

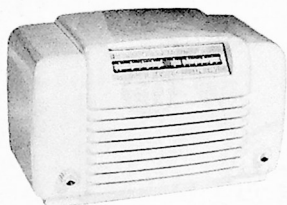
PHILCO



SERVICE

HOME RADIO

PHILCO RADIO, MODEL 46-142



MODEL 46-142

SPECIFICATIONS

CABINET:	Table model, plastic, ivory finish.
CIRCUIT:	Five-tube superheterodyne.
FREQUENCY RANGE:	540 to 1400 kc.
OPERATING VOLTAGES:	{ Plate supply: 90 volts at 8—10 milliamperes. (battery pack, type P 60B-6L) { Filament supply: 1.5 volts at .250 ampere.
POWER CONSUMPTION:	1.3 watts (total for both plate and filament supplies).
AERIAL:	External, Philco Part No. 45-1469.
INTERMEDIATE FREQUENCY:	455 kc.
PHILCO TUBES USED:	1LA6, 1LN5, 1LH4, 1A5GT/G(2).

CIRCUIT DESCRIPTION

Model 46-142 is a five-tube, farm table-model superheterodyne, normally using 90-volt plate, and 1.5-volt filament supplies from a battery pack contained in the cabinet with the radio.

The circuit consists of a 1LA6 pentagrid converter, a 1LN5 i-f amplifier, a 1LH4 diode detector and first audio amplifier, and two 1A5GT/G push-pull audio-output tubes, supplying approximately 160 milliwatts to a 5-inch, round, permanent-magnet type of dynamic speaker.

To conserve battery life, pilot lamps are omitted; instead, a mechanical arrangement provides a red warning flag, visible through the dial when the radio is turned on. Permeability tuning of the mixer and oscillator circuits is used instead of the conventional condenser tuning. Trimmer condensers are used for high-frequency padding; an iron-core adjustment is used for low-frequency oscillator tracking.

An outstanding design feature is the aerial input circuit. The radio is designed to use a 100-foot external aerial. Condensers C404 and C405 (Figure 10) form a capacity voltage divider across the series-resonant circuit comprised of L400, C403, and C406A. Therefore the capacity of the individual aerial installation has little effect on input tuning. Resistor R402 affords protection to the input circuits, by providing a d-c path from aerial to ground, and also reduces noise which ordinarily would be produced by static charges building up on the external aerial, and then discharging suddenly through the input circuit to ground. The oscillator is of the tuned-grid, plate-tickler type. Tuning of the grid circuit is accomplished by a variable inductor, L401, shunted across the grid side of the oscillator transformer, T400. Adjustment for oscillator tracking at low frequencies is provided by the variable iron core in the oscillator transformer.

The first i-f transformer is double-tuned to produce the necessary selectivity. The second i-f transformer is single-tuned, and designed so that very little coupling exists between windings, the coupling being mostly through condenser C301D. The diode-detector filter resistor and by-pass condensers are contained in the same shield can with the second i-f transformer, thus providing a compact assembly, and eliminating possibility of oscillation through capacity coupling to other circuits. The diode portion of the 1LH4 detector—first audio tube supplies the audio signal to the triode-amplifier portion; the rectified diode-output voltage is filtered and smoothed to supply a controlled amount of negative d-c voltage for automatic volume control. This a-v-c voltage is fed back through a voltage divider to the grids of the mixer and i-f amplifier. Because of tube cutoff characteristics, only a portion of the developed a-v-c voltage is used.

The output of the first audio stage is applied to the push-pull output circuit, which uses two type 1A5GT/G tubes in a unique

plate-current phase-inversion circuit. The operation of this new circuit is independent of normal variations in tube characteristics, so that changing of tubes has very little effect on the undistorted output. This circuit insures full output of 160 milliwatts (with new batteries) at the primary of the output transformer. The output transformer (T200), which comprises the plate loads, is of special design, employing two primary windings instead of the conventional tapped winding. The screens are connected to the B+ side of the line, and a resistor (R206) is connected between the two plate-supply leads of the output transformer, so that the plate current of only one output tube passes through it. The varying plate current in this tube (the one which is driven by the first audio stage) causes small audio-frequency voltage variations across resistor R206. Since these voltages are approximately 180 degrees out-of-phase with the grid input voltages of the same tube, they are of proper phase to excite the grid of the remaining output tube. The combined output of both tubes is applied to the permanent-magnet dynamic speaker.

PHILCO TROUBLE-SHOOTING PROCEDURE

In this manual, the circuit is divided into four sections, which are shown both in schematic and chassis-base layouts, with test points for each section. The first step in each simplified trouble-shooting chart provides a master check which makes it possible to quickly determine whether trouble exists in that section. Wherever trouble is indicated, by failure to get the "NORMAL INDICATION" in a given test, it should be located by voltage, resistance, or capacitance checks of the parts indicated in the step, and remedied before testing further. Components are symbolized according to the letter designations as given on the first page of the service manual for PHILCO RADIO, MODEL 46-350.

PRELIMINARY CHECKS

Before starting the trouble-shooting procedure, the following steps are recommended.

1. Carefully inspect both top and bottom of the chassis. Make sure that all tubes are secure and in the proper sockets. Look for bad connections, burnt resistors, or other obvious faults.
2. Before turning on the radio power, disconnect the battery, and check the resistance between B+ and chassis (test points D and C, figures 1 and 2) with the ohmmeter polarity such that the highest resistance reading is obtained; if lower than 100,000 ohms, check condenser C100 for leakage or short.
3. Check the battery voltage with the radio connected and turned on; if the voltage between B+ and B- (red and green leads) is less than 60 volts, or if the voltage between A+ and A- (brown and black leads) is less than 1.1 volts, the battery pack should be replaced.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 1

Make all tests with a d-c voltmeter, using a suitable range. All voltages given in the chart are average, and were made with a 20,000-ohms-per-volt meter. The radio was turned on, and was drawing normal current; the volume control was set at minimum.

If the "NORMAL INDICATION" is obtained in step 1, proceed to the tests for Section 2. If not, isolate and remedy the trouble in this section.

Note: These voltages are normal for a fresh battery; they will never exceed battery voltage measured with set turned off. When the radio is turned on, the plate voltage usually drops a few volts; as the battery becomes exhausted, this drop becomes greater.

STEP	TEST POINTS	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1a 1b	D to C A to C	85 volts 1.5 volts	Trouble within this section. Isolate by the following tests.
2	B- to C	5.6 volts	High voltage: Open R100. Excessive current drain (check C100 for leaks or shorts); see following steps. Low voltage: Open circuit. Defective tube in other sections. Low battery voltage. No voltage: Open S100. Broken connection in battery cable or plug. Defective tube.
3	D to C	85 volts	Low voltage: Leaky C100. Defective tube, or T200.
4	A to C	1.5 volts	No voltage or low voltage: Dead or weak battery; check for filament short if new battery does not give normal indication.

NOTE: Battery should be replaced when B+ drops below 80 volts, or A+ drops below 1.1 volts.

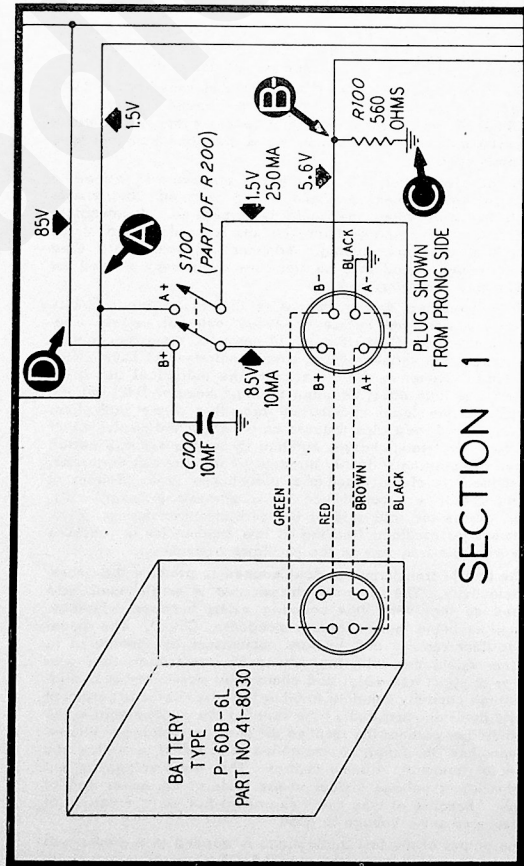


Figure 1. Section 1 schematic.

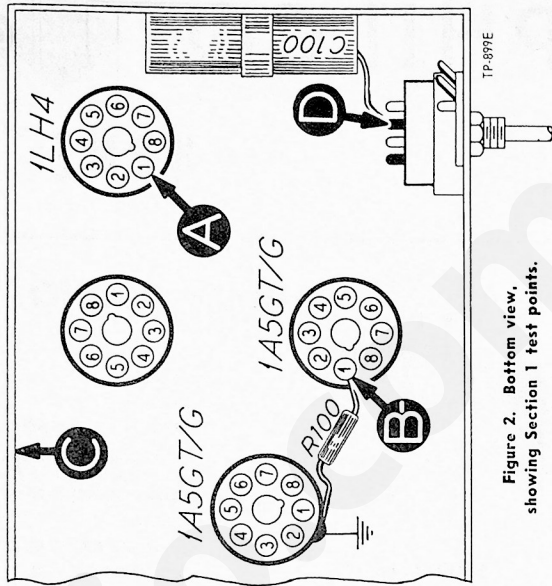


Figure 2. Bottom view, showing Section 1 test points.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 2

Connect audio-signal-generator ground lead to the radio chassis, and test point "C"; connect the output lead through a .1-mf condenser to the test points indicated in the chart. Set the radio volume control to maximum. Connect an output meter between the terminal panel (figure 9)

and chassis; for each step, adjust the signal generator for an output indication not exceeding 0.4 volt.

If "NORMAL INDICATION" is obtained in step 1, proceed to the tests for Section 3. If not, isolate and remedy the trouble in this section.

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	E	Loud, clear signal with low signal-generator output.	Trouble within this section. Isolate by the following tests.
2	A	Loud, clear signal with high signal-generator output.	Defective 1A5GT/G tube, T200 or 1S200. Shorted C205. Open C204.
3	B	Same.	Defective 1A5GT/G tube, or T200. Shorted C206. Open R206.
4	D	Loud, clear signal with moderate signal-generator output.	Defective C203 or 1LH4 tube. Shorted C202. Open R203, R204 or R205.
5	E	Same. (Check operation of volume control.)	Open R200 or C200.
Listening check.			
Distortion may be caused by leaky or shorted C200, C203 or C204; defective tubes, or R203.			

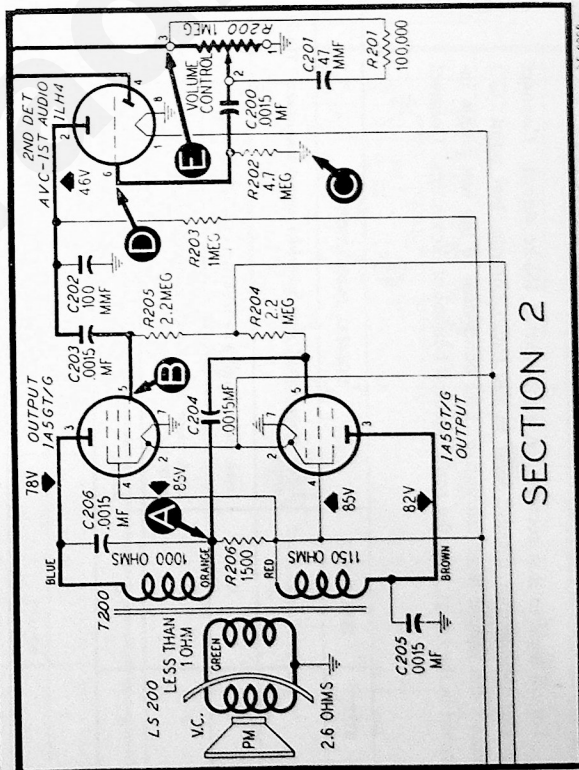


Figure 3. Section 2 schematic.

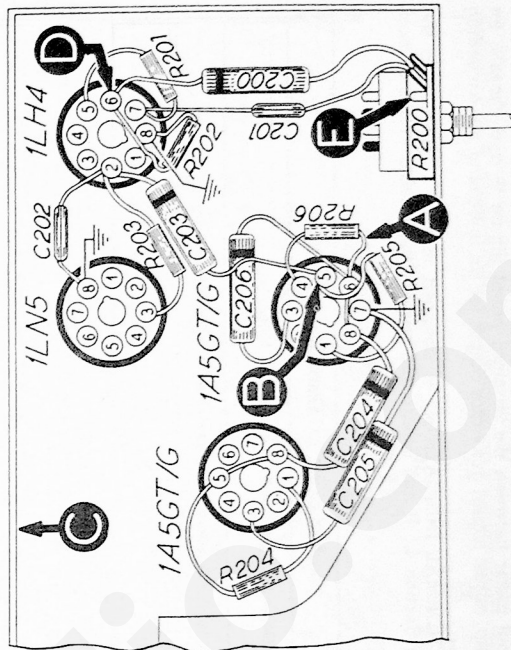


Figure 4. Bottom view, showing Section 2 test points.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 3

For all tests in this section use a modulated 455-kc signal. Connect the signal-generator ground lead to the radio chassis, test point "C"; connect the output lead through a .1-mf condenser to the test points indicated in the chart. Set the radio volume control at maximum. Connect an output meter between the terminal panel (figure 9) and chassis; for each step, adjust signal generator output for an indication not exceeding 0.4 volt.

If "NORMAL INDICATION" is obtained in step 1, proceed to the tests for Section 4. If not, isolate and remedy the trouble in this section.

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	D	Loud, clear signal with moderate signal-generator output.	Trouble within this section. Isolate by the following tests.
2	A	Loud, clear signal with high signal-generator output.	Shorted C301B, C301C. Defective or misaligned Z301. Open R300.
3	B	Loud, clear signal with moderate signal-generator output.	Defective 1LN5 tube or Z300.
4	D	Same.	Defective or misaligned Z300.

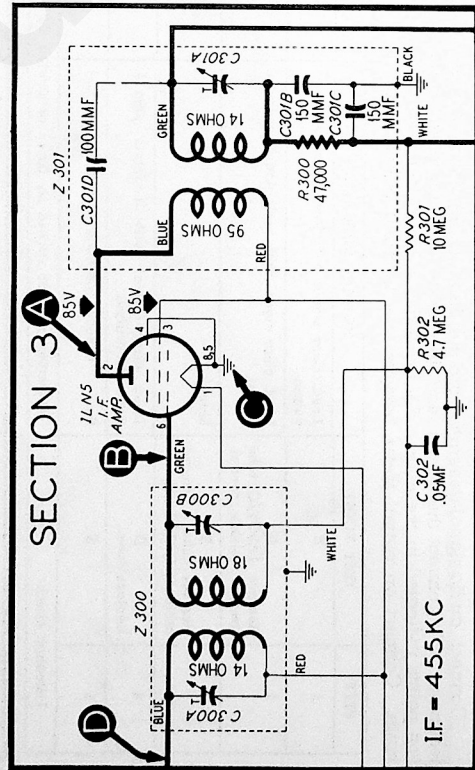


Figure 5. Section 3 schematic.

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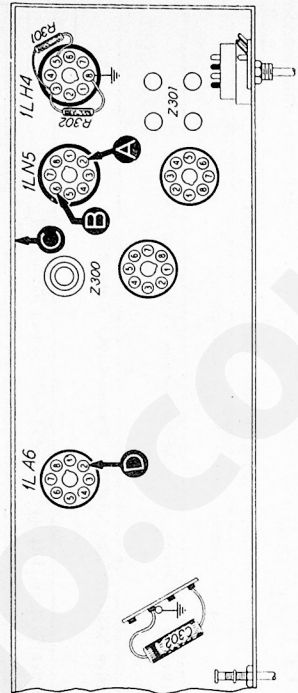


Figure 6. Bottom view, showing Section 3 test points.

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TESTS TO ISOLATE TROUBLE WITHIN SECTION 4

- For tests indicated in the chart, with the exception of the oscillator tests, use an r-f signal generator with modulated signal. Connect the ground lead of the signal generator to the radio chassis. Connect the connect lead of the signal generator to the test points indicated in the chart. Connect an output meter between the terminal panel (figure 9) and chassis; for each step (except step 3), adjust signal generator output for an indication not exceeding 0.4 volt. Set the radio volume control at maximum. Set the signal generator to 1000 kc and adjust tuning control for maximum signal.
- Preliminary Check: Rotate tuning control throughout its range and observe that the tuning cores move correspondingly (the cores should

be completely in at 540 kc, and out at 1620 kc).

3. Oscillator Test: Connect the positive lead of a 20,000-ohms-per-volt meter to the radio chassis. Using the 10-volt range, connect the negative prod through a 100,000-ohm isolating resistor to test point "D" (oscillator grid). A negative voltage of approximately 3 volts should be obtained as the tuning control is rotated throughout its range. If this indication is not obtained, trouble exists in the oscillator circuit. Step 3 indicates possible cause of oscillator trouble.

If "NORMAL INDICATION" is not obtained in step 1, isolate trouble by following remaining steps.

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	B	Loud, clear signal with low signal-generator output.	Trouble within this section. Isolate by the following tests.
2	A	Loud, clear signal with low signal-generator output.	Defective 1LA6 tube or Z300. Oscillator inoperative. Open R400. Shorted C400, C403, or C406A.
3	D	Negative 3 volts over tuning range. Osc. test. (See Par. 3 above.)	Defective L401 or T400. Shorted or open C401. Shorted C402 or C406B.
4	B	Loud, clear signal with low signal-generator output.	Shorted C404. Open C403, C405, or C406A. Defective L400.

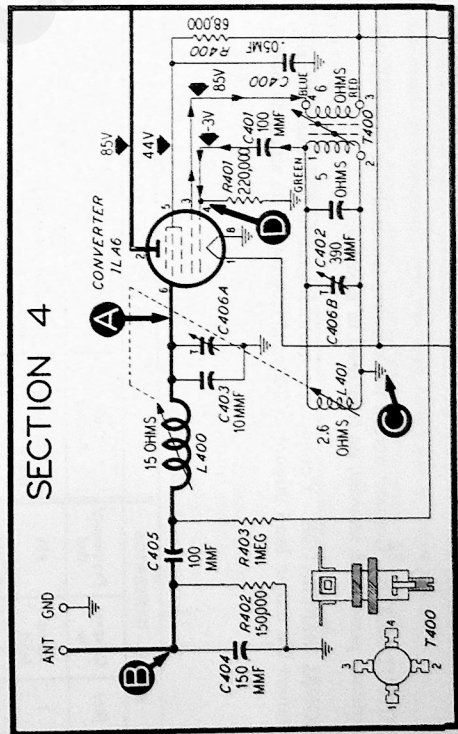


Figure 7. Section 4 schematic.

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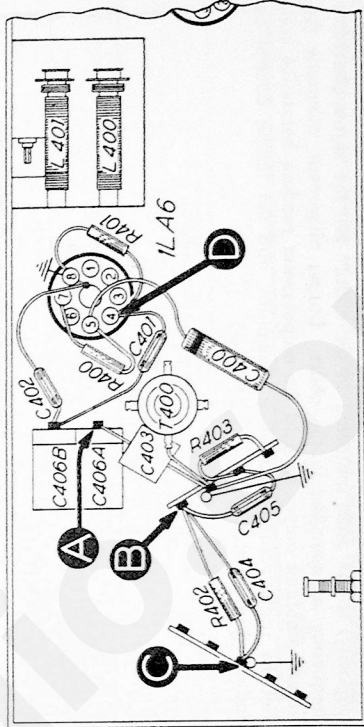


Figure 8. Bottom view, showing Section 4 test points.

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ALIGNMENT PROCEDURE

OUTPUT METER: Connect across the speaker terminals, or between the terminal panel and chassis, as indicated in figure 9.

SIGNAL GENERATOR: Connect the ground lead to the radio chassis; connect the output lead through a 200-mmf condenser (to simulate aerial

capacity) to the point indicated in the chart. Set the signal-generator frequency as specified in the chart. During alignment, attenuate the signal-generator output to hold the output-meter reading below 0.4 volt. Set the radio volume control at maximum, and the tuning control as indicated in the chart.

SIGNAL GENERATOR		RADIO			
Step	Connect to	Frequency (kc)	Dial Setting	Special Instructions	Adjust
1	Aerial lead	455	At left index mark.*	Adjust for maximum, once only.	C301A C300B C300A
2	Same	1600	Approx. 5 1/2" from index mark* (1600 kc)	Adjust for maximum.	C406E
3	Same	1500	Approx. 5 7/8" from index mark* (1500 kc)	Adjust for maximum.	C406A
4	Same	580	Approx. 1" from index mark* (580 kc)	Adjust for maximum while rocking tuning control.	T40
5	Same	Repeat steps 2, 3, 4 and then step 2.			

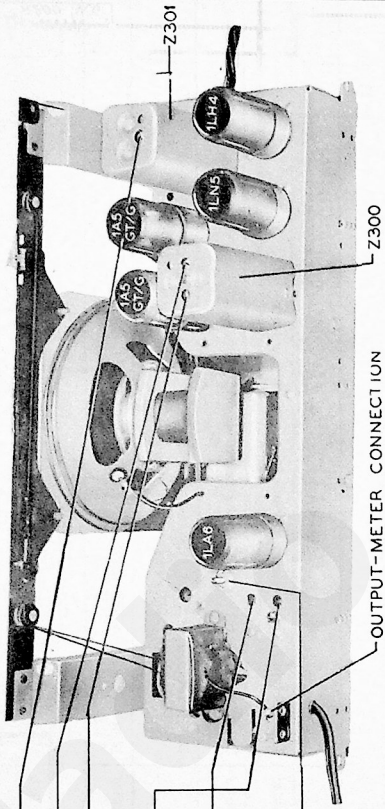


Figure 9. Chassis, showing alignment adjustments.

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* NOTE: The index mark is the small hole approximately 3.3/8" from the left side of the scale backplate.

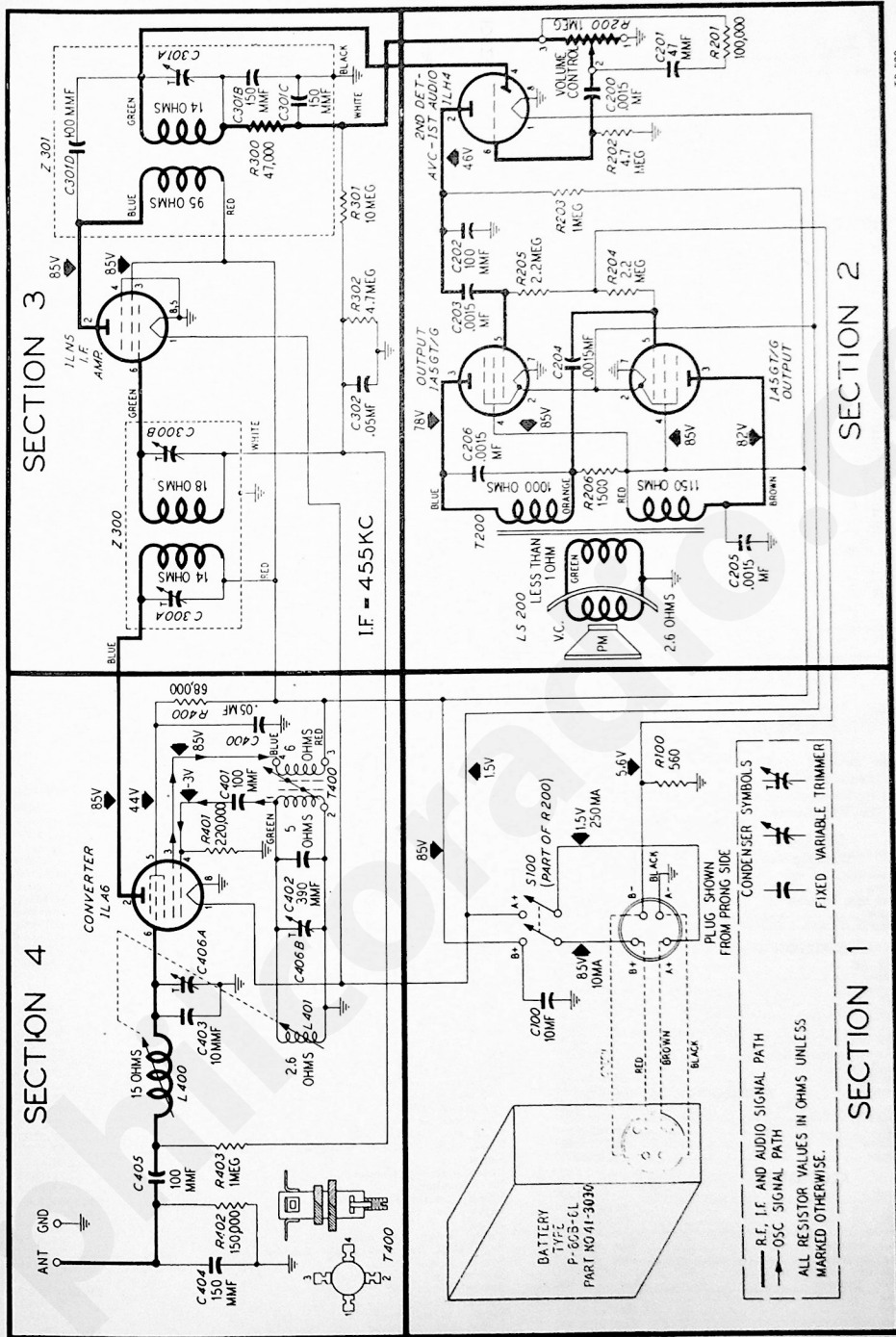


Figure 10. Complete schematic.

NOTE: All voltage, capacity, and resistance values shown are average. The voltages were measured between the points indicated and the chassis, with a 20,000-ohms-per-volt meter. A new battery pack was used. Oscillator grid voltage was measured through a 100,000-ohm resistor in series with the negative voltmeter prod. with the positive lead connected to the chassis. The volume control was set at minimum (counterclockwise), and the tuning control at 550 kc. Note that the voltage readings will normally decrease as the battery becomes exhausted.

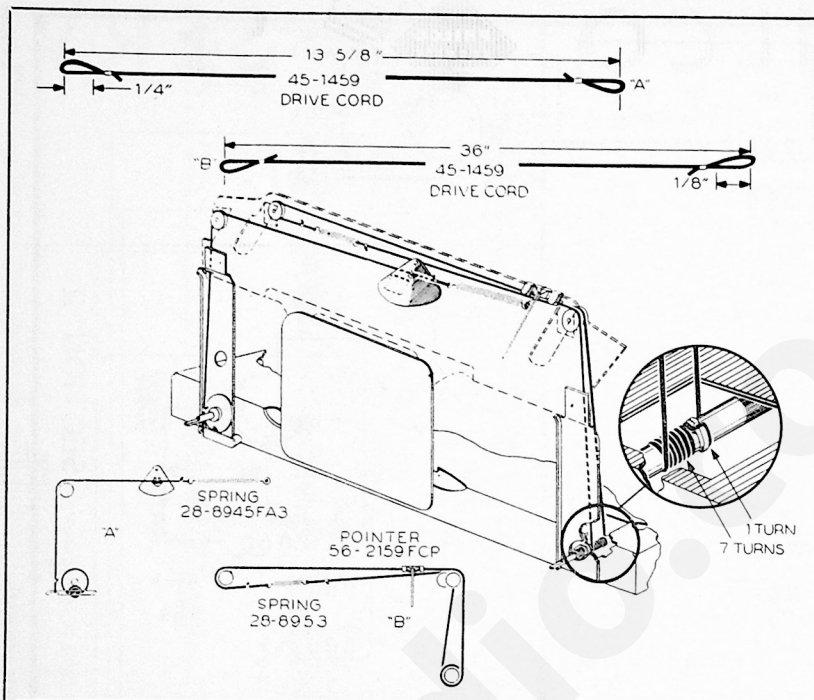


Figure 11. Pointer and flag-drive-cord details.

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REPLACEMENT PARTS LIST — MODEL 46-142

* These parts are general replacement items, and the part numbers may not be identical with those used on factory assemblies. When ordering replacements, use only the "SERVICE PART NUMBER" shown in the Replacement Parts List.

Reference No.	SECTION 1 Description	Service Part No.
C100	Condenser, electrolytic, 10 mf	30-2540*
R100	Resistor, 500 ohms	66-1563340*
PL100	Battery cable and plug assembly	41-3477-1
	Plug, battery cable	217-1057*
S100	Switch, OFF-ON	Part of R200
SECTION 2		
C200	Condenser, .0015 mf	45-3500-6*
C201	Condenser, 47 mmf	60-00515307*
C202	Condenser, 100 mmf	60-10105407*
C203	Condenser, .0015 mf	45-3500-6*
C204	Condenser, .0015 mf	45-3500-6*
C205	Condenser, .0015 mf	45-3500-6*
C206	Condenser, .0015 mf	45-3500-6*
LS200	Speaker	36-1507-2*
R200	Control, volume, 1 meg	33-5493*
R201	Resistor, 100,000 ohms	66-4103340*
R202	Resistor, 4.7 meg.	66-5473340*
R203	Resistor, 1 meg.	66-5103340*
R204	Resistor, 2.2 meg.	66-5223340*
R205	Resistor, 2.2 meg.	66-5223340*
R206	Resistor, 1500 ohms	66-2153340*
T2C0	Transformer, output	32-8289-2*
SECTION 3		
C302	Condenser, .05 mf	60-0122*
R301	Resistor, 10 meg.	66-6103340*
R302	Resistor, 4.7 meg.	66-5473340*
Z3C0	Transformer, 1st i-f	32-3949*
	C300A: condenser, trimmer	Part of Z3C0
	C300B: condenser, trimmer	Part of Z3C0
	Transformer, 2nd i-f	32-3897*
Z301	C301A: condenser, trimmer	Part of Z301
	C301B: condenser	Part of Z301
	C301C: condenser	Part of Z301
	C301D: condenser	Part of Z301
	R300: resistor 47,000 ohms	Part of Z301
SECTION 4		
C400	Condenser, .05 mf	61-0122*
C401	Condenser, 100 mmf	60-10105407*
C402	Condenser, silver-mica, oscillator shunt, 390 mmf	30-1220-14*

SECTION 4 (Continued)

Reference No.	Description	Service Part No.
C403	Condenser, 10 mmf	60-00105407*
C404	Condenser, 150 mmf	60-10155407*
C405	Condenser, 100 mmf	60-10105407*
C406	Condenser assembly, antenna trimmer	31-6391
	C406A: condenser, antenna trimmer	Part of C406
	C406B: condenser, oscillator trimmer	Part of C406
L400	Coil, antenna tuning	65-0380-1
L401	Coil, oscillator tuning	65-0381-1
R400	Resistor, 68,000 ohms	66-3683340*
R401	Resistor, 220,000 ohms	66-4223340*
R402	Resistor, 150,000 ohms	66-4153340*
R403	Resistor, 1 meg.	66-5103340*
T400	Coil, oscillator tracking	32-4092
MISCELLANEOUS		
	Cabinet	10618D
	Back	54-7244
	Baffle and cloth assembly	40-6746
	Scale, glass	27-5918
	Cam assembly	76-1650
	Dial Scale	27-5918
	Drive cord, flag or pointer drive (25-ft. spool)	45-1459
	Core-guide assembly	76-2478
	Spring, retaining	57-1398
	Core-guide shaft	57-1672FA3
	Core, iron, antenna coil	57-1702
	Core, iron, oscillator tuning coil	57-1703
	Knobs	54-4375
	Lever assembly, transfer	76-1655
	Nut, backlash	57-1706
	Palnut, tuning-unit assembly	1W29091FA3
	Palnut, 1st i-f	1W29084FA3
	Pointer	36-2159
	Rubber band, scale mounting	54-4025
	Scale plate, flag and upright assembly	76-1652
	Socket, Loktal	27-6138*
	Socket, octal	27-6199*
	Spacer, speaker (2)	1W29184FA3
	Spring, flag-drive	28-9011
	Spring, pointer-drive	28-8953
	Screw, scale-mounting	1W23129FA3
	Strap, scale-mounting, R.H.	56-2672FA3
	Strap, scale-mounting, L.H.	56-2671FA3
	Studs, back-mounting	W2235FA9
	Studs, baffle-mounting	W2235-2FA9
	Tuning-shaft assembly	76-2480
	Tuning unit, manual, inductive	76-2481