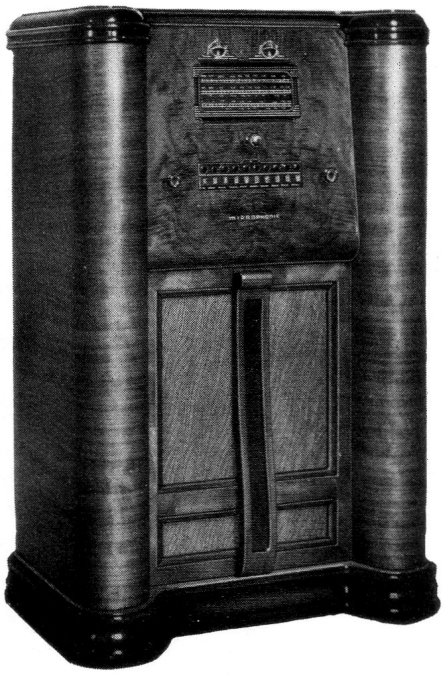
Model 1331A

Radio Receiver



Specifications

Frequency Range:

Broadcast—540 to 1600 K.C.
Police—1.58 to 4.82 megacycles
Shortwave—4.8 to 15.5 megacycles

I.F.:

470 K.C.

Tubes:

Type	Function
6A8	1st Detector
6J5	Oscillator
6K7	1st I.F. Amplifier
6K7	2nd I.F. Amplifier
6K7	Suppressor Limiter
6H6	2nd Detector; A.V.C.; Suppressor Rectifier
6K5G	1st A.F. Amplifier
6J5	Phase Inverter
2 – 6F6G	Push-Pull Output Amplifiers
6V6G	Suppressor Control
6U5	Tuning Eye
5X4G	Rectifier

Power Supply:

105 to 125 volts A.C., 25-60 cycles

A.V.C.:

Applied to 1st Detector and 1st I.F. Amplifier stages; partial control to 2nd I.F. Amplifier

Controls:

Left—Volume control; Centre—Tuning control; Right—fidelity control. Three pairs of push buttons for tuning to stations within 535 to 900, 750 to 1300, and 930 to 1600 K.C. Also push button A.C. switch, and three wave band selector buttons. A tuning eye and an automatic silent tuning indicator are mounted above dial.

Loudspeaker:

Ten inch electrodynamic speaker enclosed in a "Mirrophonic Tone Chamber".

Cabinet:

Console model.

GENERAL:—This is an A-C operated radio receiver in a console cabinet using thirteen tubes and a superheterodyne circuit. Three manually tuned bands are provided: Broadcast, Police and Short-Wave, with frequency ranges of 540 to 1600 kilocycles, 1.58 to 4.82 megacycles, and 4.8 to 15.5 megacycles respectively. The positions of the push-button tuning unit of the wave-change switches for these bands are shown on the Control Layout (Fig. 1). An indicator lamp illuminates the name of the band on the dial which is in use. A large rectangular dial with an edge-lighted glass dial-scale is used and has the calibrations in megacycles in etched white figures. The main short-wave bands are marked in red and identified by figures indicating the wavelength. The tuning points for the main short-wave stations together with their call-letters are marked above the upper short-wave calibrations. The manual tuning control is equipped with a flywheel to give smooth operation and drives the tuning gang and pointer through a bronze cable. A reduction ratio of 19 : 1 gives satisfactory fine tuning, and fast tuning can be accomplished by giving a spin to the flywheel.

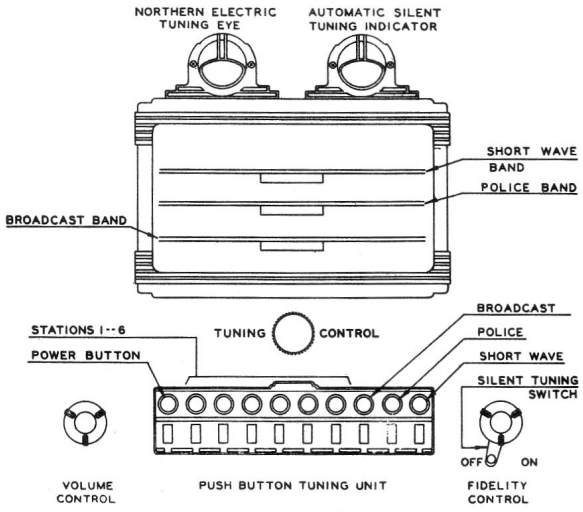


Figure 1.—Control Layout

Push-button tuning of six pre-set stations is available. There are three pairs of buttons for tuning to stations having frequencies within the ranges 535-900 kilocycles, 750-1300, and 930-1600 kilocycles respectively. The inductance trimmers for adjusting the tuning on this position are located behind the station call-cards.

Variable selectivity is provided by means of the Fidelity Control switch. The broad-tuning or expanded-selectivity position is the furthest to the left, the intermediate expansion is the next position tuned to the right, sharp-tuning or contracted-selectivity is furnished in the third position, and the remaining three positions are part of a treble tone control. An electric Tuning Eye is used to indicate tuning.

The Automatic Silent Tuning feature can be used by turning the silent Tuning Switch to the "on" position. The set is then muted in between stations and static and other interference is eliminated. The colour of the Automatic Silent Tuning Indicator (to the right of the Tuning Eye) turns from green to red when a station is tuned in and the muting is removed. This feature is not operative on the short-wave band regardless of the switch position.

This model operates on a 115 volt line having any frequency between 25 and 60 cycles. The a-c load rating at this voltage is 140 watts. Power is switched on when any tuning button is pressed and is cut off by the left-hand end button. The ten-inch loudspeaker is enclosed in a special Mirrophonic Tone Chamber.

CIRCUIT:—The antenna and oscillator coils and their respective switches are part of an assembly that includes the Push Button Tuning Unit. In the manual tuning positions the switches for both antenna and oscillator circuits (for example—items 25, 26, 27 and items 37, 38 and 39 on the short-wave band) are on a common button and plunger. Similarly a common button operates the switches for the antenna and oscillator coils and the selectivity-changing switch for each of the six pre-set-station positions (for example: items 55, 69 and 61 on position No. 6).

Switches, items 25, 28 and 31, connect the antenna transformer primaries to the antenna and break the circuit to capacitor, item 67, which provides the coupling to the coils for the pre-set stations. Switches, items 26, 29 and 32, connect the antenna-transformer secondaries simultaneously to the first detector grid, antenna section of tuning gang, item 75, and break the grid connection to the pre-set-station antenna preselectors. Switches, items 27, 30 and 33, control the shorting of the secondaries that are not in use and the voltage to the appropriate one of the three indicator lamps, items 12, 13 and 14. There is no trimmer

capacitor across the broadcast band secondary, item 9, but it has an iron-cored inductance trimmer, item 10. The short-wave and police antenna-transformer secondaries use trimmer capacitors, items 3 and 5, respectively. Items 6 and 11 are coupling capacitors.

Switches, items 55 to 60, short-circuit the preselector coils for the pre-set station positions or connect them to the 6A8 grid and the antenna-preselector trimmer capacitor, item 68. Good image ratio is obtained by taking the input to the grid from capacitor, item 68, instead of from the preselector coils. The trimmer offers a lower impedance to the image signal since it has a higher frequency than the wanted signal. Resistor, item 216, is a leak resistor across the input capacitor, item 67, to prevent building up of power-frequency hum voltages or static charges. No separate switch is required to change from manual to pre-set tuning or vice versa. Switches, items 69 to 74, prevent the use of contracted selectivity by broadening the tuning of the first i-f transformer when any one of the six pre-set-station selectors is in use. Switches, items 61 to 66, short-circuit the oscillator coils, items 49 to 54, or connect them to the oscillator tube. The pre-set-station antenna and oscillator coils are tuned by means of inductance trimmers, items 209 to 214, which move the iron cores in both antenna and oscillator coils on a common screw. The terminal layout for the push-button switches is shown at the left-hand end of the schematic.

A separate oscillator tube (6J5) is employed and uses plate tuning for high frequency stability on the manually tuned bands. A Colpitt's oscillator circuit is used in conjunction with the pre-set-station oscillator coils. Plate voltage is shunt fed to the oscillator through the filter resistor, item 104, and the plate is coupled to the oscillator coils through the capacitor, item 106. Item 208 is an r-f choke, necessary for short-wave stability. The grid blocking capacitor and grid leak are items 107 and 108 respectively. Switches, items 34, 37 and 40 switch the grid windings of the oscillator coils, items 15, 19 and 22, respectively, or couple the grid to the "Silvercap" mica capacitor, item 78, when the pre-set-station oscillator coils are in use. To maintain oscillator stability, the short-wave oscillator coil has a resistor, item 17, shunted across the grid winding, item 15, and another resistor, item 77, in series with it. The broadcast band oscillator has a resistor, item 79, across the lag capacitors, items 80 and 81, for the same purpose. The short-wave oscillator has a fixed lag capacitor, item 82. The lag capacitor for the police band is item 83, with item 84 in parallel. Switches, items 36, 39 and 42, connect the oscillator plate to the plate winding of the short-wave, police and broadcast band oscillator coils respectively, or to the "Silvercap" mica capacitor, item 85, which couples to the pre-set-station oscillator coils. These switches also switch the oscillator section of the tuning gang, item 76. On the police and broadcast bands, respectively, switches, items 38 and 41, are used to short-circuit the oscillator plate windings, items 20 and 23, when these coils are not in use. Switch, item 35, is used to open the screen-voltage supply to the suppressor control tube (6V6G) when the short-wave band is in use.

The first detector (6A8) uses the No. 1 grid for injection of the oscillator voltage coupled through capacitor, item 105. The No. 2 grid is connected to the screen grid. The control grid is resistance-capacitance coupled to the antenna coils through capacitor, item 86, and resistor, item 87. Items 88 and 90 comprise the a-v-c filter, items 91 and 92, and items 102 and 103 serve as filters in the screen and plate leads respectively. There are two i-f amplifier stages, in which the first two transformers, items 93 and 109, are capable of expansion by inclusion of the tertiary coupling coils, items 96 and 112, respectively. In the normal or contracted-selectivity position the secondaries alone are connected into circuit by sections 101 and 117 of the fidelity-control switch, unless a pre-set-station button is depressed causing the tertiary to be coupled in the first transformer. This gives an intermediate value of selectivity corresponding to the second position on the control switch. In the first position of the switch the tertiary coils are connected in series with the secondaries and the broad selectivity essential to high quality reception is furnished. In this position the first two transformers are over-coupled and produce a flat-topped response over a wide band covering all the side-bands.

In the second detector tube (6H6) one diode plate (pin No. 5) serves as the second detector and a-v-c diode. Capacitor, item 123, is part of the trimmer capacitor, item 122, and together with resistor, item 124, it comprises an i-f filter. The diode load consists of two resistors, items 127 and 128, which give full a-v-c bias to the first detector and first i-f amplifier and partial a-v-c bias to the second i-f amplifier. Items 129 and 125, and items 130 and 126, are used as a-v-c filters. The volume control, tem 160, is coupled to the load resistors through capacitor, item 159. Item 161 is a tone-compensating capacitor which shunts the upper portion of the volume control. When the volume control is fairly well advanced, as on the reception of distant stations, the higher audio frequencies are attenuated. When the volume control is reduced further, as on reception of strong local signals, the higher audio frequencies are increased in relative amplitude permitting high quality reproduction. Item 215 is a resistor that forms part of the tone compensator circuit.

The cathode (pin No. 8) of the second detector (6H6) is connected to the cathode of the first audio amplifier (6K5G) tube, and grid bias for the latter is obtained from the 1.3-volt bias cell, item 162, which is connected between the grid and the slider on the volume control. Item 163 is an i-f by-pass capacitor on the grid. The first audio stage is coupled to the phase-inverter stage (6J5) by means of the resistors, items 164 and 171, and capacitor, item 170. Capacitors, items 166 to 169, attenuate the treble audio range in four positions of the fidelity-control switch. Resistor, item 172, in the cathode produces the grid bias for the phase-inverter tube. The load consists of the plate resistor, item 174, and resistor, item 173, in the cathode circuit. The plate resistor is resistance-capacitance coupled to the upper push-pull output tube (6F6G) through items 175 and 176, and the resistor, item 173, in the cathode is similarly coupled to the lower one by means of items 177 and 178. Items 186 and 187 are plate by-pass capacitors, and capacitor, item 184, and

resistor, item 185, form an equalizer circuit to match the loudspeaker load.

Removal of the loudspeaker plug disconnects the main filter capacitors from the B-supply. Filter capacitors, items 194 and 195, are returned to the centre-tap of the power transformer. Resistor, item 181, and filter capacitor, item 196, form an additional filter stage supplying plate voltage to the oscillator, the first audio and inverter tubes, and to the tuning eye. Bias for the output tubes is developed across resistors, items 197 and 198, and bias for the tubes on a-v-c is obtained from the latter. Resistor, item 199, is used to reduce the voltage to the dial and indicator lamps. Capacitors, items 157 and 158, constitute an r-f line filter.

The circuits that produce the inter-station noise suppression include a limiter tube, sharply tuned circuits, rectifier, audio-delay network, control tube, telephone type relay and associated indicator lamps. The input to the suppressor-limiter tube (6K7) comes from the plate circuit of the second i-f amplifier, and the amount is regulated by the trimmer capacitor, item 133, which is in series with the grid leak resistor, item 134. This tube is operated at reduced plate voltage applied through the ballast resistor, item 142, and with very low screen voltage taken from the voltage divider consisting of resistors, items 143 and 144. Capacitors, items 146 and 145, are plate and screen by-passes. Under these operating conditions saturation occurs in the tube for low input signals, and all signals above this value produce nearly the same plate current changes. Thus large amplitudes of signal due to static or electrical interference do not produce larger signals in the plate circuit than a weaker station carrier.

The suppressor i-f transformer includes a large inductance, high-Q primary, item 136, tuned by capacitors, items 140 and 138, and a low-inductance secondary, item 137, having a large fixed capacitor, item 141, and a trimmer capacitor, item 139, to tune it with high stability. This secondary feeds the suppressor rectifier diode in the 6H6 tube (pin No. 3). The load resistor is item 147, and is shunted by the i-f by-pass capacitor, item 148. The suppressor i-f transformer is sharply tuned and attenuates any signals in the limiter output outside of its narrow pass-band.

To further sharpen the noise-suppressor action, a negative bias from the drop across resistor, item 153, is applied between the cathode (pin No. 4) and diode (pin No. 3) of the 6H6 tube. This prevents any rectification of the output signal from the limiter until the signal exceeds the delay bias. Thus the suppressor-control tube is prevented from functioning until the desired carrier is within a few kilocycles of optimum tuning.

The rectified signal from the suppressor diode produces a d-c voltage across the load resistor, item 147. This voltage is applied to two filters or delay networks. One network includes resistor, item 152, and capacitor, item 155. The voltages across resistor, item 147, that are applied through the network to the control grid of the type 6V6G suppressor-control tube may consist of a steady d-c component due to a rectified carrier or pulses of short duration due to static or electrical interference. The time constant of items 152 and 153 is such that capacitor, item 155, is charged up by the steady d-c voltage from the rectified carrier but is incompletely charged by the pulses of short duration from static and interference. The voltage across capacitor, item 155, forms the grid bias that controls the plate current of the control tube. The operating voltages are such as to produce a large plate current change for a small change in bias. This change controls the operation of the relay, item 131. When a station carrier is tuned in the plate current is decreased and releases the relay, thus removing the short-circuit in contacts nos. 3 and 4 across the volume control. It will be noticed that when the silent-tuning feature is in operation, in tuning off a station the response is cut off before the usual side-band distortion becomes noticeable. This is an apparent increase in sharpness of tuning that is very desirable.

When a station is not tuned in, the plate current of the suppressor control tube is high and the relay is closed. Contacts nos. 5 and 6 then short-circuit the indicator lamp, item 204, and full voltage is applied to the other lamp, item 203, which gives a green illumination to the glass dial of the Automatic Silent Tuning Indicator. When the relay is open, resistor, item 205, shunting the lamp, item 203, passes sufficient current to light the lamp, item 204, brightly (while lamp, item 203, is dim) and colour the indicator red.

The relay is prevented from functioning when either the Silent Tuning Switch, item 156, is closed, thereby short-circuiting the winding, item 132, or when the switch, item 35, breaks the screen supply to the suppressor control tube during operation of the set on the short-wave band. The rectified signal used to bias the grid of the type 6U5 tuning eye is fed through a network consisting of resistor, item 150, and capacitor, item 151, having a larger time-constant than the other network. When the set is tuned to a carrier the tuning eye closes to a steady value which is practically independent of the strength of the received signal.

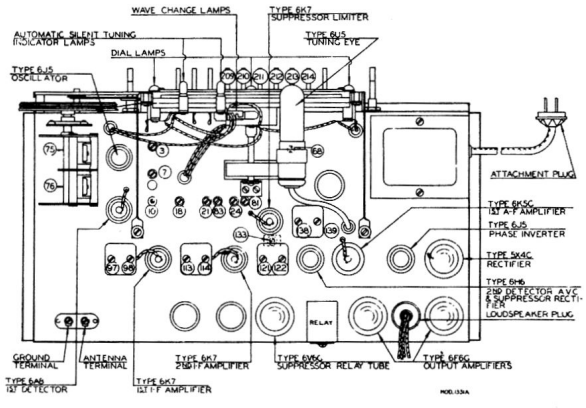


Figure 2.—Chassis Layout Showing Aligning Positions.

DIAL STRINGING:—Figure 3 shows how the bronze cable that drives the tuning gang and pointer can be restrung if necessary. Instructions are given on the diagram, and the numbers show the order of procedure to follow.

Before attempting to remove the chassis from the cabinet, remove all the knobs, release the tuning-eye assembly from the clamp on the instrument panel, and remove the indicator lamps from the bracket on the Automatic Silent Tuning Indicator. (After the chassis has been removed, be careful that the sockets on these indicator lamps do not short to the chassis when the power is on, or the resistor in series with the lamps may burn out.) After removing the four drive screws at the rear of the chassis and disconnecting the loudspeaker plug, the chassis can be removed.

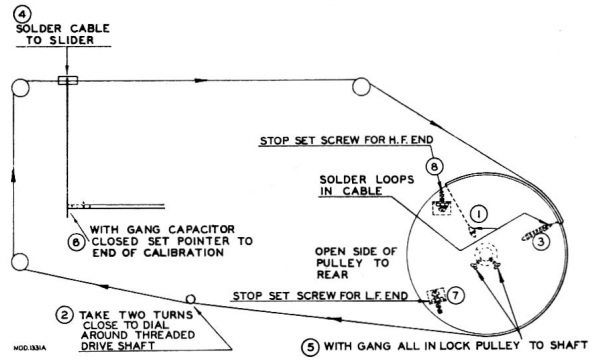


Figure 3.—Dial Stringing Diagram

SPECIAL NOTES

CIRCUIT CHANGES:—Some of the first production sets have one or more of the following circuit elements missing: resistor, item 27, in the short-wave oscillator circuit; coupling capacitor, item 5, on the police-band antenna transformer; resistor, item 215, in series with the volume control and capacitor,item 161, across the top portion of it. The relay connections may be to different terminals than those shown on the schematic. Some sets have reversed connections on the oscillator coils for the pre-set station positions. Most of the sets having serial numbers below 1330 have the input circuit to the pre-set-station preselector coils similar to that shown in the lower right-hand corner of the schematic. These departures will not cause difficulty in operation.

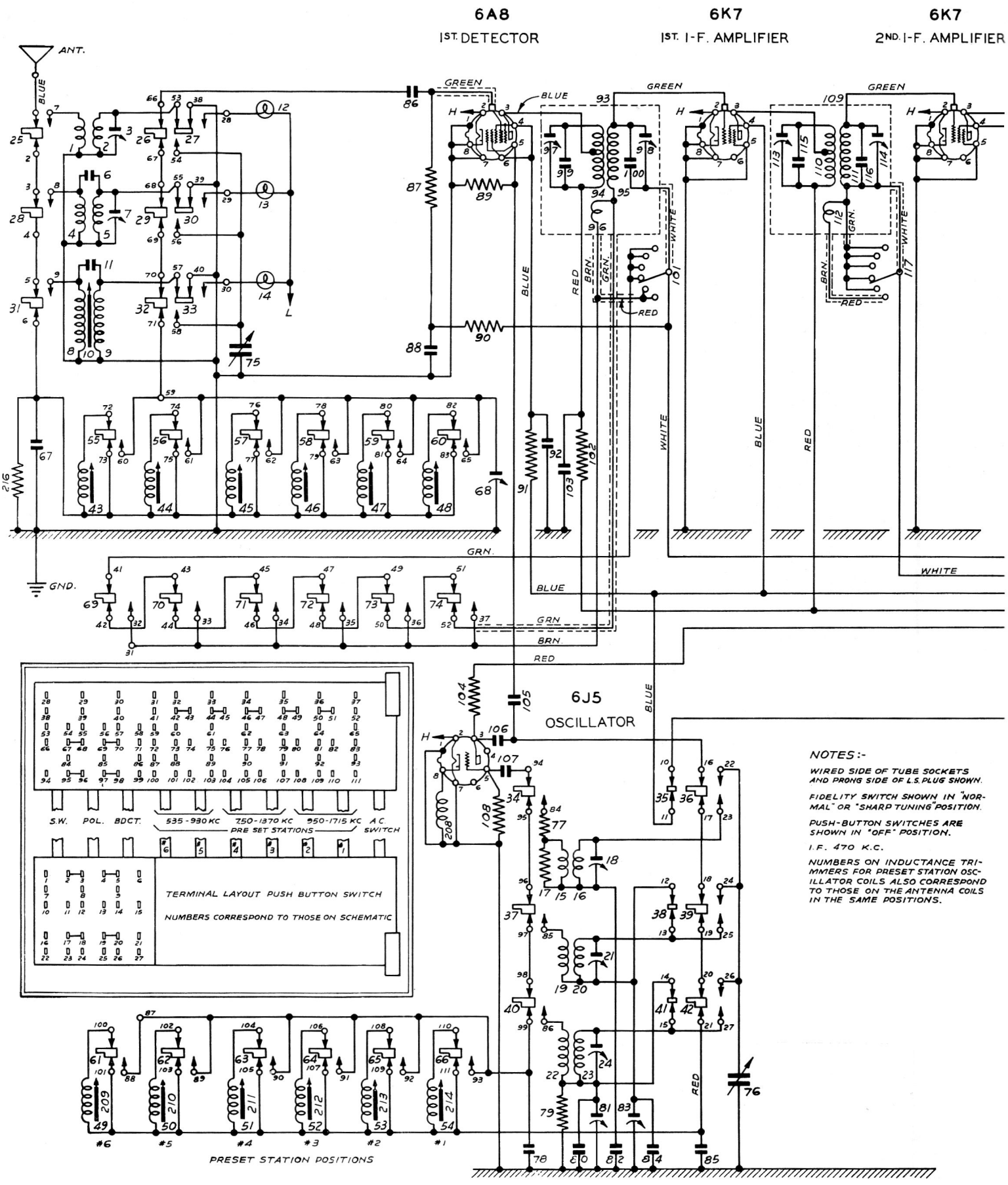
IMPROPER OPERATION OF INTER-STATION NOISE SUPPRESSOR:—If, when the Silent Tuning Switch is in the "on" position, the relay does not release when tuning through a station whose signal strength is above the noise level, check the alignment of the suppressor trimmers and other i-f circuits. Screw in trimmer, item 133, if it is loose, and retrim the second i-f transformer. Check relay operation and control tube current (6V6G). Do not attempt to adjust the relay springs. (Note that the noise suppressor does not operate on the short-wave band.)

If, in an area of high level of interference, such noise breaks through and releases the relay, check the alignment and operation as above. The sensitivity of the suppressor can be reduced by unscrewing trimmer, item 133 (and retrimming the 2nd i-f). If this is not effective, check operating conditions on the limiter tube. If changing limiter and control tubes does not improve results, in an extreme case it may be necessary to reduce the voltage divider resistor, item 144, or the cathode resistor, item 153, to alter the operating conditions and raise the signal level at which release of the relay takes place. The change of the cathode resistor affects the level at which the control tube operates the relay, and the other change controls the level at which the limiter tube saturates. The limiter screen voltage is critical and large changes in it may result in unsatisfactory operation if the line voltage changes.

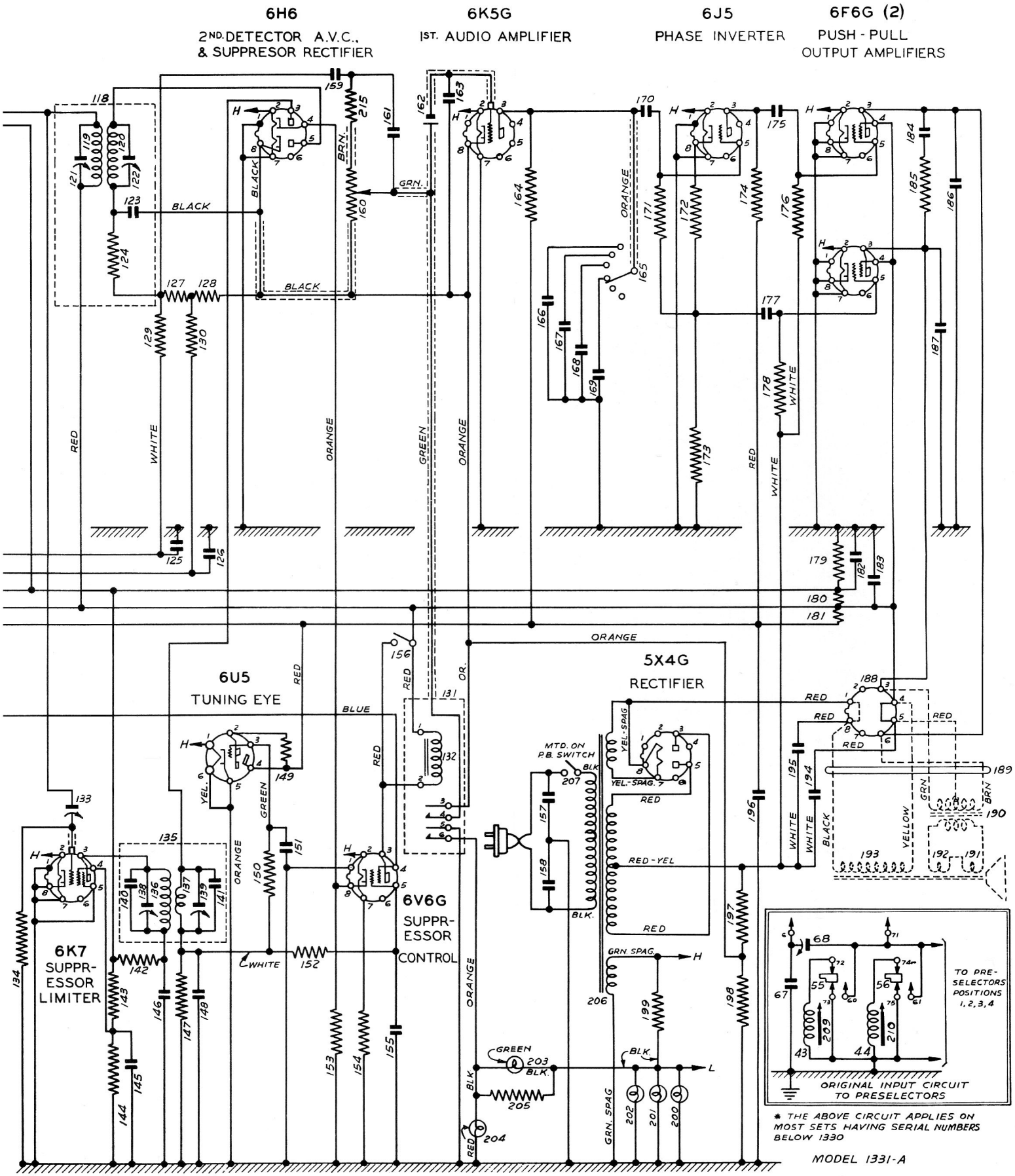
D.C. RESISTANCE OF COILS — OHMS

Item	*Description*	*Resistance*
1	S-W Antenna Transformer, Primary	Less than 0.5
2	S-W Antenna Transformer, Secondary	Less than 0.5
4	Police Antenna Transformer, Primary	5.0
5	Police Antenna Transformer, Secondary	1.5
8	Bdct. Antenna Transformer, Primary	22.5
9	Bdct. Antenna Transformer, Secondary	2.5
15	S-W Oscillator Coil, Grid Winding	1.5
16	S-W Oscillator Coil, Plate Winding	Less than 0.5
19	Police Oscillator Coil, Grid Winding	1.75
20	Police Oscillator Coil, Plate Winding	1.0
22	Bdct. Oscillator Coil, Grid Winding	0.75
23	Bdct. Oscillator Coil, Plate Winding	4.3
43	Pre-set-station—No. 6 Antenna Coil	11.0
44	Pre-set-station—No. 5 Antenna Coil	11.0
45	Pre-set-station—No. 4 Antenna Coil	4.0
46	Pre-set-station—No. 3 Antenna Coil	4.0
47	Pre-set-station—No. 2 Antenna Coil	3.0
48	Pre-set-station—No. 1 Antenna Coil	3.0
49	Pre-set-station—No. 6 Oscillator Coil	9.0
50	Pre-set-station—No. 5 Oscillator Coil	9.0
51	Pre-set-station—No. 4 Oscillator Coil	5.0
52	Pre-set-station—No. 3 Oscillator Coil	5.0
53	Pre-set-station—No. 2 Oscillator Coil	4.0
54	Pre-set-station—No. 1 Oscillator Coil	4.0
94	1st I-F Transformer, Primary (entire winding)	6.25
95	1st I-F Transformer, Secondary	6.25
96	1st I-F Transformer, Tertiary	1.0
110	2nd I-F Transformer, Primary (entire winding)	6.25
111	2nd I-F Transformer, Secondary	6.25
112	2nd I-F Transformer, Tertiary	1.3
119	3rd I-F Transformer, Primary	9.5
120	3rd I-F Transformer, Secondary	9.5
132	Suppressor Relay Winding	2000
136	Suppressor I-F Transformer, Primary	13.8
137	Suppressor I-F Transformer, Secondary	3.9
190	Output Transformer, Primary	460
	Output Transformer, Secondary	Less than .5
191	Loudspeaker Voice Coil (Imp. 1.82 ohms @ 400 cycles)	2.3
192	Loudspeaker Humbucking Coil	Less than .5
193	Loudspeaker Field Coil	340
206	Power Transformer, Primary	3.8
	Power Transformer, H.V. Secondary	243
	Power Transformer, Heater Winding	Less than .5
	Power Transformer, Rectifier Winding	Less than .5
208	R-F Choke Coil	.4

MODEL 1331A RADIO RECEIVER



MODEL 1331A RADIO RECEIVER



REPLACEMENT PARTS LIST

Item	Description	Part Number
1	Short-Wave Antenna Trans. Primary	K-4195
2	Short-Wave Antenna Trans. Secondary	
3	Trimmer Capacitor, 3-30 mmf.	K-3860-2
4	Police Ant. Trans Primary	K-4193
5	Police Ant. Trans. Secondary	
6	Capacitor, 5 mmf. Mica	K-4235-1
7	Capacitor, Trimmer, 3-30 mmf.	K-3860-2
8	Broadcast Antenna Trans. Primary	K-3831-5
9	Broadcast Antenna Trans. Secondary	
10	Broadcast Antenna Inductance Trimmer	
11	Capacitor, 5 mmf. Mica	K-4235-1
12	Short-Wave Indicator Lamp	K-2589-3
13	Police Indicator Lamp	K-2589-3
14	Broadcast Indicator Lamp	K-2589-3
15	Short-Wave Osc. Trans., Grid Winding	K-4196
16	Short-Wave Osc. Trans., Plate Winding	
17	Resistor, 5,000 ohms	K-2226-12
18	Trimmer Capacitor, 13-50 mmf.	K-3860-3
19	Police Osc. Trans., Grid Winding	K-4194
20	Police Osc. Trans., Plate Winding	
21	Trimmer Capacitor, 13-50 mmf.	K-3860-3
22	Bdct. Osc. Trans., Grid Winding	K-4192
23	Bdct. Osc. Trans., Plate Winding	
24	Trimmer Capacitor, 13-50 mmf.	K-3860-3
25	Short-Wave Antenna Primary Switch	Part of K-4190
26	Short-Wave Antenna Secondary Switch	
27	Short-Wave Lamp & Coil Shorting Switch	
28	Police Antenna Primary Switch	
29	Police Antenna Secondary Switch	
30	Police Lamp & Coil Shorting Switch	
31	Bdct. Antenna Primary Switch	
32	Bdct. Antenna Secondary Switch	
33	Bdct. Antenna Lamp & Coil Shorting Switch	
34	Short-Wave Osc. Grid Circuit Switch	
35	Short-Wave Relay Shorting Switch	
36	Short-Wave Osc. Plate Circuit Switch	
37	Police Osc. Grid Circuit Switch	
38	Police Plate Winding Shorting Switch	
39	Police Osc. Plate Circuit Switch	
40	Broadcast Osc. Grid Circuit Switch	
41	Broadcast Osc. Plate Winding Shorting Switch	
42	Broadcast Osc. Plate Circuit Switch	
43	Push-Button Ant. Coil (Station No. 6)	
44	Push-Button Ant. Coil (Station No. 5)	
45	Push-Button Ant. Coil (Station No. 4)	
46	Push-Button Ant. Coil (Station No. 3)	
47	Push-Button Ant. Coil (Station No. 2)	
48	Push-Button Ant. Coil (Station No. 1)	
49	Push-Button Osc. Coil (Station No. 6)	
50	Push-Button Osc. Coil (Station No. 5)	
51	Push-Button Osc. Coil (Station No. 4)	
52	Push-Button Osc. Coil (Station No. 3)	
53	Push-Button Ant. Coil (Station No. 2)	
54	Push-Button Osc. Coil (Station No. 1)	
55	Push-Button Ant. Switch (Station No. 6)	
56	Push-Button Ant. Switch (Station No. 5)	
57	Push-Button Ant. Switch (Station No. 4)	
58	Push-Button Ant. Switch (Station No. 3)	
59	Push-Button Ant. Switch (Station No. 2)	
60	Push-Button Ant Switch (Station No. 1)	
61	Push-Button Osc. Switch (Station No. 6)	
62	Push-Button Osc. Switch (Station No. 5)	
63	Push-Button Osc. Switch (Station No. 4)	
64	Push-Button Osc. Switch (Station No. 3)	
65	Push-Button Osc. Switch (Station No. 2)	
66	Push-Button Osc. Switch (Station No. 1)	
67	Capacitor, 2000 mmf. Mica	K-1952-18
68	Trimmer Capacitor, 20-80 mmf.	K-3860-5
69	Selectivity Control Switch (Station No. 1)	Part of K-4190
70	Selectivity Control Switch (Station No. 2)	
71	Selectivity Control Switch (Station No. 3)	
72	Selectivity Control Switch (Station No. 4)	
73	Selectivity Control Switch (Station No. 5)	
74	Selectivity Control Switch (Station No. 6)	
75	Gang Capacitor, Ant. Sect., 12-491 mmf.)	K-4198
76	Gang Capacitor, Osc. Sect., 12-491 mmf.)	

Item	Description	Part Number
77	Resistor, 50 ohms	K-2226-25
78	Capacitor, 320 mmf. Silvercap	K-4144-2
79	Resistor, 15,000 ohms	K-2226-9
80	Capacitor, 440 mmf. mica ± 3%	K-1611-31
81	Trimmer Capacitor, 20-80 mmf. (Bdct. Lag)	K-3860-5
82	Capacitor, .01 mf. 200 volt (S.W. Lag)	K-2227-6
83	Trimmer Capacitor, 20-80 mmf. (Police Lag)	K-3860-5
84	Capacitor, 1000 mmf. Mica ± 5%	K-1611-30
85	Capacitor, 370 mmf. Silvercap	K-4144-1
86	Capacitor, 500 mmf. Mica	K-1611-6
87	Resistor, ½ megohm	K-2226-3
88	Capacitor, .02 mf. 200 volt	K-2227-7
89	Resistor, 50,000 ohms	K-2226-6
90	Resistor, 1/10 megohm	K-2226-5
91	Resistor, 1000 ohms	K-2226-16
92	Capacitor, .05 mf. 200 volt	K-2227-8
93	1st I.F. Trans. Assy. (Includes Items 94-100)	K-3998
94	1st I.F. Trans. Primary	K-4074
95	1st I.F. Trans. Secondary	
96	1st I.F. Trans. Tertiary	
97	Trimmer Capacitor, 15-100 mmf.	K-2134-3
98	Trimmer Capacitor, 15-100 mmf.	
99	Capacitor, 200 mmf. Mica	K-1611-3
100	Capacitor, 200 mmf. Mica	K-1611-3
101	Fidelity Control Switch (1st I.F. Sect.)	Part of K-4152
102	Resistor, 100 ohms	K-2226-16
103	Capacitor, .05 mf. 400 V	K-2228-8
104	Resistor, 20,000 ohms (1 watt)	K-1870-16
105	Capacitor, 5 mmf. Mica	K-4235-1
106	Capacitor, .002 mf. 400 Volts—Part of K-4190	K-2228-2
107	Capacitor, 100 mmf. Mica	K-1611-2
108	Resistor, 50,000 ohms	K-2226-6
109	2nd I.F. Trans. Assy. (Includes Items 110-116)	K-3999
110	2nd I.F. Trans. Primary	K-4075
111	2nd I.F. Trans. Secondary	
112	2nd I.F. Trans. Tertiary	
113	Trimmer Capacitor, 15-100 mmf.	K-2134-3
114	Trimmer Capacitor, 15-100 mmf.	
115	Capacitor, 200 mmf. Mica	K-1611-3
116	Capacitor, 200 mmf. Mica	K-1611-3
117	Fidelity Control Switch (2nd I.F. Sect)	Part of K-4152
118	3rd I.F. Trans. Assy. (Includes Items 119-124)	K-4050
119	3rd I.F. Trans. Primary	K-4080
120	3rd I.F. Trans. Secondary	
121	Trimmer Capacitor, 70-170 mmf.	K-2932-2
122	Trimmer Capacitor, 70-170 mmf.	
123	Capacitor, 100 mmf. (Part of item 122)	
124	Resistor, 50,000 ohms	K-2226-6
125	Capacitor, .05 mf. 200 volts	K-2227-8
126	Capacitor, .05 mf. 200 volts	K-2227-8
127	Resistor, 350,000 ohms	K-2226-53
128	Resistor, 150,000 ohms	K-2226-36
129	Resistor, 2 megohms	K-2226-1
130	Resistor, 1 megohm	K-2226-2
131	Suppressor Relay Assy.	K-4282-2
132	Suppressor Relay Winding (Part of Item 131)	
133	Trimmer Capacitor, 3-25 mmf. (Sup. Limiter Input)	K-1458-6
134	Resistor, 1 megohm	K-2226-2
135	Suppressor I.F. Trans. Assy. (Includes items 136-141	K-4001
136	Suppressor I.F. Trans. Primary	K-4076
137	Suppressor I.F. Transformer Secondary	
138	Trimmer Capacitor, 15-100 mmf.	K-2134-3
139	Trimmer Capacitor, 15-100 mmf.	
140	Capacitor, 50 mmf.	K-1611-1
141	Capacitor, 1000 mmf.	K-1611-30
142	Resistor, 10,000 ohms	K-2226-10
143	Resistor, 75,000 ohms	K-2226-27
144	Resistor, 50,000 ohms	K-2226-6
145	Capacitor, .05 mf. 200 volt	K-2227-8
146	Capacitor, .05 mf. 200 volt	K-2227-8
147	Resistor, ½ megohm	K-2226-3
148	Capacitor, 250 mmf. Mica	K-1611-14
149	Resistor, ½ megohm	K-2226-3
150	Resistor, 1 megohm	K-2226-2

REPLACEMENT PARTS LIST—(Continued)

Item	Description	Part Number
151	Capacitor, .05 mf. 2000 volt	K-2227-8
152	Resistor, ½ megohm	K-2226-3
153	Resistor, 300 ohms	K-2226-20
154	Resistor, 0.5 ohm, 1 watt	K-4063-2
155	Capacitor, .02 mf. 200 volt	K-2227-7
156	Suppressor Relay Shorting Switch	K-4277
157	Buffer Capacitor, .025 mf. 525 volt	K-3750
158	Buffer Capacitor, .025 mf. 525 volt	
159	Capacitor, .01 mf. 200 volt	K-2227-6
160	Volume Control, 2 megohm	K-3558-1
161	Capacitor, 100 mmf. Mica	K-1611-2
162	Bias Cell, 1.25 volts	K-3810
163	Capacitor, 100 mmf. mica	K-1611-2
164	Resistor, ¼ megohm	K-2226-4
165	Fidelity Control Switch, Tone Control Sect. Pt. of	K-4152
166	Capacitor, .005 mf. 400 volts	K-2228-14
167	Capacitor, .003 mf. 400 volts	K-2228-3
168	Capacitor, .002 mf. 400 volts	K-2228-2
169	Capacitor, .001 mf. 400 volts	K-2228-1
170	Capacitor, .1 mf. 400 volts	K-2228-9
171	Resistor, 1 megohm	K-2226-2
172	Resistor, 2,500 ohms	K-2226-13
173	Resistor, 15,000 ohms	K-2226-9
174	Resistor, 15,000 ohms	K-2226-9
175	Capacitor, .1 mf. 400 volts	K-2228-9
176	Resistor, 1/10 megohm	K-2226-5
177	Capacitor, .1 mf. 200 volts	K-2227-9
178	Resistor, 1/10 megohm	K-2226-5
179	Resistor, 8,000 ohms, 1 watt	K-1870-34
180	Resistor, 7,000 ohms, 10 watts	K-4300-3
181	Resistor, 5,000 ohms	K-2363-1
182	Capacitor, .1 mf., 200 volt	K-2227-9
183	Capacitor, .25 mf. 400 volts	K-2228-10
184	Capacitor, .003 mf. 400 volts	K-2228-3
185	Resistor, 20,000 ohms, 1 watt	K-1870-16
186	Capacitor, .001 mf. 400 volts	K-2228-1
187	Capacitor, .001 mf. 400 volts	K-2228-1
188	Loudspeaker Plug—K-2678	K-4149-1
189	Loudspeaker Cable	
190	Output Transformer—K-2718-12	
191	Voice Coil & Diaphragm Assy.—K-3483-3 (K-4150-1)	
192	Hum Bucking Coil	
193	Field Coil—K-4247	
194	Capacitor, 16 mf. Elec. 500 P.V.	K-4199
195	Capacitor, 16 mf. Elec. 500 P.V.	K-4199
196	Capacitor, 16 mf. Elec. 500 P.V.	K-4199
197	Resistor, 80 ohms, 10 watt	K-4300-6
198	Resistor, 27 ohms, 1 watt	K-4063-4
199	Resistor, 0.25 ohm, ¼ watt	K-2252-15
200	Dial Lamp, 6.3 volt	K-2589-3
201	Dial Lamp, 6.3 volt	K-2589-3
202	Dial Lamp, 6.3. volt	K-2589-3
203	Tuning Lamp, 6.3 volt	K-2589-3
204	Tuning Lamp, 6.3 volt	K-2589-3
205	Resistor, 10 ohms, 10 watt	K-4300-5
206	Power Transformer, 25 cycle	K-4244-2
207	Power Switch—Part of	K-4190
208	R-F Choke	K-3935
209	Inductance Trimmer P.B. Ant. & Osc. Coils—Station No. 6	Part of K-4190
210	Inductance Trimmer P.B. Ant. & Osc. Coils—Station No. 5	
211	Inductance Trimmer P.B. Ant. & Osc. Coils—Station No. 4	
212	Inductance Trimmer P.B. Ant. & Osc Coils—Station No. 3	
213	Inductance Trimmer P.B. Ant. & Osc. Coils—Station No. 2	
214	Inductance Trimmer P.B. Ant. & Osc. Coils—Station No. 1	
215	Resistor, ¼ megohm	K-2226-4
216	Resistor, 10,000 ohms	K-2226-10

MISCELLANEOUS:—

Sockets	K-1924
Terminal Strip	K-2595
Single Standoffs	K-2594
Dial Frame Assy	K-4180
Slider & Indicator Assy	K-4012-4
Drive Shaft	K-4314
Tuning Eye Mounting Bracket	K-4274
Thumb Screw	K-3900
Tuning Eye Clamp	K-3899
Rubber Light Shield (for tuning eye)	K-4231
Dial Scale	K-4241
Dial Backing	K-4243
Bronze Cable (5 ft. length)	K-1694-9
Light Shield	K-3874
Flywheel	K-4100
Flexible Coupling	K-4098
Special Mounting Nuts for Trimmers	K-3882
Relay (only)	K-4283
Relay Can (only)	K-4285
Grid Clips	K-3030-2
Lamp Sockets	K-2835-1
Lamp Sockets	K-2835-2
Escutcheon (tuning eye)	K-3839-6
Escutcheon (push button)	K-4162-2
Escutcheon (dial)	K-4263-2
Knobs (push button)	K-3539-3
Knob (tuning)	K-4168
Knob (volume)	K-3961-11
Knob (fidelity)	K-3961-10
Knob (suppressor)	K-3711-3
Tuning Eye Scale (for stop-go tuning)	K-4233
Tee nuts (bottom plate mounting)	K-3282
Instruction Folder (English)	K-4163
Instruction Folder (French)	K-4164
Station Call Letter Cards	K-4166
Celluloid Windows	K-4270
Tuning Eye Scale Backing	K-4238-2
Six Prong Socket (tuning eye)	K-3906
Terminal Strip	K-2505
Suppressor Switch Arm Assy	K-4310
S.S. Connecting Link	K-4312
Mirrophonic Label	K-4066
Mounting Clip for Bias Cell	K-3810
Indicator (for S.S.)	K-3977
Tube Shield Base	K-2390-2
Tube Shield	K-2267-1
Tuning Wrenches—all models	K-836

SOCKET VOLTAGE READINGS — MODEL 1331-A

These readings were taken with the gang capacitor all in, wave-change switch on the broadcast band and line voltage of 115 volts. They can be duplicated with anv good volt-ohmmeter such as the Weston Model 663 or the Weston Model 772 and a Weston Model 666 socket selector. When taking readings with the selector attachment, connect a 0.1 mf. capacitor from the grid of the tube in the selector to the chassis, to prevent oscillation.

TUBES	VOLTAGES					CURRENTS—MA.		
	Heater A-C	Plate	Screen	Grid	Cathode	Screen	PLATE	
							Normal Bias	Bias Red 4½ V.
Type 6A8 1st Detector	6.2	260	87	—3.7 ②	0	5.0	9.0 ⑦	10.5
Type 6J5 Oscillator	6.2	110	—	—	0	—	4.5	5.1
Type 6K7 1st I-F Amplifier	6.2	262	93	—3.7 ②	0	1.2	5.5	9.5
Type 6K7 2nd I-F Amplifier	6.2	262	93	—3.7 ②	0	1.2	5.5	9.5
Type 6K7 Suppressor Limiter	6.2	75	26	—	0	.5	1.5	1.8
Type 6H6 2nd Det., A.V.C. Supp. Rect.	6.2	—	—	—	3.7 ⑥	—	—	—
Type 6K5G 1st A-F Amplifier	6.2	83	—	— ③	3.7	—	.45	82
Type 6J5 Phase Inverter	6.2	170	—	—5 ④	38	—	2.2	3 0
Type 6F6G Output Amplifier	6.2	252	262	—16 ⑤	0	5.6	20	24
Type 6F6G Output Amplifier	6.2	252	262	—16 ⑤	0	5.6	20	24
Type 6V6G Suppressor Control	6.2 ①	262	92	—	4.4	.65	13.2	20
Type 6U5 Tuning Eye	6.2	22	210 (Target)	—	0	1 6 (Target)	.35	.37
Type 5X4G Rectifier	5.1	—	—	—	315 ⑧	Pin No.5 70	70	—

① Other heater terminal is 0.22 volts above ground.
② Measured across resistor item 198.
③ Bias cell voltage (1.3 volts)—cannot be measured with meter.
④ Measured across resistor, item 172.
⑤ Measured across resistors, items 197 and 198.
⑥ Other cathode (Pin No. 4) measures 4.4 volts above ground.
⑦ Current to No. 2 grid is 1.8 ma.
⑧ In sets having serial numbers 1000 to 1100 this voltage is 325 and the other plate and screen voltages are a few volts higher than shown in the table.

SOCKET RESISTANCE READINGS TO GROUND — OHMS, MODEL 1331-A

Top Cap. (Cont. Grid)	Pin No. 1 (Shell)	Pin No. 2 (Heater)	Pin No. 3 (Plate)	Pin No. 4 (Screen)	Pin No. 5	Pin No. 6	Pin No. 7 (Heater)	Pin No 8 (Cathode)
3.1 meg.	0	less than 0.5	15,500	8,500	No. 1 Grid 50,000	No. 2 Grid 8,500	0	0
—	0	less than 0.5	39,500	—	Cont. Grid 50,000	—	0	1.5
2.5 meg.	0	less than 0 5	14,500	7,500	(Suppressor) 0	—	0	0
1.15 meg.	0	less than 0.5	14,500	7,500	0	—	0	0
1 meg.	0	less than 0.5	17,500	31,000	0	—	0	0
—	0	less than 0.5	Diode Plate .5 meg.	300	Diode Plate .55 meg.	—	0	27
2 ① meg.	—	less than 0.5	.269 meg.	—	—	—	0	27
—	0	less than 0.5	34,500	—	Cont. Grid 1 meg.	—	0	17,500
—	0	less than 0.5	14,730	14,500	Cont. Grid .1 meg.	—	0	0
—	0	less than 0.5	14,730	14,500	Cont. Grid .1 meg	—	0	0
—	0	less than 0.5	16,500	7,500	Cont. Grid 1 meg.	—	5	300
—	Heater 1.5	Plate .519 meg.	Cont. Grid 1.5 meg.	Target 19,500	Cathode 0	Heater 0	—	—
—	—	—	227	—	Plate 227	—	1 ②	0

These readings were taken with power switch off, wave change switch in broadcast position, volume control in extreme counterclockwise position and relay switch open.

① Measured from high end of volume control to avoid possible damage to bias cell.

② Measured to pin No. 8 on 5X4G Rectifier Tube.

REALIGNING INSTRUCTIONS

To secure full advantage of the performance characteristics of these receivers, any realignment necessary should be carried out carefully. A reliable test oscillator or signal generator and also an output meter should be employed. A signal generator utilizing harmonics to cover the short wave band should not be used.

I.F. ALIGNMENT:

(*a*) Set the push-button switch in the (manual) broadcast position, the tuning capacitor gang in the closed position, the fidelity control in the "Normal" (contracted-selectivity) position (3rd position from furthest position to left), and the Silent Tuning Switch in the "off" position. Accuracy in setting the signal generator to the required frequency of 470 kc. is essential to ensure good tracking of the I-F and R-F circuits. Very careful alignment will be necessary to preserve the proper band-pass characteristics when the fidelity control is turned to the expanded-selectivity position. Couple the output of the signal generator with a 0.1 mf. capacitor to the grid cap of the converter (6A8) tube. Do not attempt to align the I-F circuits using the tuning eye, because trimmer, item 122, will open the eye further instead of closing more at resonance.

(*b*) In the contracted-selectivity position the first and second I-F transformers have a single sharp response. The diode I-F transformer is more broadly tuned. Re-alignment can be carried out in the usual fashion by adjustment of the trimmers, items 121, 122, 113, 114, 97 and 98, for maximum response. (Note:—Do not disturb the trimmers, items 133, 138 and 139, while adjusting the I-F circuits).

(*c*) Reduce the output from the signal generator to the lowest value that will produce an output reading and check all the adjustments. All trimmers should peak properly.

(*d*) Set the fidelity control in the expanded-selectivity position. If the previous adjustments have been made correctly, as the generator frequency is varied a few kilocycles on either side of 470, the output from the receiver should remain nearly constant due to the flat-top, band-pass response and should drop off fairly abruptly and symmetrically for frequencies further above and below. A small peak may be observed on both sides just before the response cuts off abruptly. The peaks should be symmetrical in amplitude and in frequency separation from 470 KC. If the response is not symmetrical, adjust the trimmers on the diode I-F transformers slightly until symmetry is obtained.

SUPPRESSOR I-F ALIGNMENT:

(*a*) This adjustment should follow after the I-F alignment described above. Since the adjustments have some effect upon the alignment of the other I-F stages, it will be necessary to recheck the final adjustment of the I-F, if changes are made in the suppressor I-F circuits.

(*b*) With the signal generator at 470 kc. coupled to the converter, turn down the volume control, and use the tuning eye as an indicator for alignment. A strong signal—of say 10,000 microvolts—should be used for this adjustment. Trimmer, item 133, should be set turned in completely until the other adjustments have been made. This trimmer controls the input to the limiter tube and therefore the signal level at which the tuning eye, the stop-go lights and the suppressor relay operate.

(*c*) The adjustment of trimmers 138 and 139 is somewhat critical. If these are badly out of line it may be necessary to make several attempts to get the proper adjustments. The normal position for trimmer 139 is all in, and the other trimmer, item 138, is normally screwed in about half way. With the trimmer 139 at a given adjustment, the other trimmer is varied to obtain a partial closing of the tuning eye. If no effect is noted, change the adjustment of trimmer 139 slightly and repeat the operation. When an adjustment is found that gives partial closing of the tuning eye, both trimmers should be adjusted for maximum closing.

(*d*) After these adjustments have been completed, check the overall alignment of the I-F stages.

R-F ALIGNMENT— BROADCAST "MANUAL" BAND:

(*a*) Connect the output of the signal generator through a 100-mmf. capacitor to the antenna terminal of the receiver. Ground the receiver ground terminal. In the R-F alignment of this and the other two manually tuned bands as well as the pre-set stations, the fidelity control should be in the contracted-selectivity or normal position.

(*b*) Check the position of the pointer on the dial when the gang is turned completely in. The inner edge of the pointer should line up with the left hand end of the dial calibrations.

(*c*) Set the signal generator and receiver at 1400 kc. Adjust trimmer, item 24, to bring in the signal. Note that there is no antenna trimmer to adjust on this band.

(*d*) Set the generator at 540 kc. and the gang completely turned in. Adjust trimmer, item 81, to bring in the signal.

(*e*) Set the generator to 600 kc. and tune the receiver to it. Then adjust the inductance trimmer, item 10, for maximum response. The pointer will probably line up slightly to the higher side of 600 kc. on the dial.

(*f*) Re-check at 1400 kc., and if a further adjustment is necessary, the 540 kc. and 600 kc. adjustment should be re-checked also.

R-F ALIGNMENT—POLICE BAND:

(*a*) Use the same connections from the generator as for the broadcast band alignment.

(*b*) Push in the proper button on the push-button tuning unit, and set both generator and receiver at 4.5 megacycles. Adjust trimmer, item 21, to bring in the signal. (The oscillator is operated above the signal in frequency on all bands, so that the image will be tuned in with the generator set at a frequency 940 kc. higher than the desired signal. Check that the set is not tuned to the image by locating the image at a higher frequency on the generator.)

(*c*) Adjust trimmer, item 7, for maximum output while rocking the gang slightly.

(*d*) Set the generator at 1.8 megacycles and tune the receiver to it. While rocking the gang, adjust trimmer, item 83, for maximum sensitivity.

(*e*) Re-check at 4.5 megacycles.

R-F ALIGNMENT—SHORT-WAVE BAND:

(*a*) Substitute a 400-ohm resistor in place of the capacitor in the lead from the signal generator.

(*b*) Push in the proper button on the push-button tuning unit. Set generator and receiver at 14 megacycles. Adjust trimmer, item 18, to bring in the signal. (Check that the set is not tuned to the image.)

(*c*) Adjust trimmer, item 3, for maximum output while rocking the gang slightly.

(*d*) This band uses a fixed lag capacitor, so that there is no adjustment to be made at the low frequency end.

R-F ALIGNMENT—PRE-SET STATION POSITIONS.

(*a*) Use a 100 mmf. capacitor in the lead from the signal generator, and set the generator at 1400 kc.

(*b*) Push in the buttons for either station No. 1 or station No. 2 (these are the second and third buttons from the left hand end facing the push button tuning unit.) Adjust the inductance trimmer corresponding to the button to bring in the signal.

(*c*) Adjust trimmer, item 68, for maximum response.

(*d*) The other high frequency pre-set station and the middle and low-frequency positions can be adjusted to the desired stations using the inductance trimmers and noting the response on the tuning eye. It is unwise to attempt to line up these trimmers except on strong local stations which give a consistently usable signal. Very weak stations may not operate the suppressor relay if the silent tuning switch is in the "on" position, and will not give complete closing of the tuning eye or the same output volume as the same station would produce in the manual-tuning position.

SUPPRESSOR RELAY ADJUSTMENT:

(*a*) If the suppressor relay does not release at a sufficiently low signal level and the alignment of the R-F and I-F circuits has been checked, then the alignment of the trimmers, items 133, 138 and 139, should be checked. The alignment of the trimmers, items 138 and 139, on the suppressor I-F transformer has been described above.

(*b*) If the signal required to effect release of the relay is too high, screw the trimmer, item 133, in further, if it is not already in this position. If the release of the relay occurs at too low a value, unscrew this trimmer. If the suppressor relay circuits are too sensitive, the relay may release on strong static or other signals due to electrical interference. If the trimmer, item 133, is changed in adjustment, it will be necessary to re-align the trimmers on the diode I-F transformer, item 121, and item 122.

(*c*) If the above adjustments do not result in proper operation, then check the plate current of the suppressor control tube (6V6G) and the current at which the relay opens and closes. The relay should close at $10 \pm .5$ ma. and should release at $7 \pm .5$ ma. The current through the relay can be varied for purposes of checking, by controlling the signal delivered by the generator. If the relay does not operate within the prescribed limits, a replacing relay should be obtained. It is inadvisable to attempt to adjust the relay, since special tools and considerable experience are necessary to do this properly.