Telesets. For the fringe areas, RG-11/U coaxial cable should be used. This cable has a characteristic impedance of 72 ohms designed to match the input impedance of the Teleset. It has much lower line losses than RG-59/U coaxial cable. RG-59/U also has an impedance of 72 ohms but due to its higher line losses should be used only in strong or moderately strong signal areas. RG-11/U coaxial cable can be recognized in comparison to RG-59/U because of its larger diameter. The outside diameter of RG-11/U is .4" as compared to .2" for the RG-59/U. The loss in RG-11/U is 2.1 db per 100 foot at 100 mc as compared to 3.8 db per 100 foot at 100 mc for RG-59/U.

2. "Ghost" Areas

In installations in areas of this type where there are reflections from surrounding buildings or the terrain causing "ghosts" in the received picture,

the conditions should be carefully examined to determine whether or not the "ghost" is coming in the same direction as that of the direct signal or whether it is coming at an angle. If the delayed signal causing the "ghost" is coming from the same direction as the desired signal, then it is impossible to eliminate the condition at the receiver. Reflections of this type usually exist because of the location of the television transmitter. "Ghosts" caused by this condition would remain until the transmitter is moved to a more suitable location.

If the "ghost" is caused by a reflection from an object located at an angle from the desired signal, the condition may be alleviated in some cases simply by rotating the antenna slightly. However, if other conditions will not permit this, it may be necessary to install separate antennas with separate transmission lines. If the problem is extremely acute, it may be necessary to go to a very narrow beam antenna such as a Yagi or in some cases even a Rhombic antenna, if space permits, may be desirable. It is possible, however, that if the customer desires to go to the additional expense, the use of a rotating mechanism for turning the antenna may be in order.

Another "ghost" condition could be caused by a mismatch at the antenna terminal of the Teleset. For example, if 300 ohm transmission line were used, the mismatch at the antenna terminal would result in reflections that would be delayed by an amount equal to the time it takes for the signal to travel twice the length of the cable. The seriousness of this condition will depend primarily upon the length of the cable. In this case, the only obvious answer is to use the proper coaxial transmission line.

In certain urban locations where there are many tall buildings reflecting the transmitted signal, it may be desirable to use an indoor antenna as in some locations, the indoor antenna will work better than the outdoor antenna as far as "ghosts" are concerned. Also, if the "ghost" condition is very bad, it may be necessary to polarize the antenna at some unconventional angle in order to pick out a signal that is clean and free from reflections.

3. Noisy Areas

Due to the excellent noise immunity as provided by the narrow band synch type circuit, the installation of these Telesets in noisy industrial areas or locations of heavy traffic, is greatly simplified. Obviously, precautions must be taken pertaining to the method of running the coaxial transmission line. Whenever possible, the antenna and the coaxial cable should be kept as far away from the source of interference as possible and the coax should be grounded at several points along the line. If the noise is extremely bad, it may be necessary to run RG-11/U which has more effective shielding instead of the RG-59/U.

4. Areas of Varying or Fluctuating Line Voltage

This Teleset utilizes a constant voltage power transformer. Use of such a transformer will permit the installation of this Teleset in locations where line voltage fluctuations occur due to other equipment being operated on the same line. Such equipment that could cause fluctuating voltages are water coolers, refrigerators and other similar types of machines. In some locations, the line voltage may change as much as 10 volts from the daytime reading to evening values. As long as the voltage remains somewhere between 105 and 129 volts, the operation of the set will not be impaired.

5. Areas of Varying Signal Strength from the Transmitter

Varying signal strength from the transmitter occurs not only in fringe areas but also may be encountered in areas close to the television transmitter

proper. In either case, where the set is located in a fringe area where the signal varies or in a very strong area where the signal varies, the AGC circuit in this chassis will maintain the picture steady at all times. The AGC circuit is also effective in locations near airports where a condition due to reflection from airplanes, commonly known as "airplane flutter" is encountered.

6. Areas of Strong FM Interference

The problem of installation in areas where formerly FM interference was encountered will be greatly simplified because of the high image rejection and selectivity of the RA-109A Teleset. It is doubtful that any FM interference will be seen except in those locations where the Teleset is located very close to the FM transmitter proper. Traps to eliminate FM interference caused by these isolated cases can be obtained from the Teleset Service Control Department.

In addition to the above, what is perhaps one of the most important items involved in the installation of the Teleset pertains to the proper education of the customer. It is definitely to the advantage of the serviceman to see that the customer knows how to properly adjust his Teleset. A very complete handbook on the proper method of using the Teleset is attached to each receiver. Nevertheless, it should be the responsibility of the installer to properly instruct the customer how the receiver should be adjusted and the handbook may be therefore used as a reference.

Lack of proper education in the past has resulted in many unnecessary service calls on which the additional time spent in call backs represents a definite loss in profit to the installer, as well as a dissatisfied customer.

The above resume is not intended to be a complete manual on installation but rather an attempt to clarify to the installation man the advantages of the RA-109A Teleset in solving problems normally encountered in his installations.

In the event that a particular location is encountered where the service man is unable to cope with the situation, he should contact either the Du Mont Regional Field Service Manager or the Teleset Service Control Department.

RA-109A Section

4.0 Service Sheets

In the large envelope accompanying these service notes are three service sheets. When devising these sheets it was intended that as much service information as deemed necessary was included on these sheets. The Schematic Diagram and the Alignment Procedure sheets were devised for use by the serviceman at his bench. The third sheet "Block Diagram, Adjustments and Troubleshooting" was designed to be used by the serviceman when making service calls.

Please send your comments on these sheets and also your ideas on improving them. These sheets have been made exclusively for your benefit, therefore, it is essential that we supply you with the information you need.

You will note on the schematic diagram for the RA-109, a number of symbols. In the lower right hand corner of the schematic you will find a legend that attempts to describe their purpose. It was necessary to use these symbols as we deleted as many interconnecting lines as possible in an attempt to simplify the schematic. As indicated in the legend it was intended that the large outlined symbol indicate the source of a voltage and the small plain symbol indicate the point to which the voltage was applied. In the event a short circuit occurred on the +338 volt line, it would merely be necessary to check all points indicated by a wheel.

Waveform Observations

All Waveforms that are of importance in the servicing of the RA-109 Teleset are shown on the schematic.

For additional information on the use of the oscillograph in servicing Telesets, please refer to the RA-105 Service Manual, pages 26 through 34.

CORRECTIONS TO PARTS LIST AND MAIN SCHEMATIC DIAGRAM

Please make the following corrections on the Main Chassis Parts List (date of issue, March 20, 1950) and on Schematic Diagram for RA-109A Teleset, first edition, April, 3, 1950.

1. R220, which is listed as "Same as R219", should be corrected to read as follows:

Symbol	Part Number	Description
R220	02031970	Res F C 47K 10% ½W

2. Delete C274 as there is no capacitor shown on the schematic with this symbol.

3. R297 which is listed as Res F C 3K 5% ½W should be corrected to read as follows:

Symbol	Part Number	Description
R297	02030630 02040630 02050630	Res F C 4.3K 5% ½W

4. The part number for the speaker connector assembly in the Miscellaneous parts list (Sherbrooke Only) should be corrected to read as follows:

Part Number	Description
09006423	Connector Asy Speaker

5. The part number for capacitor C450 should be added to the Miscellaneous Parts List. It should read as follows:

Symbol	Part Number	Description
C450	03019310	Cap M 68 mmfd 10% 1500V

6. R271 which is listed as Res F C 68 ohms 10% ½W should be corrected to read as follows:

Symbol	Part Number	Description
R271	02032060 02042060	Res F C 270K 10% ½W

7. R272, which is listed "Same as R252" should be corrected to read as follows:

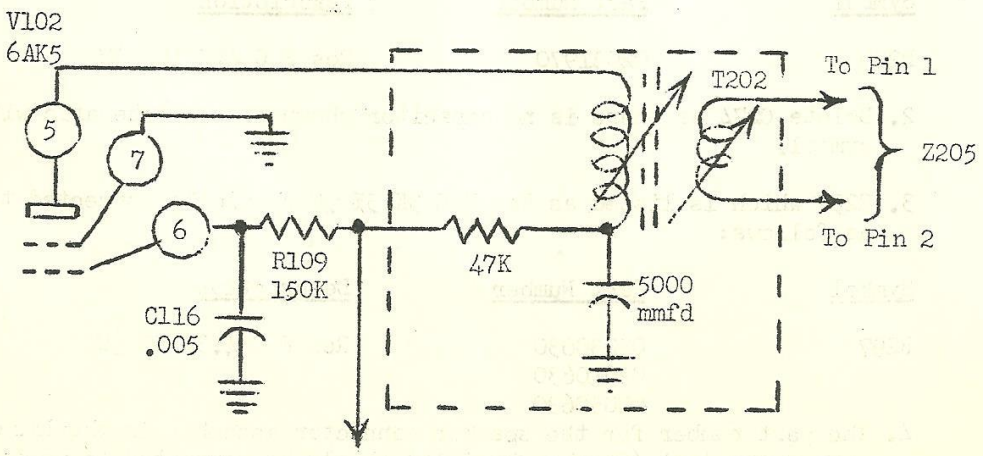
Symbol	Part Number	Description
R272	02031630 02051630	Res F C 68 ohms 10% ½W

8. The resistance reading shown between red and red-yellow of secondary of T203, main chassis schematic should be corrected so as to read 6 ohms.

9. Descriptions of the following variable resistors are to be shown on the main chassis schematic, and should read as follows:

R280	1500 ohms Focus Control
R267	500K CRT Sensitivity

10. Please make the following correction to the R. F. Assembly (Four Circuit Bottom Coupled Inputuner) schematic as shown in the drawing below:



RA-109A Section

5.0 Service Procedures

and

Troubleshooting Hints

This section of the service notes for the RA-109A Teleset will include information pertaining to various servicing and troubleshooting procedures that require detailed information. Additions to this section will be made whenever necessary.

INPUTUNER TROUBLES

No particular difficulty should be encountered in the field from Inputuner troubles. Loss of picture and sound, weak picture and sound or intermittent picture and sound are conditions usually resulting from faulty tubes.

In the event of a component failure, it is very important that the placement of the component, its lead length and the associated wiring, be maintained exactly the same as when received from the factory. For replacement purposes use only the exact replacement part as specified on the Parts List. In the event that alignment becomes necessary or the cause of the defect cannot be found, the Inputuner should be returned to the factory for exchange.

NOISY INPUTUNER

Bright flashes on the screen that occur while tuning the Teleset is an indication of a noisy Inputuner. This condition, if it exists, will usually occur on the high channels. Lubrication of the Inductuner will overcome this condition. Use only Lubriplate #105 for lubrication of the Inductuner. This may be obtained from the Teleset Service Control Department.

It is not necessary to clean the Inductuner with carbon-tet before applying the lubricant as was required for the original Inductuner.

To lubricate the Inductuner, proceed as follows:

Remove the Inductuner cover by removing the four special type fasteners found on the top-side of the Inductuner. These fasteners may readily be removed by first rotating them 90°.

Apply Lubriplate #105 to the contact ring, indicated by arrows in Figure 5-1. This is the only point where lubricant need be applied.

<u>Procedure for the Removal and Replacement of Inputuner Assembly.</u>

Note: The Inputuner for the RA-109A (Part No. 89003002) includes the dial assembly complete. Therefore, when returning the Inputuner for replacement, the Inputuner must be sent with its dial assembly intact.

Important: Do not cut any leads from the Inputuner; keep them full length.

1. Loosen thumb screw and remove tuning indicator tube (A - Figure 5-2) and clamp from mounting.

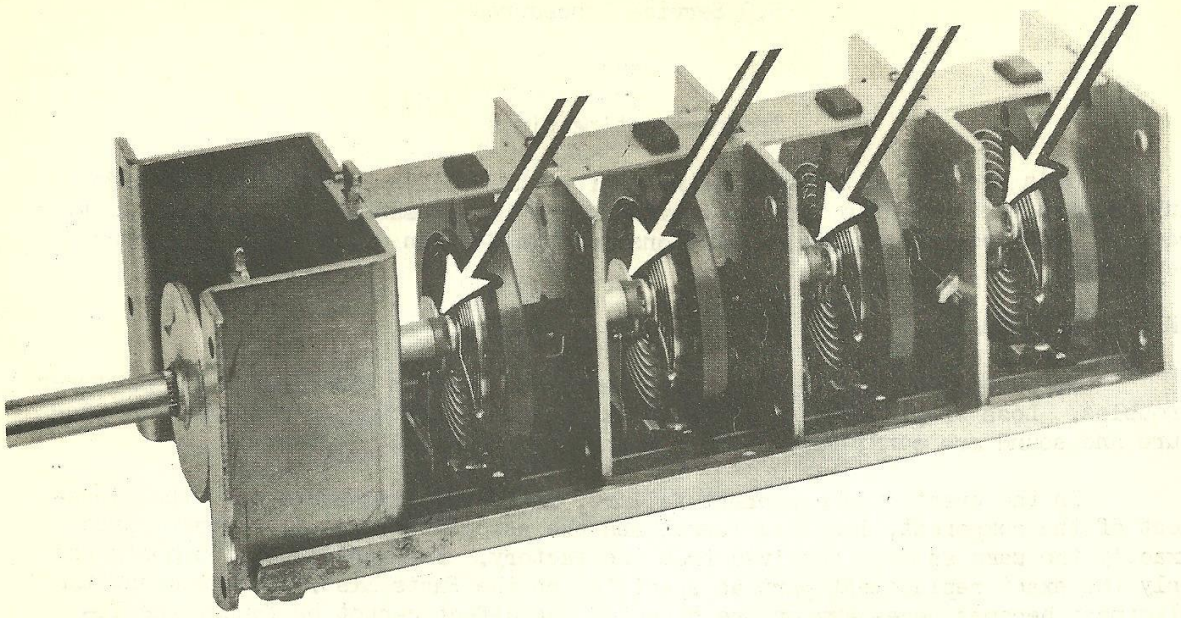


Figure 5-1. Inductuner Lubrication Points

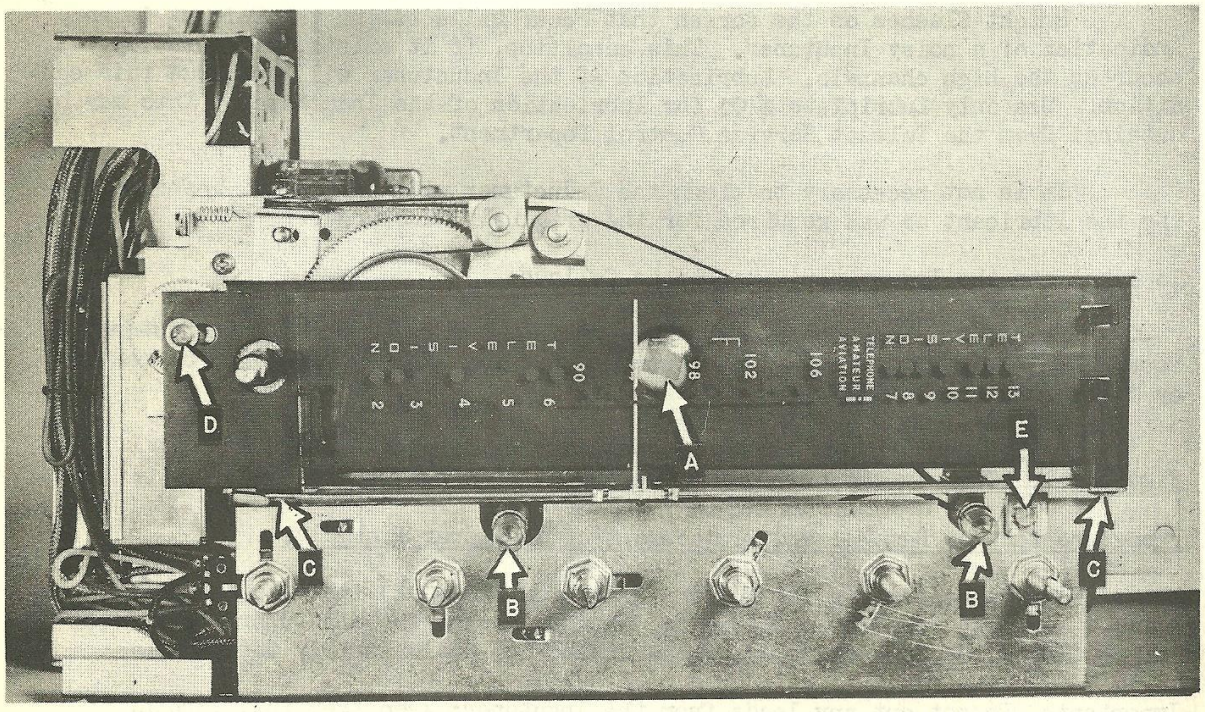


Figure 5-2. Inputuner Removal Points

2. Remove the two dial lamps (B - Figure 5-2) with clip mounting.

3. Unsolder the three leads connecting the Inputuner to the receiver chassis, carefully noting the color coding of each wire and the terminal from which each wire was removed.

4. Unsolder the twin-lead from the first video IF transformer.

5. Disconnect the Inputuner antenna cable at the antenna terminal on the receiver chassis.

6. Remove screw (E - Figure 5-2) holding dial assembly to main chassis.

7. Remove the four screws beneath the Inputuner which hold it to its mounting plate.

8. Lift Inputuner from chassis, complete with dial assembly.

9. To replace Inputuner assembly, follow the above procedure in reverse.

Procedure for Replacement of Dial Cable

1. Loosen thumbscrew and remove tuning indicator tube (A - Figure 5-2) and clamp from its mounting.

2. Remove the two dial lamps (B - Figure 5-2) with clip mounting.

3. Place tuning control in extreme clockwise position.

4. Remove dial plate mounted by two snap fasteners (C - Figure 5-2) and one screw (D - Figure 5-2), taking care not to damage pointer.

5. Install dial string, using Figure 5-3 as a guide.

6. Reassemble dial assembly by following steps 1 - 4 (above) in reverse order.

Part number for RA-109A Inputuner dial cord: #30008310. Length of dial cord: 44½ inches.

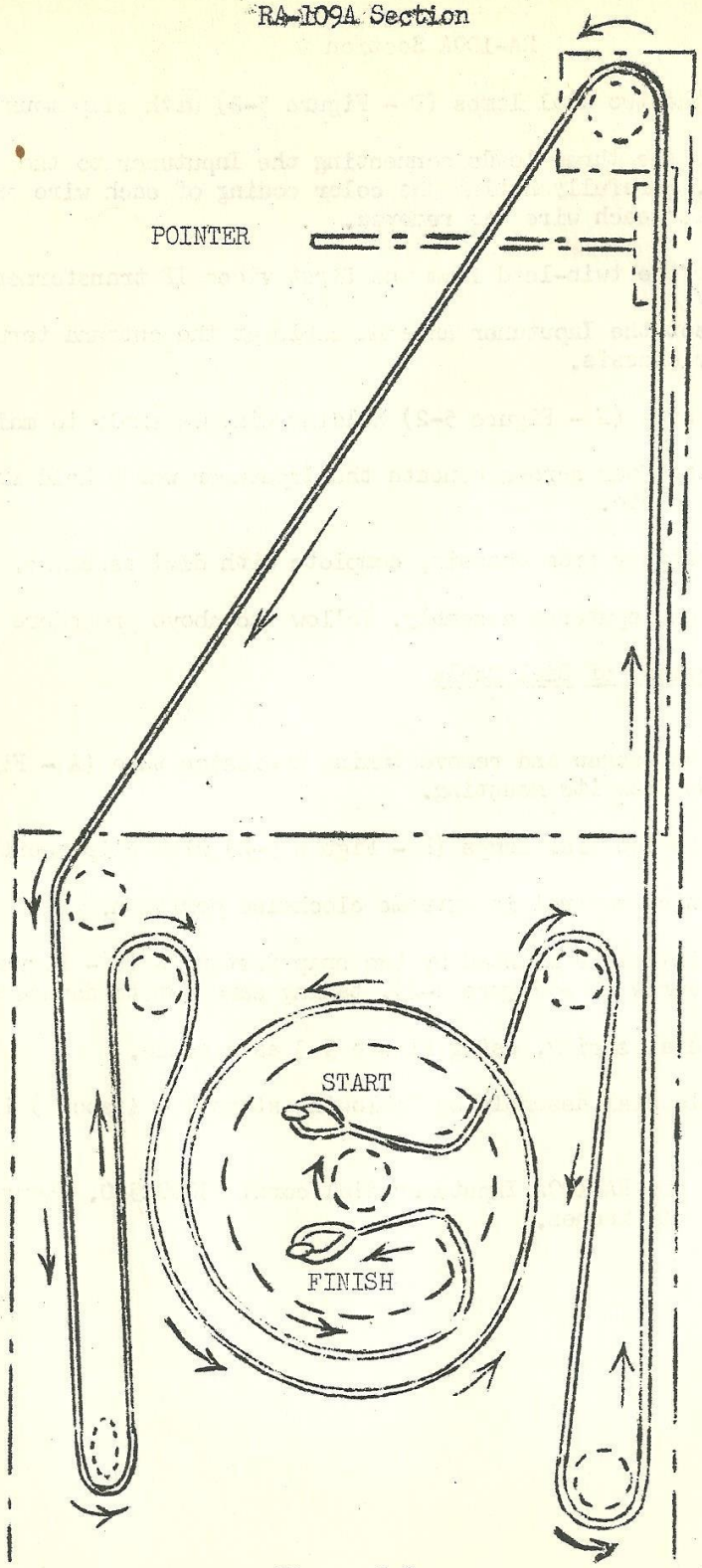


Figure 5-3

RA-109A INPUTUNER CABLE STRINGING

Replacement of Horizontal Output Transformer in RA-109A

Note: This transformer (T206), Part Number 20004941, is supplied only with chassis mounting bracket and bakelite base containing terminals and two 1X2 tube sockets. When returning defective transformer for replacement, it is necessary to first remove all other components, including resistors, capacitors, standoff tie posts, and leads (except 1X2 filament) from the assembly (Figures 5-3 and 5-4). It is advisable that the serviceman first have on hand a new transformer, so that parts may be removed from the old transformer singly and re-installed on the new assembly. This will aid in ensuring proper placement, assembly, and high voltage lead dress.

I. Removal of Transformer:

1. Unhook protective cover over horizontal-high voltage section of chassis.
2. Remove plate cap assembly from 6BG6G tubes. Lead need not be unsoldered at this time.
3. Remove 6BG6G tubes.
4. Unsolder six leads and capacitor C299, (.03) from terminals 1 through 4 on transformer assembly, carefully noting points to which they connect.
5. Remove Teletron (picture tube) anode lead from beneath clamp on chassis.
6. Loosen C284 (500 mmf HV ceramic, near V230) from phosphor bronze grounding clip on chassis.

(The transformer assembly is now ready to be removed from the receiver chassis.)

7. Remove 3 screws holding transformer mounting bracket to receiver chassis and lift transformer assembly from set.

II. Replacement of Transformer:

1. Use the removed transformer assembly as a guide, and transfer all necessary components, tubes, standoff tie posts, and leads from the old to the new assembly. Take care to leave no sharp points of solder. Round off all soldering to prevent corona discharge.

III. Replacement of Transformer (alternate procedure):

1. If old and new transformers not on hand at same time for guide purposes (II,1), remove following from old transformer assembly:
   a) 6BG6G plate cap assembly, with lead and standoff tie post (latter is threaded, and may be easily unscrewed).
   b) Capacitor C283 (500 mmfd HV ceramic) between 1X2 plate caps, along with V230 plate connector and lead to transformer winding.
   c) 1X2 (V231) plate corona cap, standoff tie post, and bleeder string of three 470K resistors (R342, R343, R344). Unsolder bleeder string only at bakelite plate; remove standoff tie post from bottom side.
   d) Two 1X2 tubes (V230, V231).

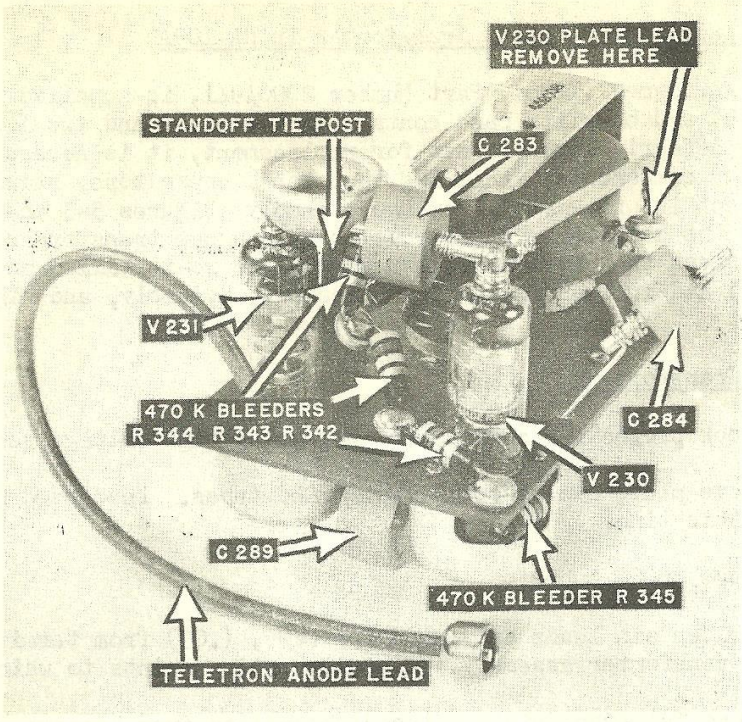


Figure 5-3. Horizontal Output Transformer Assembly

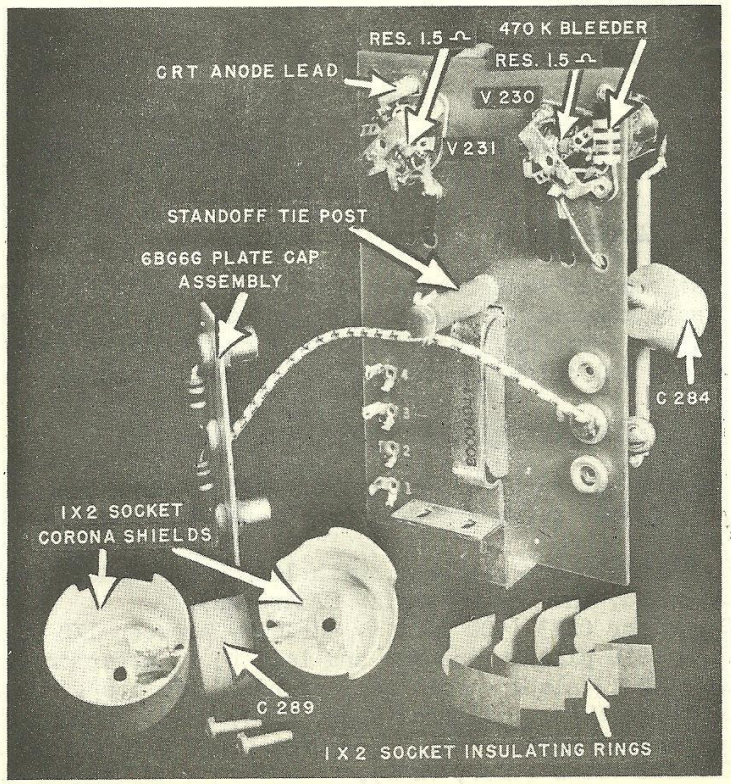


Figure 5-4. Horizontal Output Transformer Assembly

e) 1X2 socket corona caps, with C289 (500 mmfd HV ceramic).
f) Fishpaper insulating rings at 1X2 sockets (4 pieces).
g) C284 (500 mmfd HV ceramic), with its coiled-spring connector lead.
h) 470K bleeder resistor (R345) beneath bakelite plate (at V230 socket).
i) Teletron anode lead.
j) 1.5 ohm resistor at each 1X2 socket.

2. Re-install above items on the new transformer assembly, following steps a through j in reverse order, using figures 5-3 and 5-4 as a guide. Take care to leave no sharp points of solder. Round off all soldering to prevent corona discharge.

3. Mount transformer assembly in receiver chassis, following "Removal of Transformer" procedure (I) in reverse order.

Replacement of 1X2 HV Rectifiers in RA-109A

1. Unhook protective cover over horizontal-HV section of chassis.

2. V230 (nearest end of chassis) may be withdrawn by first removing connector from its plate cap.

3. V231 may be withdrawn by first removing screw beneath standoff post (near socket) holding its plate corona shield. If screw is not easily accessible, corona shield over V231 socket may be loosened by removing its mounting screw. Removal of the standoff post screw allows lifting of tube, post, and plate corona shield as one unit for easy withdrawal of tube.

RA-109A Section

Elimination of Channel 7 Beat

A few complaints of an annoying "beat" on channel 7 in the RA-109A Telesets have been received.

This interference is the result of the 8th harmonic (175.2 mc) of the sound IF (21.9 mc) beating against the video carrier (175.25 mc) of channel 7 and thus producing a 50 kc beat. This beat shows up in the picture as black horizontal streaks.

A single circuit change is necessary to eliminate this condition and should be made as follows:

1. Tune the RA-109A accurately to channel 7 using the tuning indicator.

2. With the receiver properly tuned, remove the AC plug from the Teleset.

3. Without disturbing the tuning, remove capacitor C213. This is the 47 mmfd RF by-pass capacitor connected between pin 5 and ground of V204 (the 6AL5 discriminator).

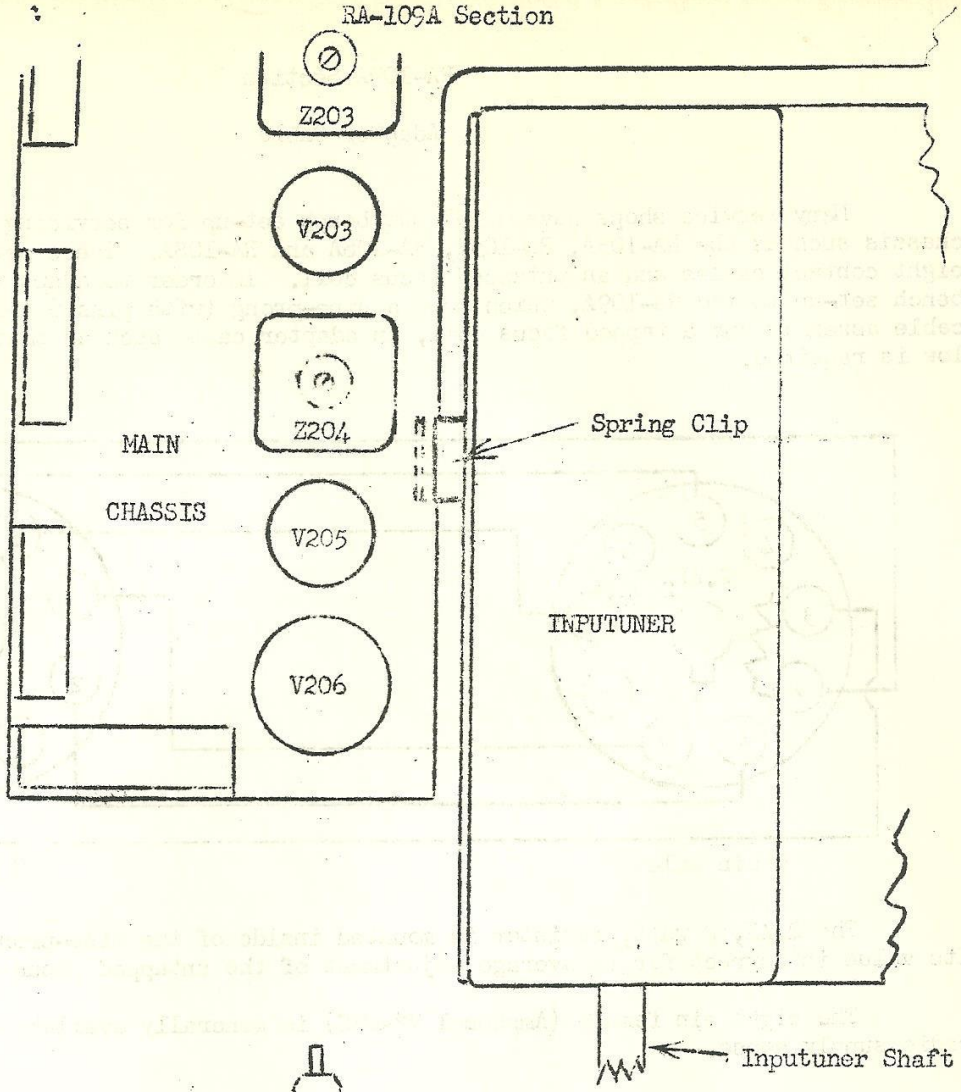
4. Replace the AC plug into the Teleset. As soon as the set becomes operative, it will be noticed that the tuning indicator shows the set to be improperly tuned. Do not attempt to correct by retuning the Teleset.

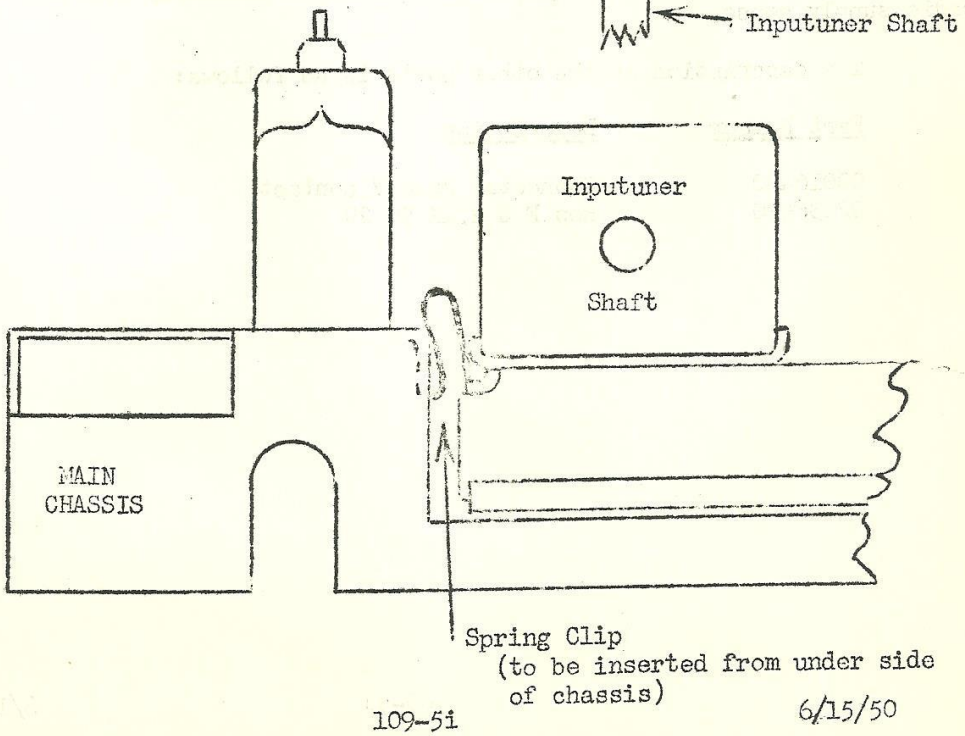
5. To realign the discriminator, merely turn the top slug of the discriminator transformer until the tuning eye indicates correct tuning. This usually requires about 1/4 turn of the slug.

In addition, a spring clip part number 30015401, should be inserted between the Inputuner and the chassis as shown on the following page.

These changes are effective with chassis beginning with serial number 0915725.

RA-109A Section



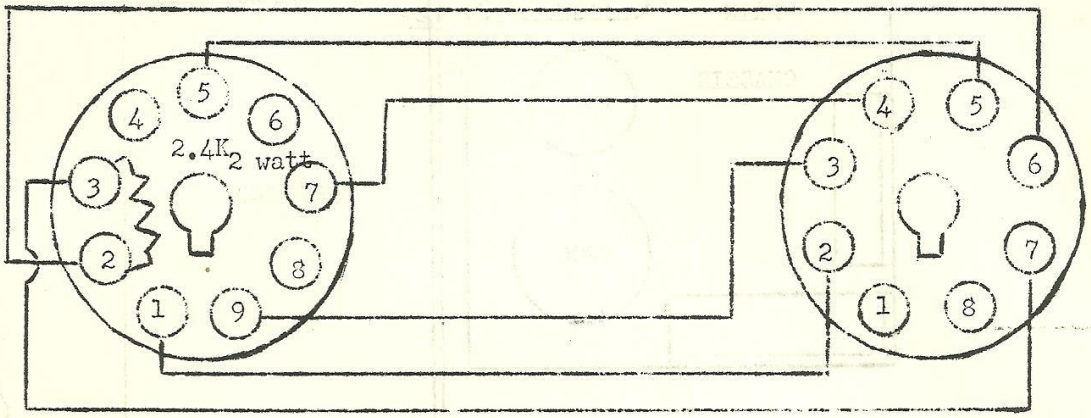


6/15/50

RA-109A Section

Adapter Cable

Many service shops have a 15" CRT bench set-up for servicing larger chassis such as the RA-105A, RA-105B, RA-106A and RA-108A. These sets all used eight contact cables and an untapped focus coil. In order to adapt the existing bench set-up to the RA-109A, which uses a nine-prong (with pins 6 and 8 removed) cable assembly and a tapped focus coil, an adapter cable such as that shown below is required.



9 pin male 8 pin female

The 2.4K, 2 watt, resistor is mounted inside of the nine-prong male plug. Its value is correct for an average adjustment of the untapped focus coil.

The eight pin female (Amphenol 78-PF8) is generally available at any radio supply house.

The description of the other parts is as follows:

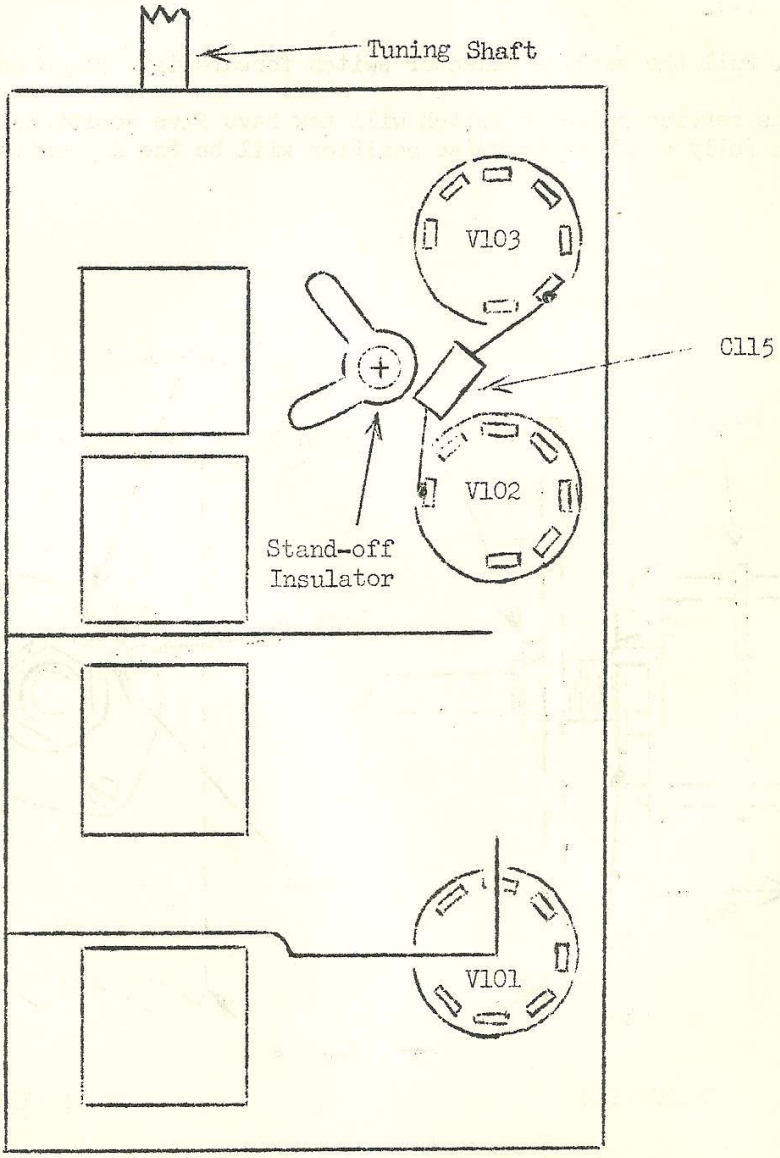
Part Number	Description
09016480	Connector Male 7 contact
02036570	Res F C 2.4K 5% 2W

High Channel Sensitivity

A few field complaints have been received indicating that the high channel sensitivity of the new model Telesetsis low in certain areas, as a result of low oscillator injection voltage.

If this condition should be encountered it is suggested that the following procedure be followed to improve the sensitivity:

Remove the Inputuner and dress capacitor C115 as far away from the bottom of the Inputuner chassis (not bottom plate) as possible and close to the standoff insulator mounted between V102 (6AK5) and V103 (6AB4). (See the following figure.) Care should be exercised not to disturb the position of other components in the Inputuner while redressing C115.



Modification of Service Selector Switch to include AM Position

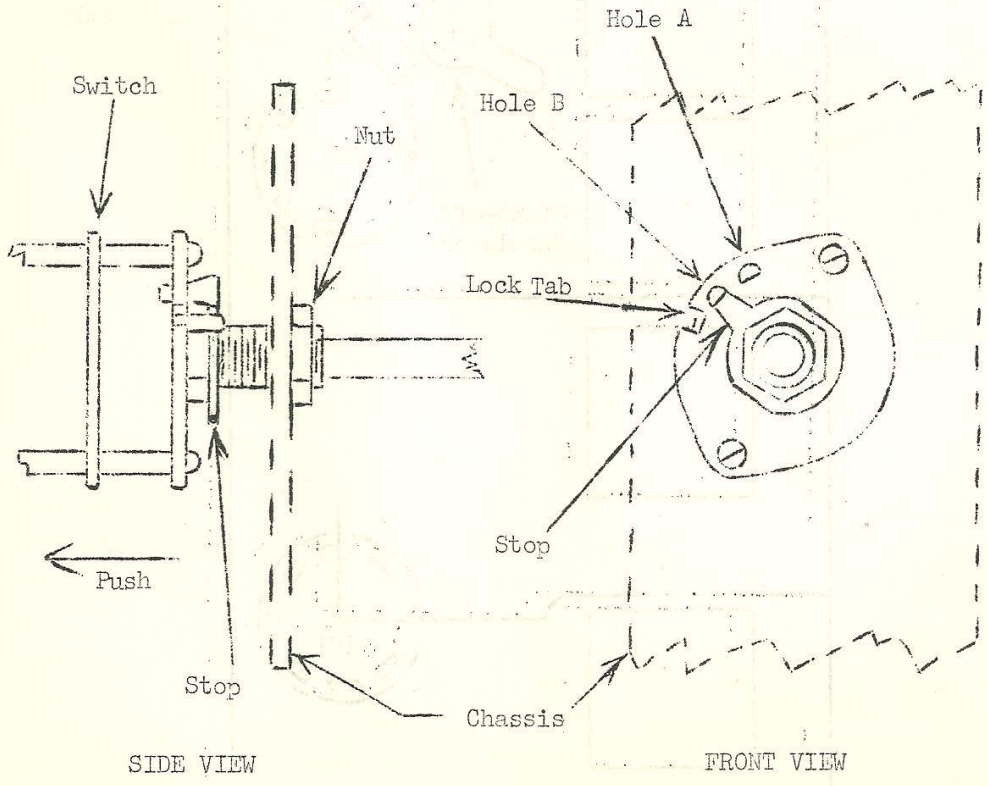
It is conceivable that occasionally a serviceman may have an AM tuner in the shop for service and may not have a Sherbrooke chassis available to use with it. If an RA-109A chassis such as that used in the Winslow or Hanover is available, the service selector switch may be modified as follows in order to include the AM position. (See sketch below.)

1. Loosen the nut holding the service selector switch in place and push the switch away from the front of the chassis.

2. Move the stop counter-clockwise just enough so that the stop is held in place by the hole (B) to the left of the one in use initially, (A).

3. Pull the service selector switch forward into place and replace nut.

The service selector switch will now have five positions, rather than four. The fully counter-clockwise position will be the AM position.



Video IF Bandwidth Adjustment

If difficulty is encountered obtaining the curves specified in steps 1, 5 or 10 of the alignment procedure, it is possible that the coupling capacitor inside of the associated video IF transformer (Z206, Z207 or Z209) may require readjustment. These capacitors take the form of a wire protruding from the bottom of these video IF transformers which fits into a sleeve inside. They are preset at the factory during alignment for proper bandwidth and are sealed in place with Miracle Adhesive C2M55. In order to readjust the coupling, the wire protruding from the bottom of the transformer should be heated with a soldering iron to soften the adhesive. Once the wire is free, the heat may be removed and the wire slid in (for increased bandwidth) or out (for decreased bandwidth) of the sleeve to adjust for proper bandwidth. The wire should then be sealed in place with Miracle Adhesive C2M55 (obtainable from Du Mont Spare Parts Sales.).

Under normal circumstances it will not be necessary to readjust these coupling capacitors and it is recommended that they not be tampered with unless a test with a sweep generator and oscillograph definitely indicates improper bandwidth.

New IF to Eliminate Channel 7 Beat Interference

In order to eliminate the possibility of the 8th harmonic of the 21.9 mc. sound IF beating against the received signal and producing an interfering beat frequency pattern observable on the picture tube screen, the IF has been lowered by 0.15 mc.

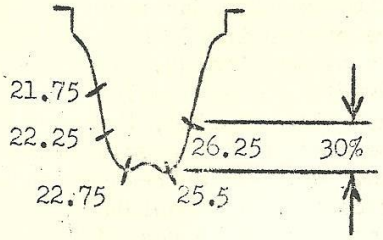
All frequencies noted on the RA-109A Alignment Table in the column entitled "Marker Gen. Freq. Mc." should be decreased by 0.15 mc. except 4.5 mc. in step 13. For example, in step 11, 27.9 mc. should be 27.9 mc. - 0.15 mc. = 27.75 mc. The shape of the curves is unchanged. The curves with the new marker frequencies are shown below.

The new IF (21.75 mc. sound and 26.25 mc. video) is used in RA-109A chassis beginning with serial number 0916058. The letter E stamped on the rear of the chassis indicates that it contains this change.

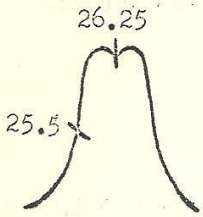
Any RA-109A which requires re-alignment should be aligned to the new IF if any such beat interference has been observed. A quick check for beat interference of this type is to remove the sound discriminator tube (V204). If the beat pattern on the picture tube screen disappears simultaneously with removal of this tube, the interference is caused by a harmonic of the sound IF.

RA-109A Section

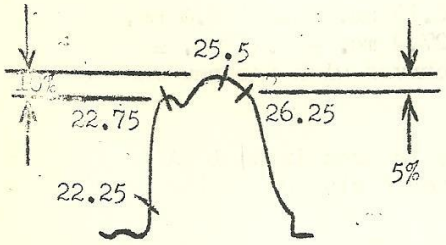
Alignment Curves Showing
New Marker Frequencies



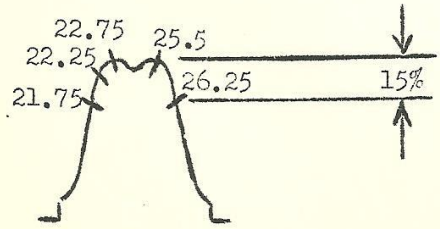
STEP 1



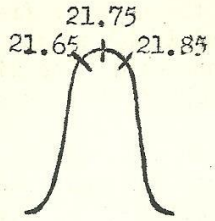
STEP 2



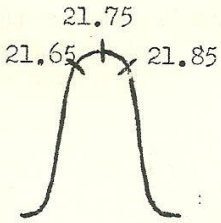
STEP 4



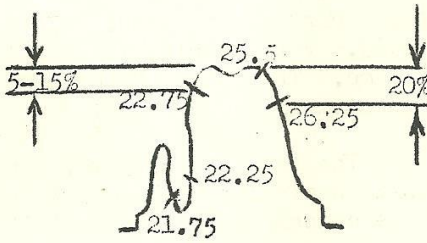
STEP 5



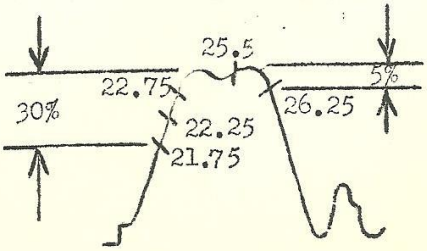
STEP 6



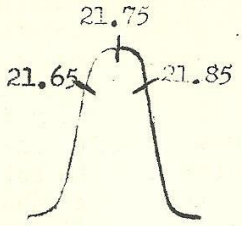
STEP 7



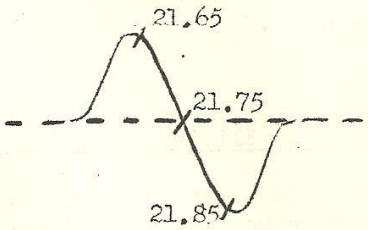
STEP 10



STEP 12



STEP 8



STEP 9

6.0 Production Changes

The first edition (April 3, 1950) of the main chassis Schematic Diagram for the RA-109A is shown as issue #10 through P-70. This issue identification has significance only to Du Mont for the purpose of identifying production changes. All production changes made to these Telesets will have arbitrary numbers assigned with the numbers listed consecutively. In these production changes a number may be shown in parentheses adjacent to the change number. This number is used as a reference number for Du Mont and has no significance in the field.

Change #1 (P-71)

Resistor R300 (cathode resistor of V220) is changed from 1000 ohms, 1 watt, 10% to 560 ohms, ½ watt, 10%.

The purpose of this change is to improve vertical linearity. Only very early production sets use the 1000 ohm resistor.

The new part is identified as follows:

Symbol	Part Number	Description
R300	02031740 02041740 02051740	Res F C 560 ohms 10% ½W

Change #2 (P-82)

C266 (used in negative voltage supply across R309) is changed from .1 mfd, 200 volts to 25 mfd, 25 volts. The purpose of this change is to eliminate an audible background rumble.

The new part is identified as follows:

Symbol	Part Number	Description
C266	03015310	Cap E 25 mfd 25 volts

Change #3 (P-86)

In order to eliminate electrical breakdown between chassis and the white-red wire from the flyback transformer (T-206-6) the following changes are made:

The white-red wire from T206-6 to the capacitor end of the clip on V230 is removed and replaced with a white wire to the tube end of the clip on V230.

This change has been incorporated in chassis starting with chassis number 092397. These are identified by a large letter A stamped on the rear fold of the chassis.

Change #4 (ECN-4204)

Capacitors C261 and C262 (primary of T203) are changed from .05 mfd 600V to .02 mfd 20% 600V.

The purpose of this change is to correct a specification error. The new parts are identified as follows:

Symbol	Part Number	Description
C261	03018570 03018560	Cap Pa .02 mfd 20% 600V

Change #5 (P-95)

Resistor R297, (Pin #3, V220) is to be changed from 4.3K, 5% ½W to 2.7K 5% ½W.

The new part is to be identified as follows:

Symbol	Part Number	Description
R297	02030580	Res F C 2.7K 5% ½W

Delete resistor R371, 220K 10% 1W connected between Pin 2, V220 and red lead of T207.

The purpose of these changes is to improve the interlace. The vertical hold control should be very carefully adjusted for best interlace. This change was first incorporated in chassis starting approximately with chassis #093000.

Change #6 (P-88)

The following changes were made in order to give a larger deflection in the tuning indicator.

Resistor R212 (screen of V203) was changed from 1K 10% ½watt to 22K 10% ½watt. It should be disconnected from the 85 volt line and reconnected to 150 volt line.

The new part is identified as follows:

Symbol	Part Number	Description
R212	02031930 02041930	Res F C 22K 10% ½W

Delete C316, Cap F Ce 5 mmfd 10% 500V and make a direct connection between Z201 (3) and Pin #1, V201.

Delete C314, Cap F Ce 10 mmfd 10% 500V and make a direct connection between Z202 (3) and Pin #1, V202.

Disconnect the ground end of C204 and reconnect to Pin #6, V201.

Disconnect the ground end of C207 and reconnect to Pin #6, V202.

This change was incopporated in chassis starting approximately with chassis #093200.

Change #7 (P-98)

Resistor R375 100K is to be added across C261 (.02) to ground.

Symbol	Part Number	Description
R375	02035540 02045540 02055540	Res F C 100K 20% 1W

Reason: To comply with U/L criticism of shock hazard.

This change was incorporated in chassis starting with chassis #096774. These chassis are identified by a large letter B stamped on the rear fold of the chassis.

Change #8 (P-102)

Part number changed for capacitor coupling C304.

Symbol	Part Number	Description
C304	03016896	Capacitor Coupling

New capacitor to be connected to same terminals except that it must be above the chassis entering through holes adjacent to Z206 and Z207.

Reason: To improve sound attenuation.

Change #9 (P-103)

Additional Parts:

Symbol	Part Number	Description
C327	03018650	Cap Pa .002 mfd 600V
R376	02032010	Res F C 100K 10% ½W

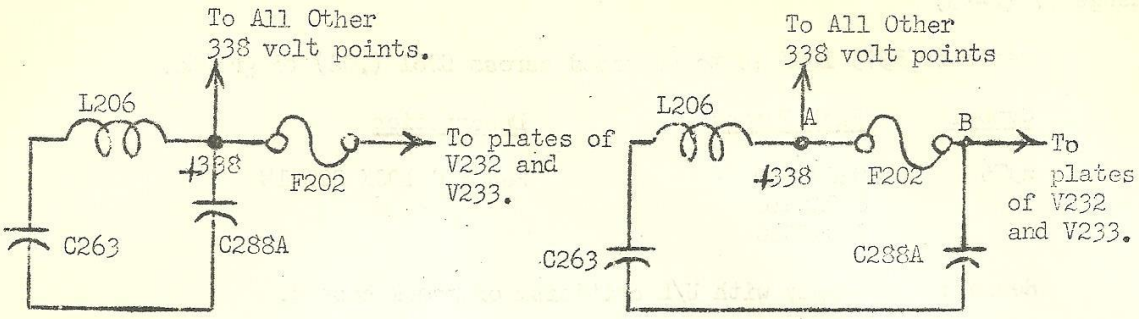
Schematic:

C327 - Connected across Pins 3 and 4, V207.
R376 - Connected across C218 to ground.

Reason: To reduce high frequency distortion in the sound output.

Change #10 (ECN 4332)

The placement of F202 has been changed as follows:



OLD CIRCUIT NEW CIRCUIT

A large letter D stamped on the rear of the chassis identifies it as containing this change.

Purpose of change

To eliminate an AC component of current from F202 which is operating too close to its rated value.

Servicemen should make this change when troubled with F202 blowing. Care should be taken to include only the connection to the plates of V232 and V233 at B, all other 338 volt leads going toA.

Change #11 (ECN-4239)

The pin numbers of the first and second sound amplifiers (12AU7, V206-A and V206-B) are interchanged, and should read as follows:

1st Sound Amp., V206-A	2nd Sound Amp., V206-B
Plate - Pin #6	Plate - Pin #1
Grid - Pin #7	Grid - Pin #2
Cathode - Pin #8	Cathode - Pin #3

Purpose of change

To minimize the possibility of short circuits occurring in these circuits due to component placement and lead dress.

Up to this point (Changes #1 to #11) all production changes made refer to the first edition (April 3, 1950) of the Main Chassis Schematic Diagram for the RA-109A. These changes have been included in the second edition (May 8, 1950) of the Main Chassis Schematic Diagram, issue #12 through P-108. The following production changes should be made to both the first and second edition of these Schematic Diagrams.

Change #12 (ECN-4239)

Delete heater choke, L209, Part No. 21005601, and connect filament line direct.

Purpose of Change

To eliminate background hum in the sound.

Change #13 (ECN-4244)

The following color coding notes on IF transformers are to be added on Main Chassis Schematic:

To Z201-2, Z202-2, Z203-2, Z204-2 and Z207-1, add dot, and words "Red dot".
To Z205-1 add dot, and words "Orange dot".
To Z206-1 add dot, and words "Blue dot".
To Z208-1 add dot, and words "Black dot".
To Z209-1 add dot, and words "Green dot".

Reason:

To provide a means for easy identification of IF transformers.

Change #14 (P-117)

The following changes are made on the Main Chassis Schematic:

Delete capacitor C315, 220 mmf connected across part of R221.
Change value of C215 from 470 mmf to 680 mmf.
New Part is identified as follows:

Symbol	Part Number	Description
C215	03012750 03020210	Cap Ce 680 mmf 10% 350V

Purpose of Change:

To improve the high frequency tone quality.

Change #15 (P-119) (See pages 109-5H and 109-5i for complete information on this change.)

Delete capacitor C213, 47 mmf between Pins 1 and 5 of V204 (6AL5).

Deletion:

Symbol	Part Number	Description
C213	03015300	Cap Ce 47 mmf 10% 500V

Insert spring clip between Inputuner and chassis.

Part Number	Description
30015401	Spring Clip

Purpose of Change

To alleviate interference on Channel 7.

RA-109A Section

7.0 Parts List Changes

This sub-section of the RA-109A Service Notes will be used to inform interested parties of changes that affect the parts list appearing on the Schematic Diagram service sheet. If a production change (see sub-section 6.0 Production Changes) causes a part number change, addition or deletion, the notation will appear in both sub-sections.

The following changes of part numbers (items 1 - 5) and additions of alternate part numbers (item 6) are to be made to the Parts List of the first edition (April 3, 1950) of the Schematic Diagram for the RA-109A (issue #10 through P-70).

1. Part Number changes in the Main Chassis Parts List (March 20, 1950). (Additional numbers shown are alternates).

C240	03019260	Cap Pa .1 mf 20% 400V
C261	03018570	Cap Pa .02 mf 20% 600V
	03018560	
C266	03015310	Cap E 25 mf 25V
C281	03019250	Cap Pa .1 mf 20% 600V
C282	Same as C281	
C285	03019560	Cap Pa .5 mf 200V
C304	03016896	Capacitor Coupling
C318	Same as C281	
C327	03018650	Cap Pa .002 mf 600V
R212	02031930	Res F C 22K 10% ½W
	02041930	
R297	02030580	Res F C 2.7K 5% ½W
R300	02031740	Res F C 560 ohms 10% ½W
	02041740	
	02051740	
R375	02035540	Res F C 100K 20% 1W
	02045540	
	02055540	
R376	02032010	Res F C 100K 10% ½W

Old Part No.	New Part No.	
42002831	42003101	Shield Corona

2. Part number changes in Miscellaneous Parts List (March 20, 1950) Winslow, Hanover, and Sherbrooke.

Old Part No.	New Part No.	Description
09003730	09002790	Connector Male, 1 contact (ant.)
05004031	05004032	Lever, Tone Control
64001291	64001292	Mask, CRT 19
35006602	35008783	Strap, Support
35002721	35009241	Plate CRT Rear Mtg.
37001931	37002241	Clamp CRT

3. Part number changes in Miscellaneous Parts List (March 20, 1950). Winslow and Hanover only.

Old Part No.	New Part No.	Description
45001761	45002051	Plate Bezel
45001871	45001877	*Knob Control (Mahogany)
45001874	45001878	**Knob Control (Blonde)
	09003730	Connector Male, 1 contact (Phono.)

4. Part number changes in Miscellaneous Parts List (March 20, 1950) Sherbrooke only.

Old Part No.	New Part No.	Description
45001791	45002241	*Knob, AM
45001792	45002242	**Knob, AM

5. Part number change in AM Tuner Parts List (March 9, 1950).

Old Part No.	New Part No.	Description
45001831	45002251	Pointer

6. Alternate part numbers are to be added to the following parts in Main Chassis Parts List (March 20, 1950).

Symbol	Part Number	Added Alt. Part No.	Description
C245	03033530	03020560	Cap F M 820 mmf 10% 500V
J203	34001906	34001916 34002372	CRT Socket Assembly
R201	02032010 02042010	02052010	Res F C 100K 10% ½W
R203	02031850 02041850	02051850	Res F C 4.7K 10% ½W
R204	02031770 02041770	02051770	Res F C 1K 10% ½W
R209	02032140 02042140	02052140	Res F C 1.2 meg 10% ½W
R210	02032060 02042060	02052060	Res F C 270K 10% ½W
R222	02032100 02042100	02052100	Res F C 560K 10% ½W
R219	02031930 02041930	02051930	Res F C 22K 10% ½W
R223	02032050 02042050	02052050	Res F C 220K 10% ½W
R224	02031970 02041970	02051970	Res F C 47K 10% ½W
R227	02031790 02041790	02051790	Res F C 1.5K 10% ½W
R228	02031860 02041860	02051860	Res F C 5.6K 10% ½W
R229	02031100 02041100	02051100	Res F C 390K 5% ½W
R232	02034730 02044730	02054730	Res F C 470 ohms 10% 1W

R236	02031600	02051600	Res F C 39 ohms 10% ½W
R237	02031890	02051890	Res F C 10K 10% ½W
	02041890		
R239	02034830	02044830	Res F C 3.3K 10% 1W
		02054830	
R245	02031660	02051660	Res F C 120 ohms 10% ½W
R254	02037980	02047980	Res F C 56K 10% 2W
		02057980	
R256	02030580	02040580	Res F C 2.7K 5% ½W
		02050580	
R257	02030720	02040720	Res F C 10K 5% ½W
		02050720	
R259	02034940	02054940	Res F C 27K 10% 1W
	02044940		
R263	02032130	02052130	Res F C 1 meg 10% ½W
	02042130		
R275	02031920	02051920	Res F C 18K 10% ½W
	02041920		
R281	02037870	02047870	Res F C 6.8K 10% 2W
		02057870	
R296	02031180	02051180	Res F C 820K 5% ½W
	02041180		
R307	02031040	02051040	Res F C 220K 5% ½W
	02041040		
R308	02032090	02052090	Res F C 470K 10% ½W
	02042090		
R309	02041950	02051950	Res F C 33K 10% ½W
	02031950		
R312	02031730	02051730	Res F C 470 ohms 10% ½W
	02041730		
R314	02031570	02051570	Res F C 22 ohms 10% ½W
R316	02037930	02057930	Res F C 22K 10% 2W
R317	02037990	02057990	Res F C 68K 10% 2W
R318	02034970	02054970	Res F C 47K 10% 1W
	02044970		
R320	02030680	02050680	Res F C 6.8K 5% ½W
	02040680		
R322	02034990	02054990	Res F C 68K 10% 1W
	02044990		
R324	02035000	02055000	Res F C 82K 10% 1W
	02045000		
R327	02034630	02054630	Res F C 68 ohms 10% 1W
R336	02032110	02052110	Res F C 680K 10% ½W
	02042110		
R338	02031870	02051870	Res F C 6.8K 10% ½W
	02041870		
R342	02038090	02058090	Res F C 470K 10% 2W
R350	02035050	02055050	Res F C 220K 10% 1W
	02045050		
R352	02037810	02057810	Res F C 2.2K 10% 2W
R355	02032250	02042250	Res F C 10 meg 10% ½W
		02052250	
R358	02031910	02041910	Res F C 15K 10% ½W
		02051910	
R359	02031700	02051700	Res F C 270 ohms 10% ½W
R365	02037790	02047790	Res F C 1.5K 10% 2W
		02057790	

Up to this point (items 1 to 6) all parts list changes and additions of alternate part numbers refer to the first edition (April 3, 1950) of the main chassis Schematic Diagram for the RA-109A. These changes have been included in the second edition (May 8, 1950) of the main chassis Schematic Diagram (Issue #12 through P-108). The following parts list changes and additions of alternate part numbers should be made to both the first and second edition of these Schematic Diagrams.

7. Part Number changes and additions in Main Chassis Parts List (April 26, 1950).

Symbol	Part Number	Description
C215	03012750 03020210	Cap Ce 680 mmf 10% 350V

8. Part Number change in Miscellaneous Parts List (April 26, 1950) Sherbrooke only.

Old Part No.	New Part No.	Description
19034581	19034582	Reproducer Sound

9. Part number change in AM Tuner Parts List (April 26, 1950).

Old Part No.	New Part No.	Description
35008381	35008382	Bracket Pointer

10. Part Number change in the Miscellaneous Parts List (April 26, 1950).

Symbol	New Part No.	Description
J203	34002372	CRT Socket Asy

11. Alternate Part Number Additions

Symbol	Part Number	Added Alternate Part Number	Description
C253	03014430	02100300	Cap Pa .002 mf 10% 600V
C210	03000950	03100030	Cap Pa .05 mf 20% 200V
C216	03001460	03100100	Cap Pa .02 mf 20% 400V
C217	03001450	03100090	Cap Pa .01 mf 20% 400V
C218	03018470	03100010	Cap Pa .02 mf 20% 200V
C220	03013910	03100040	Cap Pa .1 mf 20% 200V
C221	03018570	03100230	Cap Pa .02 mf 20% 600V
C223	03014670	03100390	Cap Pa .002 mf 25% 600V
C224	03018620	03100210	Cap Pa .005 mf 600V
C225	03015370	03100250	Cap Pa .05 mf 20% 600V
C237	03018740	03100430	Cap Pa .25 mf 600V
C238	03014820	03100260	Cap Pa .1 mf 20% 600V
C239	03018370	03100030	Cap Pa .05 mf 20% 200V
C240	03019260	03100130	Cap Pa .1 mf 20% 400V
C241	03014810	03100220	Cap Pa .01 mf 20% 600V
C251	03014780	03100040	Cap Pa .1 mf 20% 200V
C254	03018640	03100310	Cap Pa .005 mf 10% 400V
C255	03015940	03100330	Cap Pa .02 mf 10% 400V
C257	03019160	03100460	Cap Pa .051 mf 5%
C261	03018570 03018560	03100230	Cap Pa .02 mf 20% 600V

C272	03018650	03100190	Cap Pa .02 mf 600V
C279	03012560	03100220	Cap Pa .01 mf 20% 600V
C281	03019250	03100260	Cap Pa .1 mf 20% 600V
C285	03019560	03100440	Cap Pa .5 mf 200V
C297	03000420	03100060	Cap Pa .25 mf 200V
C299	03018580	03100340	Cap Pa .03 mf 10% 200V
C300	03018720	03100360	Cap Pa .1 mf 10% 200V
C305	03018750	03100420	Cap Pa .2 mf 20% 1000V