PHILCO SERVICE

TELEVISION

SERVICE BULLETIN 49T4

SERVICING PHILCO TELEVISION RECEIVERS

Subjects Covered

PHILCO TAPERED-LINE TELEVISION TUNER UNIT

PART NO. 76-5433

CIRCUIT DESCRIPTION

Philco Part No. 76-5433 is a 12-Position Television Tuner Unit consisting of a tapered-line aerial-input matching circuit, an r-f amplifier stage, a local oscillator, and a mixer stage.

The aerial-input matching circuit is comprised of two pairs of tapered transmission lines. Each pair is wound over a separate cylindrical form in such a manner that the two conductors are closely spaced near the top of the form, and widely spaced near the bottom. The impedance at any point along the tapered line is a function of the spacing between the conductors at that particular point. The conductors at one end of each line are spaced so that the impedance at that end is approximately 150 ohms. At the other end of each line, the spacing is such that the impedance is approximately 300 ohms.

The 300-ohm ends (output) of the two lines are connected in series with each other between the input to the r-f amplifier and ground. This provides a total output impedance of approximately 600 ohms from the

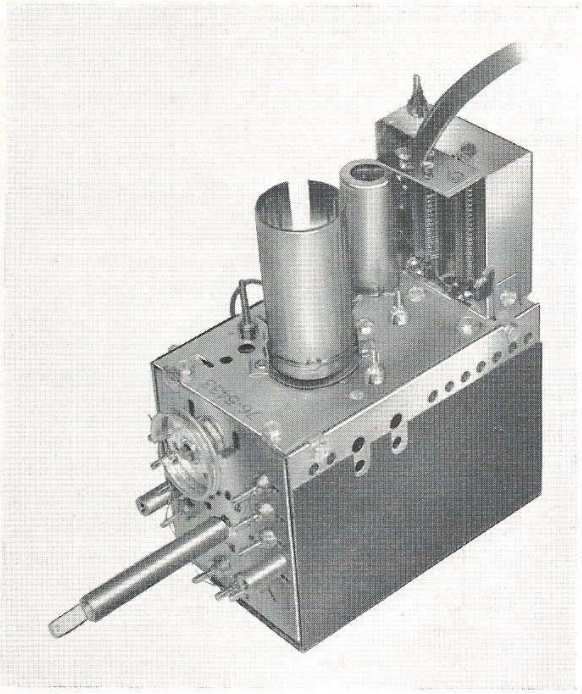

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Figure 1. Philco Tapered-Line Television Tuner Unit, Part No. 76-5433

matching circuit. The tapered line is terminated by R1-T, a 1200-ohm resistor, the impedance of the grid resonant circuit and the loading of the tube. This serves to terminate the line in approximately its characteristic impedance, providing a good match and reducing the standing-wave ratio. The impedance step-up of the line also provides a voltage step-up; since $E=\sqrt{PXR}$ and since the power (P) remains essentially constant, the voltage (E) will increase as the resistance (R) increases. Provision is made so that the 150-ohm ends (input) of the two lines may be connected either in series with each other or in parallel with each other. When they are connected in series, the total input impedance to the matching circuit is 300 ohms, which will match the impedance of a 300-ohm parallel-wire line. When the 150-ohm ends of the two lines are connected in parallel, the total input impedance is 75 ohms, which will match the impedance of a 75-ohm coaxial cable.

An FM trap is connected directly across the output of the aerial-input matching circuit. This trap is a series-resonant circuit tunable over the range of the FM band. Whenever an FM station interferes with television reception, this trap may be tuned to resonance at the frequency of the FM station. The trap will then offer an extremely low impedance to the FM signal, and prevent it from impressing a voltage on the grid of the r-f amplifier. This trap is tuned at the factory to 100 mc., and in most cases does not require retuning.

The r-f amplifier uses a 6BC5, and the mixer-oscillator employs a 7F8. Wafer switch WS1-T is used to switch in the proper coils for any channel in the r-f amplifier, mixer, and oscillator circuits. In the grid circuit of the r-f amplifier, inductance L1-T is used as the grid-tank coil for Channel 2. For Channels 3 through 13, coils L3-T through L13-T are switched individually across L1-T. The value of the inductance across the tapered line, for any channel, tunes the grid circuit for that channel.

Fine-tuning of the local oscillator is accomplished by means of a small variable condenser, C22-T, in the oscillator grid circuit.

AERIAL CONNECTION

The tapered-line transformer, Z1-T, can be connected to match either a 300-ohm or a 75-ohm transmission line. When a 300-ohm line is used, terminals 3 and 4 of Z1-T should be connected together with a short length of wire. The transmission line should be connected to terminals 1 and 2. When a 75-ohm coaxial line is used, terminals 1 and 4 of Z1-T should be connected together, and terminals 2 and 3 of Z1-T should be connected together. The center conductor of the transmission line should be connected to terminal 2 and the outer conductor (shield) to terminal 1.

ALIGNMENT

General

The tuner is aligned at the factory and normally needs no adjustment other than fine-tuning. However, under certain conditions, such as replacement of tubes, it may be necessary to touch up the adjustments.

Test Equipment Required

The following test equipment is recommended for aligning the tuner:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.
2. A vacuum-tube voltmeter or a 20,000-ohms-per-volt voltmeter.
3. A 3300-ohm noninductive resistor.

If separate signal generators and oscilloscope are used in place of Model 7008, these instruments should have the following characteristics:

FM Signal Generator

Deviation ±7 mc.

Center-frequency ranges: 45 mc. to 64 mc. and 206 mc. to 220 mc.

Sweep-sync output with either built-in or separate phase corrector.

AM Signal Generator

Carrier-frequency range: 45 mc. to 220 mc.

Dial: Suitable for setting and resetting accurately to frequencies between 45 mc. and 220 mc.

Oscilloscope

Calibrated.

Vertical sensitivity, 1 volt (peak-to-peak) per inch, or better.

Aerial-Input-Matching Network

The tuner should be aligned with the tapered-line transformer connected for 300-ohm input.

Figure 2 shows a network that is recommended for coupling the signal generator to the tuner input. This network is designed with an unbalanced input of 75 ohms to match the impedance of the signal generator, and a balanced output of 300 ohms to match the impedance of the tapered-line transformer of the tuner unit. The resistors in this network should be noninductive and should be chosen carefully to obtain values close to those indicated in figure 2.

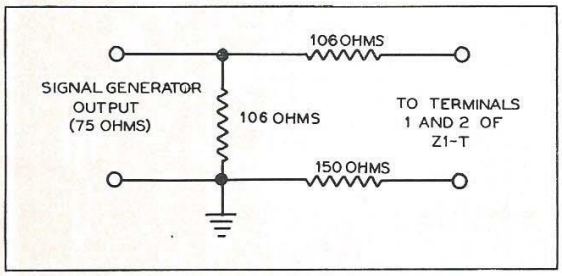

Figure 2. Aerial-Input-Matching Network

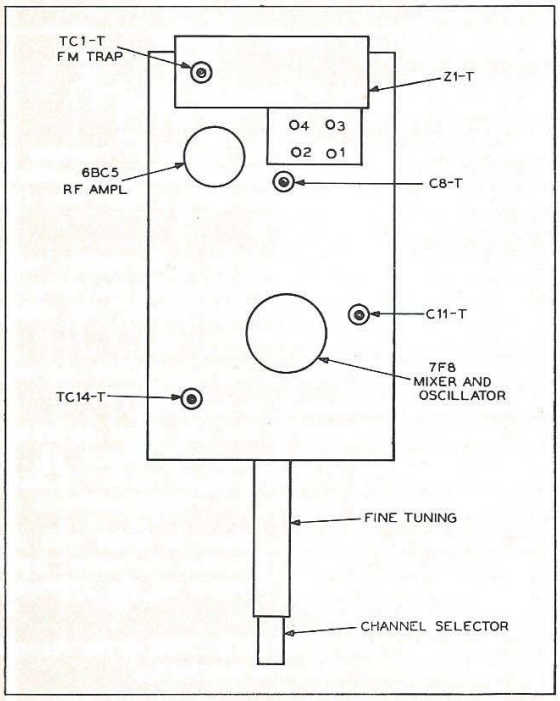

Figure 3. Top View of Tapered-Line Tuner Unit, Showing Tube, Tuning-Core, and Trimmer Locations

Band-Width and R-F Response Adjustment Procedure

To adjust the band width and r-f response of the tuner, proceed as follows:

1. Connect the outputs of the AM and FM signal generators, through the aerial-matching network (figure 2), to terminals 1 and 2 of Z1-T. Terminals 3 and 4 of Z1-T should be connected together for a 300-ohm input.

2. Connect a 3300-ohm resistor in series with the 150-volt B+ lead to R9-T. Connect the vertical input of the oscilloscope to the junction of the 3300-ohm resistor and R9-T.

3. Turn the CHANNEL SELECTOR to Channel 2.

4. Insert a piece of solder into the hole which is adjacent to tuning core TC14-T. Allow the solder to make contact with the chassis and the lug located under the hole.

5. Set the FM signal generator to 55 mc., ±7-mc. deviation.

6. Set the AM signal generator (unmodulated) to produce marker pips on the response curve, as required in step 7.

7. Adjust C8-T for a band width of 6 mc. to 14 mc. between the two points that are 70% of the maximum amplitude of the response curve. (See figure 4, which shows the minimum band width required.)

8. Turn the CHANNEL SELECTOR to Channel 13.

9. Set the FM signal generator to 213 mc., ±7-mc. deviation.

10. Adjust C11-T for maximum output and symmetry of curve.

Local-Oscillator Adjustment Procedure

The local oscillator should be adjusted as follows:

1. Refer to the service manual for the receiver in which the tuner is used. Connect the voltmeter to the FM TEST jack adapter described in the service manual, and plug the adapter into the FM TEST jack of the receiver.

2. Set the CHANNEL SELECTOR to Channel 2.

3. Set the FINE TUNING control to the center of its range.

4. Connect the output of the AM signal generator, through the aerial-matching network (figure 2), to terminals 1 and 2 of ZT-1. Terminals 3 and 4 of ZT-1 should be connected together for a 300-ohm input.

5. Set the signal generator to the sound-carrier frequency of Channel 2.

6. Adjust the oscillator tuning core for Channel 2 (TC2-T) until zero reading is obtained on the voltmeter.

7. Repeat the above steps for Channels 3 through 13. In each case, use the appropriate signal-generator setting and CHANNEL SELECTOR setting, and adjust the proper oscillator tuning core for the channel.

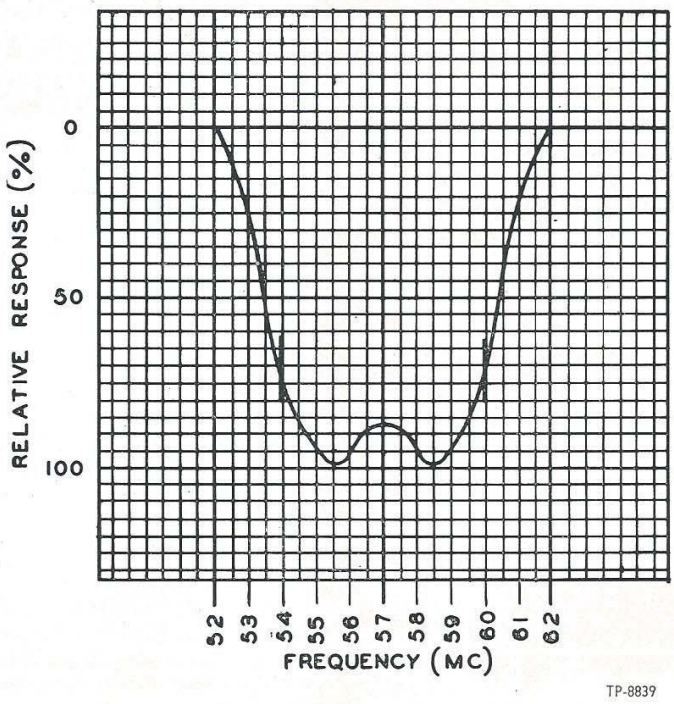

Figure 4. R-F Curve

TELEVISION SOUND-CARRIER FREQUENCIES

CHANNEL	SOUND-CARRIER FREQUENCY
2	59.75 mc.
3	65.75 mc.
4	71.75 mc.
5	81.75 mc.
6	87.75 mc.
7	179.75 mc.
8	185.75 mc.
9	191.75 mc.
10	197.75 mc.
11	203.75 mc.
12	209.75 mc.
13	215.75 mc.

FM Trap Adjustment Procedure

The trap is adjusted in the factory to resonate at 100 mc. and normally requires no further adjustment unless an FM station, with a frequency other than 100 mc., causes interference.

To reduce interference caused by an FM station, with a frequency of other than 100 mc., tune in the television station on which the interference occurs, and adjust TC1-T for minimum interference.

If the FM station is not on the air, the FM trap may be adjusted as follows:

1. Connect the output of the AM signal generator, through the aerial-matching network (figure 2), to terminals 1 and 2 of Z1-T. Terminals 3 and 4 of Z1-T should be connected together for a 300-ohm input.

2. Connect a 3300-ohm resistor in series with the 150-volt B+ lead to R9-T. Connect the vertical input of the oscilloscope to the junction of the 3300-ohm resistor and R9-T.

3. Turn the CHANNEL SELECTOR to the channel with which the FM station is interfering.

4. Set the signal generator to the carrier frequency of the FM station causing the interference.

5. Adjust TC1-T until the indication on the oscilloscope is minimum.

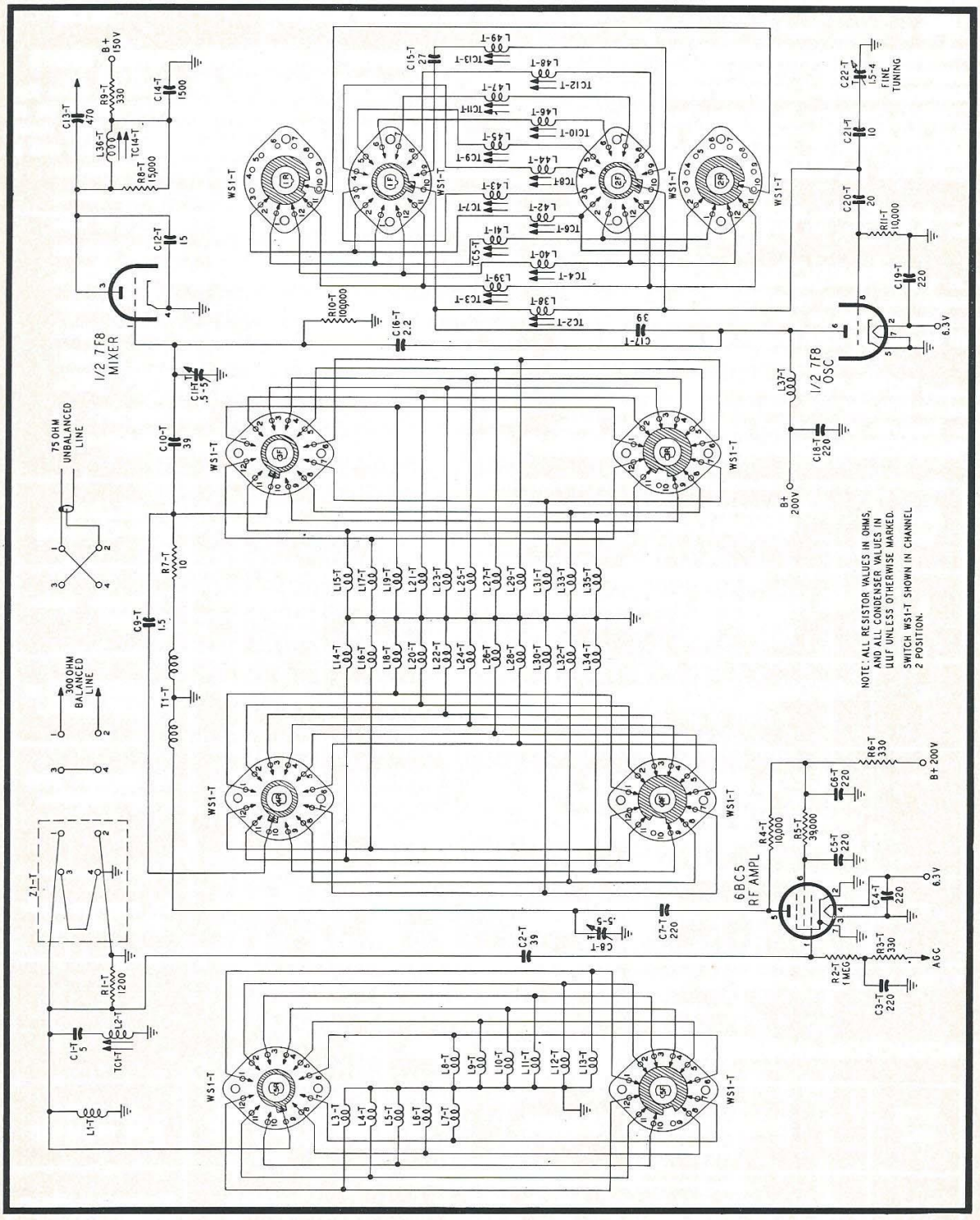

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Figure 5. Philco Tapered-Line Television Tuner Unit, Part No. 76-5433, Complete Schematic Diagram

REPLACEMENT OF 7F8 MIXER-OSCILLATOR TUBE

Whenever it becomes necessary to replace the 7F8 mixer-oscillator tube, several different tubes should be tried until one is found that will permit the FINE TUNING control to be set near the center of its range when the high-frequency channels are properly tuned. Otherwise it will be necessary to remove the television chassis from the cabinet whenever the tube is replaced, and adjust the oscillator tuning cores as described in the alignment procedure.

EXCHANGE OF DEFECTIVE TUNER UNITS

In the event of failure of any component other than tubes in the tuner unit, the entire unit should be exchanged through your Philco Distributor. Only tuners found to be defective by the Philco Distributor will be accepted for exchange.

PRODUCTION CHANGES IN MODELS 50-T1400; 50-T1401; 50-T1402; 50-T1430; 50-T1443, CODE 123; 50-T1630

Philco Service Bulletin 49T3 describes early production changes in the above models. Changes in these models which were made after the printing of Service Bulletin 49T3 are outlined below.

PRODUCTION CHANGES IN MODELS 50-T1400; 50-T1401; 50-T1402; 50-T1430

RUN NO.	DESCRIPTION OF CHANGE	REMOVED PART NO.	ADDED PART NO.	REASON FOR CHANGE
6	R94 changed from 5100 ohms to 5600 ohms.	66-2518340	66-2568340	To reduce vertical foldover.
6	R66 changed from 180 ohms to 100 ohms.	66-1184340	66-1104340	To center range of FOCUS control.
7*	L72, C111, and C115 removed. Screen (pin 8) of horizontal-output tube connected through R127 to secondary tap of T7. L43 changed to improved type width coil.	32-4143-7 45-3505-60 60-10105407 32-4419	32-4419-2	To improve horizontal deflection.
7*	R108 changed from 270,000 ohms to 180,000 ohms.	66-4278340	66-4188340	To improve horizontal deflection.

* Other runs incorporating this change have "Y" stamped after the run number.

PRODUCTION CHANGES IN MODEL 50-T1443, CODE 123

RUN NO.	DESCRIPTION OF CHANGE	REMOVED PART NO.	ADDED PART NO.	REASON FOR CHANGE
5	180-microhenry peaking coil added in series with lead between R40 and junction of L56 and R44.		32-4143-5	To improve picture quality.

PRODUCTION CHANGES IN MODEL 50-T1443, CODE 123 (Cont.)

RUN NO.	DESCRIPTION OF CHANGE	REMOVED PART NO.	ADDED PART NO.	REASON FOR CHANGE
5	6800-ohm resistor added between ground and junction of R136 and R36.		66-2688340	To improve picture quality.
5	R36 changed from 47 ohms to 10 ohms.	66-0478340	66-0108340	To improve picture quality.
5	82,000-ohm resistor added between screen (pin 3) of video-output tube and ground.		66-3824340	To improve picture quality.
5	15,000-ohm resistor added across R40 and R41.		66-3154340	To improve picture quality.
5	C69 changed from .0033 *μf.* to 680 *μμf.*	45-3505-55	60-10685401	To improve picture quality.
6	R-f choke added in series with lead between R60 and junction of R47 and C32.		32-4061-2	To reduce beat interference.
6	R32 removed. L53 removed and replaced with 10-microhenry choke. L53 connected in series with lead to ungrounded end of R29, between R29 and junction of L69 and pin 3 of J4. 100-*μμf.* condenser added between pin 2 of J4 and ground. These changes were incorporated by replacing the entire i-f strip with another strip.	66-3478340	62-110009001 32-4143-10	To reduce beat interference.
6	470-*μμf.* condenser added between ground and junction of R136 and R130.		62-147001001	To reduce beat interference.

PRODUCTION CHANGES IN MODEL 50-T1630

RUN NO.	DESCRIPTION OF CHANGE	REMOVED PART NO.	ADDED PART NO.	REASON FOR CHANGE
1Z and 2	Lead to C81A removed and connected to C63A. Lead to C63A removed and connected to C81A.			To prevent condenser breakdown.
1Y and 2	Grounded end of C36 disconnected from ground and connected to junction of R26 and R30.			To prevent spurious oscillation.

SERVICE HINTS

MODELS 50-T701; 50-T702, CODE 122

Failure of Condenser C81

Failure of condenser C81 in Models 50-T701 and 50-T702 may be caused by operating these receivers when the vertical-output tube is removed. When this tube is removed, there is no voltage drop across resistors R77 and R78. This causes the voltage applied to condenser C81 to exceed the normal value and may result in the failure of this condenser.

Dim Picture

A dim picture in Models 50-T701 and 50-T702 may result from leaky d-c blocking condensers to the deflection plates of the picture tube or by faulty high-voltage filter condensers. Whenever a dim picture is encountered, condensers C83, C84, C95, C96, C100 and C101 should be checked for leakage.

MODELS 50-T1104; 50-T1105; 50-T1106

Connecting Television Booster TB2

In the above models, the cathode and filament circuits of the 6V6GT audio-output tube are 130 volts above ground. Therefore, the octal-power adapter for Television Booster TB2 is not applicable to these models. A special 3-prong socket is incorporated into the top of the chassis, near the speaker, to supply booster power. Plug and Cable Assembly, Part No. 41-3942, should be used to connect the booster to this socket.

MODELS 50-T1443, CODE 122; 50-T1443, CODE 123

Microphonics Due to Improper Unpacking

The above models may be microphonic if their chassis do not float freely on the chassis shock mounts. When the receiver is placed in operation, the chassis-mounting bolts should be loosened, and all chassis-packing strips should be removed.

MODEL 50-T1630

Dressing the Connecting Line to the Built-In Aerial

Whenever Model 50-T1630 is serviced, the length of transmission line between the built-in aerial and the aerial-input terminal board should be dressed away from the picture tube. This can be accomplished by taping this line to the line between the aerial-input terminal board and the tuner unit, at a point as near the tuner unit as possible.

Replacing the Picture-Tube Insulating Cone (Philco Part No. 54-7791)

A replaced picture-tube insulating cone in Model 50-T1630 may be prevented from riding up on the tube bell by taping the leading edge of the cone to the rim of the tube before the insulating ring is installed. Any type of cellophane tape, such as Scotch Tape, is satisfactory for this purpose.

GENERAL

Failure of Brightness Control to Reduce Brilliance of Picture

A leaky d-c blocking condenser between the video-output stage and the picture-tube grid or between the video-output stage and the d-c restorer will cause an extremely bright picture that is not affected by the setting of the BRIGHTNESS control.

Whenever the BRIGHTNESS control fails to reduce the brilliance of a picture, these condensers should be checked for leakage.

Loose Oscillator Tuning Cores

The oscillator tuning cores of all models using the 8-position turret tuner may be secured by the use of a spring, Philco Part No. 56-7270.

Slip this spring over the tuning core and solder one side to the coil form. See figure 6.

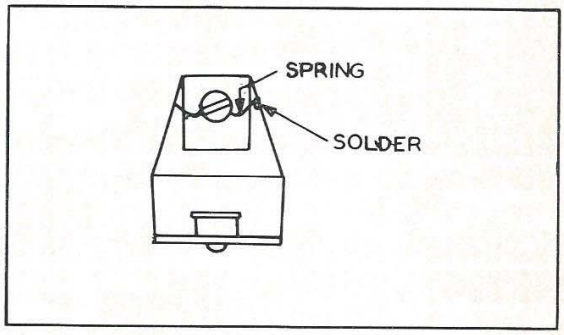

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Figure 6. Oscillator Coil for 8-Position Tuner, Showing Spring Installed Over Tuning Core

Inoperative Record Changer Models M-9C and M-12C

Improper operation of Record Changer Models M-9C and M-12C by the user is a frequent cause of an inoperative condition in these models.

The long-play tone arm of these changers has an automatic shut-off feature, which turns off the motor at the end of a long-playing record. This feature consists of a mercury switch and latch, which is operated through the tone arm by the eccentric grooves at the end of the record. After the mercury switch has been tripped "off", the long-play tone arm must be pushed firmly to the extreme right against the tone-arm rest in order to latch the mercury switch "on". Since this switch is in series with the motor circuit at all times, the long-play tone arm must be on the tone-arm rest to enable the changer to operate on standard records.

Installing Beam Bender on 16-Inch Picture Tube

It is important for the beam bender to be positioned properly on a 16-inch picture tube, in order to obtain maximum brilliance and to prevent damage to the electron gun. The following procedure is recommended:

1. Slide the beam bender (ring first) over the neck of the picture tube, so that the space between the base of the tube and the beam bender is approximately one inch.

2. Turn the beam bender until one end of the bar magnet is opposite pin 2 of the tube and the other end is opposite pin 5.

3. Rotate the ring magnet until its gap is on the same side of the beam bender as the bar magnet. Adjust the position of the ring so that the green and red dots on the ring are aligned with the dots of like color on the beam-bender frame.

4. Turn on the receiver, and move the beam bender backward and forward, and clockwise and counterclockwise, until maximum brilliance is obtained over the entire face of tube.

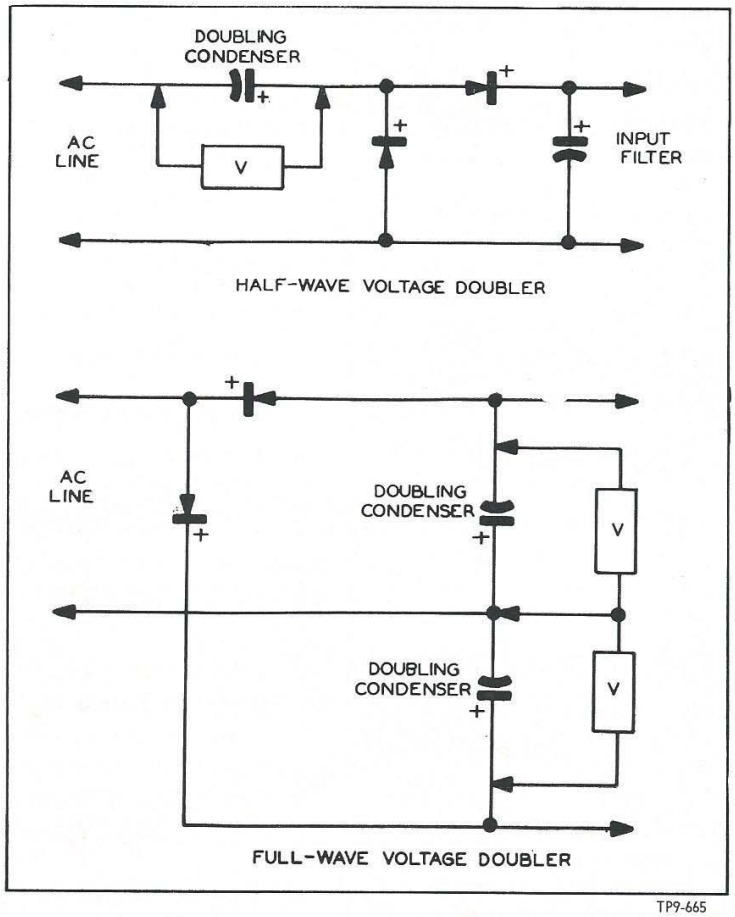

Figure 7. Voltage-Doubler Circuits

5. Rotate the ring magnet over a range of 30 degrees either side of the position described in step 3, to find the position which produces optimum brilliance and freedom from shadow; leave the ring in this position.

Trouble-Shooting Receivers Using Dry-Disc Rectifiers

To trouble-shoot receivers using dry-disc rectifiers, it is necessary to localize the trouble to either the dry-disc rectifier or the associated circuit. Since the dry disc cannot be easily removed and placed in a tester, the following method of testing the rectifier in the receiver is recommended, to prevent the indiscriminate replacement of rectifiers.

With the receiver inoperative, measure the resistance between B plus and B minus right at the output of the dry-disc rectifier. If the resistance is 5000 ohms or more, it is safe to apply power to the receiver. (It should be noted that this resistance measurement is not a quality check of the filter condensers, but only a preliminary check to determine whether it is safe to apply power to the receiver without causing further damage.)

With power applied, voltage measurements may be made to determine whether trouble is in the decoupling networks, other sections, or in the rectifier itself.

If the over-all voltage of the power supply is low and there are no indications of overload, the input-filter condenser may be open and should be checked first. It may be checked by simply shunting a good condenser across the input filter and noting whether the voltage indication rises to the normal value.

Where a voltage-doubling system is used, a voltage measurement should be taken across the doubling condenser(s). Refer to figure 7. No voltage or low voltage across the doubling condenser(s) indicates that they have lost capacitance or are leaky.

Only after it has been determined that the associated circuits are normal, should the dry-disc rectifier be replaced.