

Operating Instructions

FOR THE

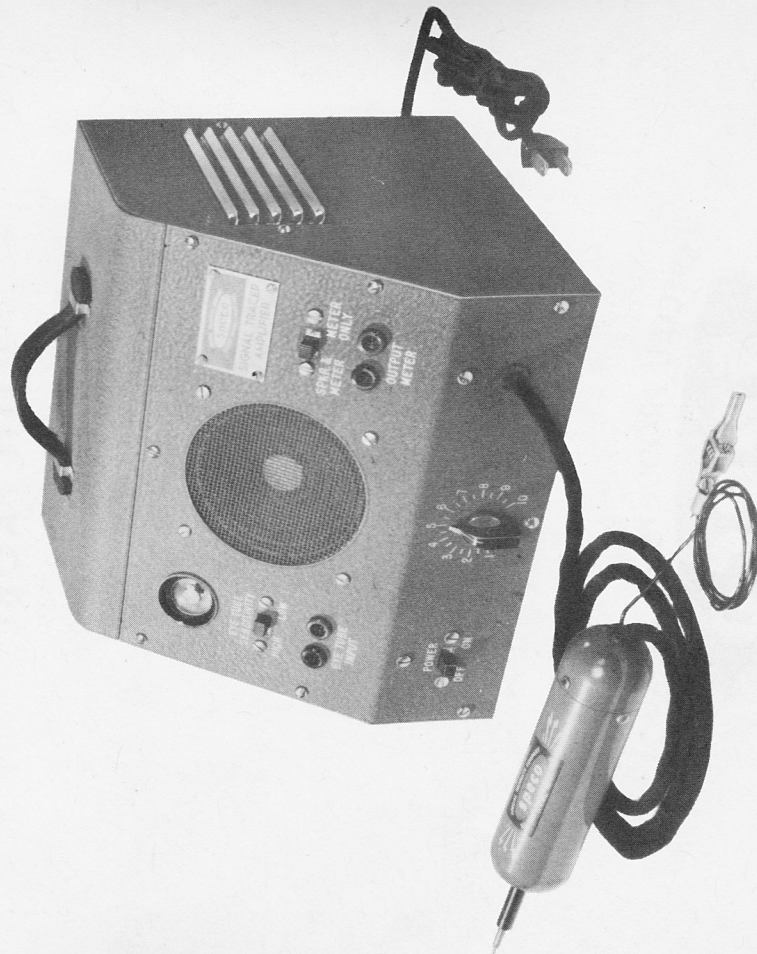
SIGNAL TRACER AMPLIFIER WITH PROBE



SPECO SIGNAL TRACER, MODEL STAC
(for A. C. operation)

Technical Details: Model STAC

Tube complement: 1-6SQ7GT/G; 1-6V6GT/G; 1-5Y3; 1-6E5; 1-6J5GT
Weight: 11 lbs.
Dimensions: Amplifier-8" h x 10" w x 8" d. Probe-5" overall less cable.
Power consumption: Approximately 50 watts at 115 volts A. C.
Maximum output power: 5 watts.
Average input voltage to probe for 0° shadow angle; 0.05 volts R.M.S.
on HIGH SENSITIVITY; 0.2 volts R.M.S. on LOW SENSITIVITY.
Average D. C. input to eye tube external terminals for 0° shadow
angle: 3 volts.

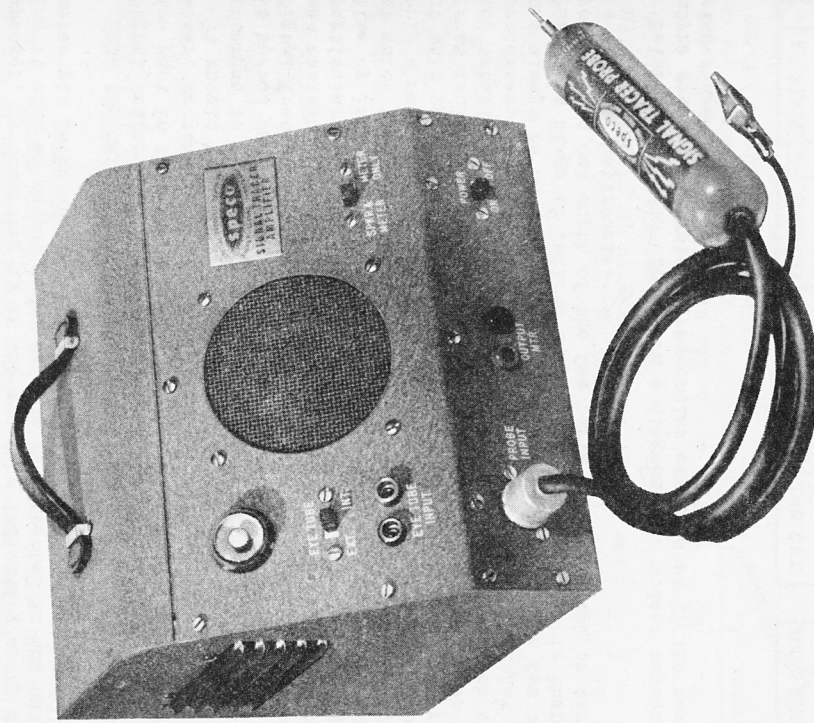


Model STAC

SPECO SIGNAL TRACER, MODEL STAP
(for A. C. - D. C. operation)

Technical Details: Model STAP

Tube complement: 1-6J7GT/G; 1-6SQ7GT/G; 1-25L6GT/G; 1-25Z6 GT/G;
1-6E5.
Weight: 8 lbs.
Dimensions: Amplifier-8" h x 10" w x 8" d. Probe-5" overall less cable.
Power consumption: Approximately 50 watts at 115 volts, A. C. or D. C.
Maximum output power: 2 watts.
Average input voltage to probe for 0° shadow angle: 0.05 volts R.M.S.
Average D. C. input to eye tube external terminals for 0° shadow
angle: 3 volts.



Model STAP

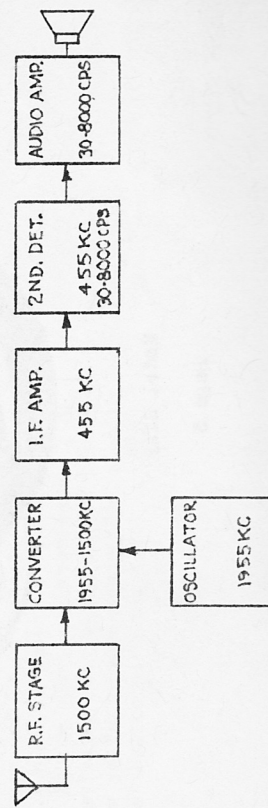
SECTION A

THE SIGNAL TRACING METHOD

1. Signal tracing, as the name implies, is a technique of following a signal, step by step, through an electronic device. Most commonly, this electronic device will be a radio set that is in need of repair. The radio set is turned on and tuned to a near-broadcasting station, or is fed a modulated continuous wave (MCW) signal from a test oscillator. This signal is then traced through the receiver, stage by stage, until the defective stage or circuit is located. The "tracing" is done by picking up the signal at each point of test with a special electronic probe. The picked-up signal is amplified by the Signal Tracer amplifier, and is there evaluated by listening to it from the amplifier speaker, by observing it in the eye tube indicator, or by checking it with an output meter externally connected to the output meter pin jacks on the Signal Tracer panel.

2. Once the defective stage or circuit is located by means of the Signal Tracer, it is usually a simple matter to find the defective part in that stage or circuit, by using a voltmeter, an ohmmeter, or sometimes by visual inspection. It should be clearly understood that the Signal Tracer is not intended to identify for example, the particular resistor that is burned out, or the exact condenser that has opened up. The Signal Tracer, rather, is used to limit the search for that burned out resistor, open condenser, or other defective part, to one particular stage of the receiver. Thus the Signal Tracer saves much time by leading you directly to the point in the receiver circuit at which the signal fails to get through properly. It is then only a matter of checking a few components affecting the working of this portion of the receiver, to find the particular part that is at fault. It is true that the Signal Tracer will often locate the trouble as being in a particular bypass condenser, or coupling condenser, for example. However, you must not expect that this can always be done. The Signal Tracer shows you in a few seconds just what stage is failing to perform properly. It is then up to you to find out which of the few parts in that stage or circuit is causing the trouble.

3. Below is shown in block form a diagram of a modern superheterodyne receiver. Typical frequencies encountered in the several stages are indicated:



The Speco electronic probe is so designed that the signal can be picked up at any stage, R.F. to audio, with a single untuned circuit. In the high frequency stages the probe functions as a detector-amplifier; on the low or audio frequencies the probe without readjustment functions as an audio amplifier. Thus it is a simple matter to check straight through a receiver from the first stage to the last. The only adjustment to the Signal Tracer is that of the Signal Tracer volume control.

SECTION B

Preparing The Signal Tracer For Work

Because of difference between the power supply circuit of the A. C. - D. C. Signal Tracer, model STAP, and that of the A. C. Signal Tracer, model STAC, there are differences in the manner in which each is made ready for use. Follow carefully the directions which apply to the model that you own:

The A. C. Signal Tracer, model STAC, is prepared for use as follows:

1. Plug the amplifier unit into 115v. A. C. outlet.

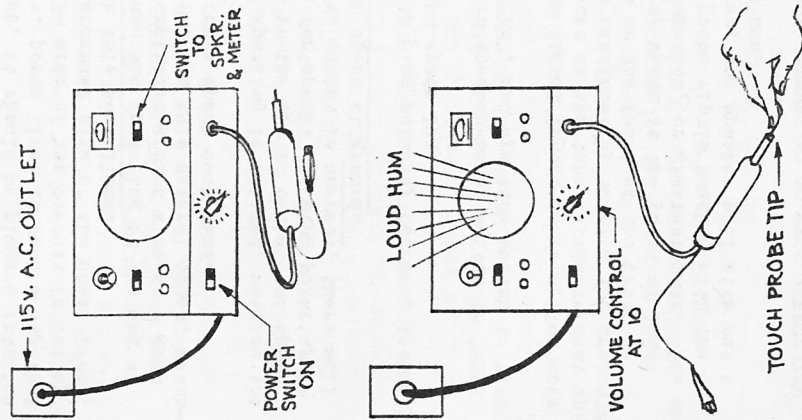
2. Turn power switch to "ON".

3. Turn speaker-meter switch to "SPEAKER & METER".

4. The Signal Tracer is ready for work as soon as the tube filaments heat up. Test readiness for use by turning the graduated volume control on the Signal Tracer panel clockwise to 10, the point of highest gain. Now when the probe tip is touched with the finger, the speaker will give out a loud hum.

BEFORE ATTEMPTING TO TEST A RECEIVER, SEE THAT IT IS IN CONDITION FOR TESTING, AS DESCRIBED IN SECTION C.

5. The crocodile clip on the end of the probe ground lead should now be grounded to the chassis of the receiver under test, except in the case of an A. C. - D. C. receiver. On A. C. - D. C. receivers the probe ground lead should be clipped to the negative side of the power supply filter condensers. (This point is called "set ground".)



Note: When plugging in an A. C. - D. C. receiver for testing, check to see that its chassis is at ground potential. If not, reverse the line plug of the receiver. The A. C. Signal Tracer will work regardless of the way the receiver is plugged in, but to safeguard against accidental electric shock, an A. C. - D. C. receiver chassis should always be polarized with respect to ground.

The A. C. - D. C. Signal Tracer, Model STAP, is prepared for use as follows:

1. Plug probe cable into probe "input" socket.
2. Plug amplifier unit into 115 volt A. C. or D. C. outlet.

3. Turn power switch "ON".

4. Since the Model STAP is an AC - DC device, it should be plugged into the 115 v. power lines in such a way that the B- side of its circuit is fed by the grounded side of the power lines. Check this as follows:

Touch the spade lug on the end of the amplifier ground wire to a good ground. Do this several times, watching for a spark each time.

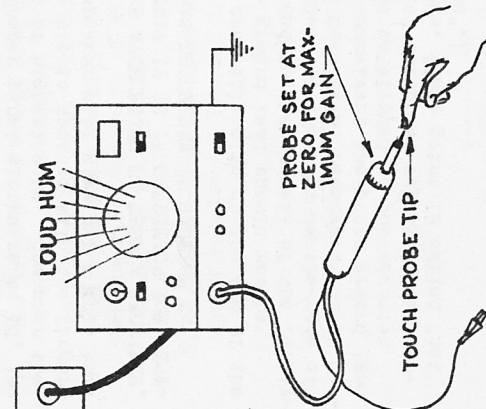
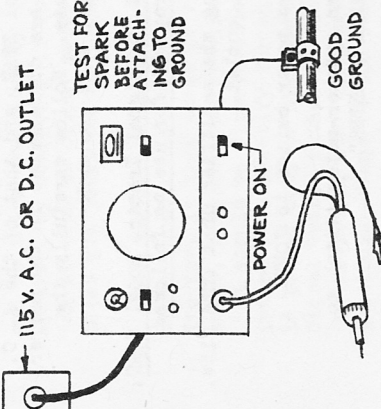
5. If sparking is noticed, reverse the plug in the 115 v. outlet and again test for spark. If plug polarity in 115 v. outlet is correct, there will be no spark at ground.

6. With plug polarity correct, securely ground spade lug.

7. Turn speaker-meter switch to "SPKR & METER", and eye tube switch to "INT".

8. The Signal Tracer is ready for work as soon as the tube filaments heat up. Test readings by turning the graduated knob on the front of the probe to "0" (zero) which is the point of least attenuation, or greatest gain. Now when the probe tip is touched with the finger, the speaker will give out a loud hum.

BEFORE ATTEMPTING TO TEST A RECEIVER, SEE THAT IT IS IN CONDITION FOR TESTING, AS DESCRIBED IN SECTION C.



9. The crocodile clip on the end of the probe ground lead should now be grounded to the receiver under test, as follows:

- a. Turn the receiver on.
- b. Only on A. C. sets or battery sets, clip the probe ground lead to the chassis of the set.
- c. On A. C. - D. C. sets or A. C. - D. C. - Battery sets NEVER ground to chassis. Touch the probe ground clip to the negative side of the power supply filter condensers. If a loud 60 cycle hum results in the Signal Tracer speaker, reverse the polarity of the receiver line plug. Clip the probe ground lead to the negative side of the power supply filter condensers. (This point, or any point at the same B-potential, may be used for attaching the probe ground clip, and will hereafter be referred to as "set ground".)

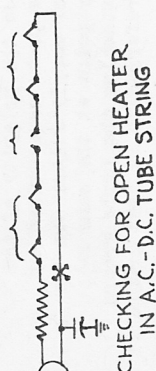
SECTION C

SOME HINTS BEFORE YOU START TESTING

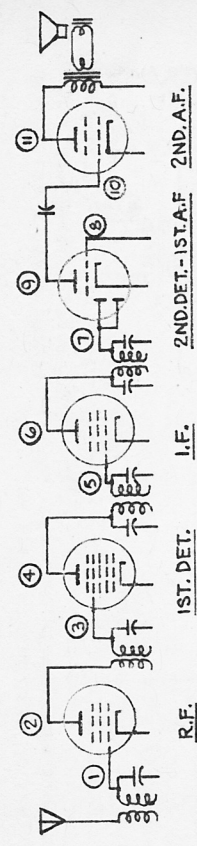
1. Signal tracing is a technique of testing a receiver dynamically, that is, with the receiver turned on and operating as well or as poorly as its condition will allow. A signal, either from a local broadcasting station or from a test oscillator is followed through the receiver until the point of faulty operation of the receiver is located. It is necessary therefore, that the receiver power supply be functioning at least moderately well before testing can proceed.
2. First, then, check the receiver power supply to see that it is functioning. A defective power supply may be the root of the trouble in a weak or inoperative receiver. Make a quick check to see that power is reaching the tube filaments and the B+ circuit. If the receiver blows fuses when turned on, or if the power transformer overheats, look for a short circuit in the power supply and correct it before commencing the Signal Tracer tests.
3. If no power is reaching the tube filaments or if there is no B+ voltage, look for an open circuit. (Check line cord, transformer windings, power tube filament, off-on switch, filter choke, or elsewhere in power supply, until trouble is located and corrected, before attempting to trace signal.)
4. In A. C. - D. C. sets with tube filaments wired in series, an open filament in any one tube will keep power from all tube filaments. If tubes fail to light up, check tube filaments in whatever manner is most convenient. If desired, the Signal Tracer may be used to locate quickly an open filament, as follows:

- a. Identify the filament connections of each tube. (See pages 22-27 for pin connections of most common tubes.)

THESE WILL
HEAT BOTH
HEATER VDS
OPEN FILAMENT
SIDE ONLY
IF ALL
NOT HUM
THESE WILL
BT ALL



- b. Clip the probe ground lead to the negative or ground side of the receiver power supply filter condensers. (Should you be using an A. C. - D. C. Signal Tracer, and a loud hum results when the ground connection is made, reverse the receiver plug, so that the polarity of the receiver will be the same as that of the Signal Tracer.)
 - c. Set the Signal Tracer for low gain, and touch the probe tip to the filament connections of each tube in turn. The tube with the open filament will hum at one side of the filament but not at the other. All other tubes in the string will either not hum at all, or will hum at both sides of the filament.
5. Once the receiver power supply is known to be functioning, testing may proceed as follows:
- a. Turn on the receiver and listen to its response, if any, when tuned to a nearby broadcasting station.
 - b. If the receiver does not bring in any signal at all, you will be mainly interested in tracking down the point in the circuit at which the signal fails to get through. You will not be particularly interested in signal gain from one stage to the next.
 - c. If the receiver's output is very weak, you will pay particular attention to the gain in signal strength as you proceed through the circuit, looking for the stage where the normal expected gain in signal strength is lacking.
 - d. If the receiver's output is distorted, noisy, or affected with A. C. hum, you will be mainly interested in listening for the point in the circuit at which the distortion, noise, or hum first appears.
 - e. If the receiver operates intermittently, you will turn it on and wait for the intermittent operation to show up before starting your test.
 6. What points will you check?
 - a. Normally, you will proceed to check in systematic fashion the grid and plate of each stage, until the trouble is located. See points 1 to 11 in the simplified diagram below.



- This means that you must know the socket connections of the various tubes, and the function of each tube. For your convenience a condensed list of the most common tubes, their function and their socket connections, is printed at the back of this book.
- b. A circuit diagram of the set being serviced is of great help. The diagram will usually identify for you the socket connections of all the tubes. If not, the pin numbers can easily be marked on the diagram. With the diagram before you, you can readily see what part each tube plays and what peculiarities, if any, the circuit contains. Values of condensers, resistors, chokes, etc. are ordinarily indicated on the diagram. If the set has been tampered with, the circuit diagram will show the manufacturer's original wiring.
 - c. If you do not have the circuit diagram for the set to be serviced, and are not already familiar with the tube base connections, you may find it convenient before starting to signal trace, to jot down a brief list of the tubes in proper order, with grid and plate connections noted for each, somewhat as follows:

6SK7 RF -----4,8
 6A7 Converter -----Cap,2 (Osc. 5,4)
 6SK7 IF -----4,8
 6SQ7 2nd Det -----2,6 (Diode Pl. 4,5)
 6F6 Push-pull -----5,3

Control grid pin number is given first, then plate pin number. Supplementary tube information, such as oscillator grids in the 6A7, may be noted in parentheses. With even this much information you are ready to check through the receiver.

SECTION D

TESTING A RECEIVER WITH THE SIGNAL TRACER

When a test oscillator is not available to feed a signal into the receiver under test, the Signal Tracer can be used very satisfactorily without one. Since good results are obtainable without the test oscillator, this method is presented first, as being simple and adequate for most jobs. (For information on signal tracing using a test oscillator or signal generator, see Section E.)

1. Connect a good antenna and ground to the radio under test. Without this it will be difficult to pick up a grid signal in the early stages of the receiver.

2. Turn on the receiver, and tune to some nearby radio station, preferably at the low end of the broadcast band (540 to 800 KC). The lower the frequency of the station tuned in, the less the set will be detuned when picking up a signal off the grid of the first R.F. tube.
If the set will not tune in a station, turn the dial to the point where a local station should come in, and proceed.

3. Leave the receiver on, but turn the volume control to minimum volume.

4. Have the Signal Tracer in operation and the probe ground clip connected to the receiver, as outlined in Section B.

5. With the Signal Tracer volume control turned to about half or two-thirds volume, touch the probe tip to the grid terminal of the first R.F. tube. (See point A on the sample radio diagram shown in Figure 1.) To pick up the signal at this point the receiver dial may have to be returned a little.

Note: Sometimes it will be found convenient to pick up point A at the stator of the antenna tuning section of the variable condenser.

If signal is loud, adjust Signal Tracer volume control for suitable volume.

If no signal is had at point A, even after retuning the receiver dial to offset any detuning caused by the slight loading effect of the probe tip on the tuned circuit, then check for trouble in the parts of the circuit that feed the signal from the antenna to point A.
For example, look for:

Antenna terminal of receiver shorted to ground.

Primary of antenna coil shorted out.

Rotors touching stators in antenna section of variable condenser.

Trimmer condenser shorted.

A very weak signal at point A might be due to:

Open secondary winding in antenna coil.

Shorted bypass condenser C1.

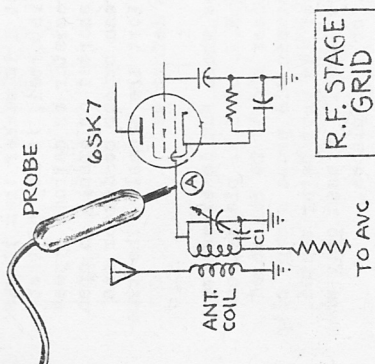
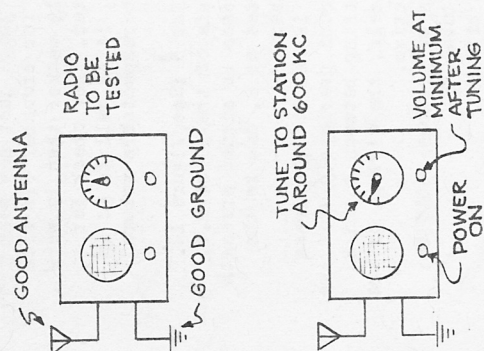
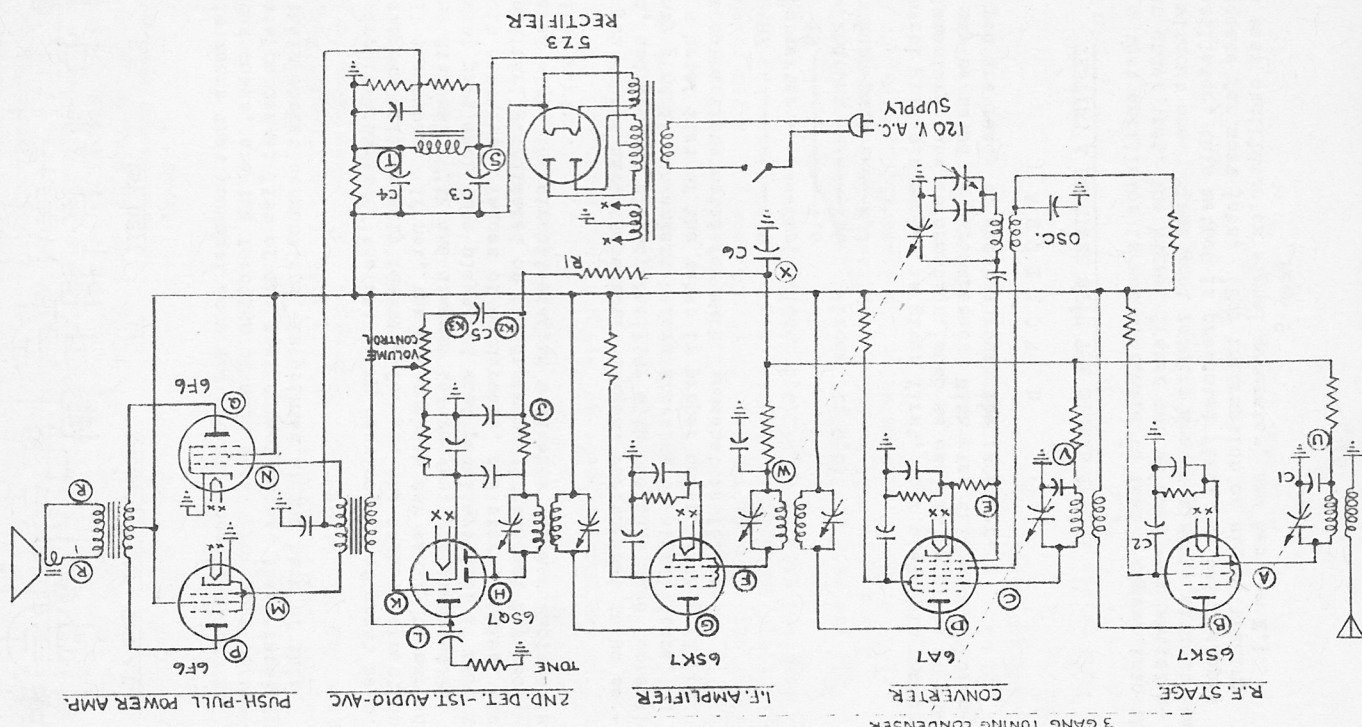


FIGURE 1: A SUPERHETERODYNE RECEIVER CIRCUIT



Note: It takes considerable experience to judge just how weak the signal at A must be before you need look for trouble. If from experience you believe that it is considerably weaker than is normal for the average of the sets you have tested, then check for trouble. If there is even a moderate signal, it is well to go on to point B, and see if the signal picks up to respectable volume at that point.

6. Now check point B (See Figure 1).

This is the plate of the first R.F. tube. An increase in signal strength is to be expected at B, due to the gain of the tube.

If no signal is had at B, whereas a signal was found previously at A, we know that something between A and B, in the tube itself, the wiring, or the parts, is defective.

Likely causes of trouble would be:

- Defective tube.
- Open plate circuit.
- Shorted screen bypass condenser (C2).
- Open circuit between cathode and ground.

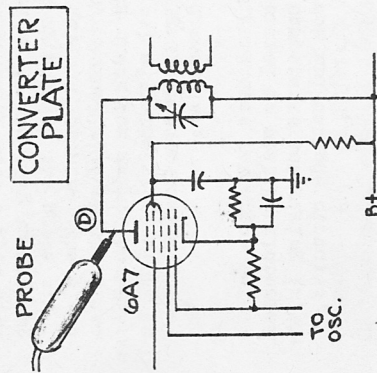
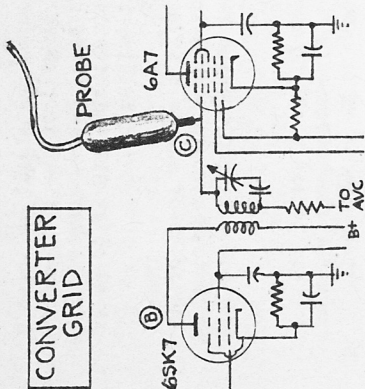
If signal at B is weaker than it was at A, or if distorted, it may be that the cathode resistor or cathode bypass condenser is shorted or open. An open circuit screen bypass condenser can weaken or distort the signal. The tube itself may be defective.

Note: In cases where hum is excessive when testing R.F. or I.F. plates, an 8 mfd. condenser should be connected in series between the probe ground clip and ϕ plus of the unit being tested. This condenser should be used only when testing R.F. or I.F. plates.

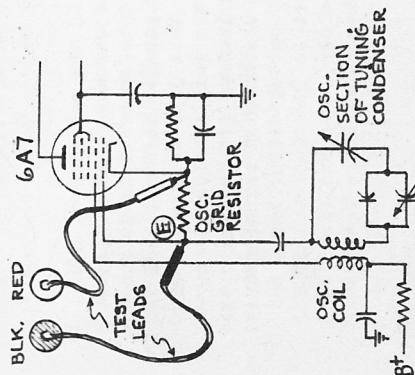
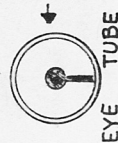
Checking for open Bypass Condensers:

If a bypass condenser is working properly, the signal will be greatly reduced at the bypassed point. For example, a strong signal picked up with the probe at the bypassed point x would indicate an open bypass condenser Cs. On the other hand, one would not expect as great a reduction of signal at point Y, which is bypassed by condenser Ck, because some signal would exist across Rk, which is usually of a low value of resistance.

Provided the signal was satisfactory at B in Figure 1, now check point C,



EYE TUBE SHADOW COMPLETELY CLOSED SHOWS OSCILLATOR IS WORKING



which is the R.F. control grid of the converter tube. It is well to try retuning the receiver dial at this point also, to offset any detuning caused by the Signal Tracer probe. Point C may likewise be reached at the stator of the R.F. section of the tuning condenser. No gain, but a possible slight loss is to be expected at C, because the gain in the R.F. transformer may be less than 1.

If signal is absent at C, or weak, look for trouble in the components and wiring of the circuit between points B and C. Defects similar to those mentioned under step 5 may be suspected. Poor alignment of R.F. transformer trimmers can cause loss of signal strength.

8. Next check at point D, the plate of the converter tube. A gain in signal strength is to be expected at D, due to the conversion gain of the tube.

If no signal is had, or if signal is weak, check the tube, and the wiring and components affecting the plate, cathode and screen. Also note that a loss in signal will result if the oscillator is poorly aligned, or if the oscillator circuit is not functioning. To check whether the oscillator is working, see the next paragraph.

9. A simple check to test whether or not the oscillator circuit is working may be made as follows:

- a. Plug a pair of test leads into the EYE TUBE INPUT jacks on the Signal Tracer panel, and switch the eye tube to external (EXT) if your Signal Tracer has such a switch.
- b. Touch the test lead from the black input jack to point E, the grid end of the oscillator grid bias resistor. Touch the other test lead to the other end of the grid bias resistor.
- c. If the oscillator is working, the eye shadow should close completely, indicating a strong rectified negative voltage at point E. If the eye does not close, or if it opens indicating a positive voltage at point E, the oscillator is not working.

10. Next check the signal at point F, the control grid of the I.F. amplifier tube. No gain, but sometimes a slight loss in signal strength is to be expected at this point.

If there is a severe loss, or no signal, check the circuit wiring and components between points D and F.

11. At point G, the plate of the I.F. amplifier, a notable increase in signal strength is to be expected.

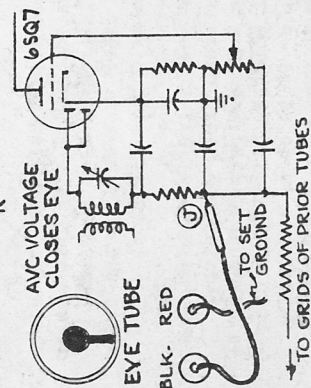
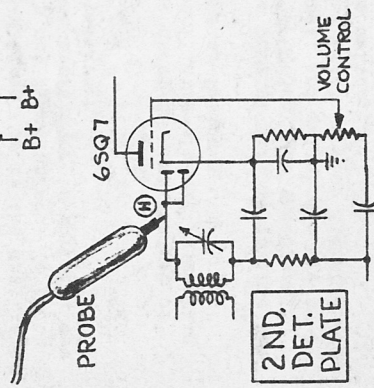
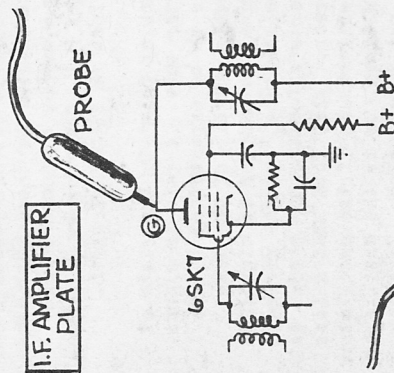
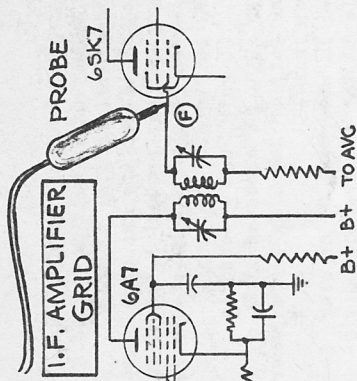
Note: If the probe picks up a certain amount of unfiltered A.C. ripple from this B+ point, it may help to pick up the signal by holding the probe tip close to, but not touching, the plate connection. Actually touch the plate terminal to check for gain; then listen to the signal with the probe close to but not touching the plate terminal to check for distortion.

If the signal does not appear at G, or if the signal is weak or distorted, check the components and wiring in the plate, screen and cathode circuits.

12. The next tube, the 6SQ7, has several functions, each of which can be checked as follows:

a. At point H check the action of the second detector section of the tube. No gain, but perhaps a slight loss, is to be expected at H.

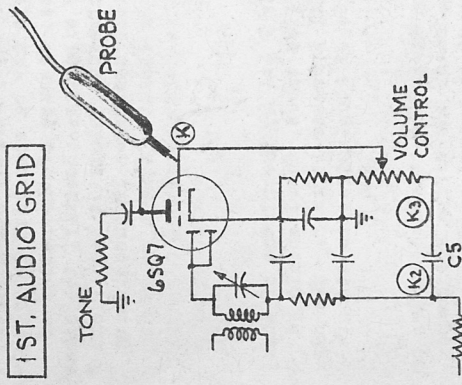
b. At point J, the presence of AVC voltage may be checked by means of the external eye tube connections on the Signal Tracer panel. The test lead from the black eye tube jack is applied to point J, and the red jack lead is connected to set ground. If the eye closes, flickering in unison with signal modulation, a negative AVC voltage is present, and the AVC circuit is functioning. If the eye does not close, or opens (indicating positive voltage) the AVC is not functioning properly.



TO SET GROUND
TO GRIDS OF PRIOR TUBES

Of course if there was no signal at point H, then there will be no AVC voltage at J, because the AVC voltage is derived from the rectifying or detector action of the second detector portion of the tube. For further notes on AVC see step 18.

c. At point K the presence of the signal on the grid of the 6SQ7 triode section can be checked. At this point the setting of the receiver volume control governs the strength of the signal. With the volume control at full volume, the signal should be approximately as loud as it was at point H.



Once you are satisfied with the gain at point K, it is well to set the volume control of the receiver just high enough to give a good signal in the Signal Tracer with Signal Tracer volume control set fairly low. Otherwise, with Signal Tracer volume control set at a high level to pick up a signal which has been cut down greatly by the receiver volume control, the Signal Tracer will amplify any hum present along with the weak signal. By setting the receiver volume control just high enough to over-ride any grid hum, the Signal Tracer can pick up a good signal without picking up the hum.

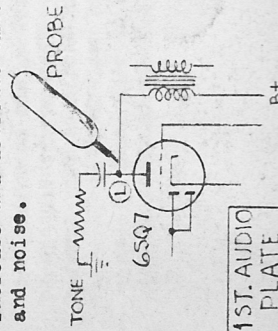
If trouble shows up in steps a, b, or c, check the components and wiring in the particular circuit involved.

Notes on the volume control:

The signal reaches point K through the volume control. Since volume controls are a frequent source of trouble, two more check points, K2 and K3 are shown on the circuit of Figure 1. If no signal or a noisy or weak signal is had at K, test for signal at K2. If the signal is satisfactory at K2 then there is a defect in the condenser C5 or in the volume control. Check at K3. If the signal is satisfactory here also, then condenser C5 is OK and the trouble is in the volume control or its wiring.

It is a good idea always to check the volume control for roughness, noise, or open spots, as follows: Place the probe on Point K, and slowly rotate volume control through its range several times. The volume should increase and decrease smoothly without breaks or objectionable scratch and noise.

13. At point L, the plate of the first audio amplifier stage, a substantial gain in signal strength may be expected. The receiver volume control may be employed to regulate the signal at this and later points, except where gain at full volume is particularly being checked.



If signal is defective, check the components of the plate circuit, including the tube itself, and the tone control circuit.

14. Points M and N are the inputs to the grids of the two push-pull power amplifiers. There may be some loss in signal at these points, because of the ratios of transformer windings. However, the signal should be of equal volume at both M and N if the input transformer is functioning properly.

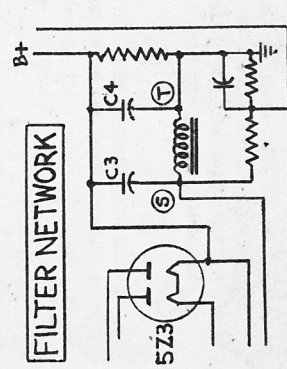
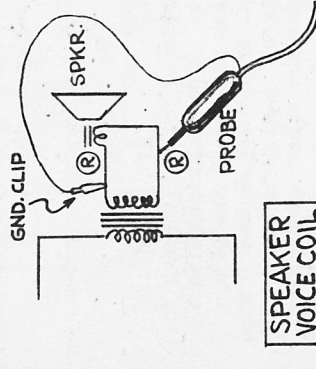
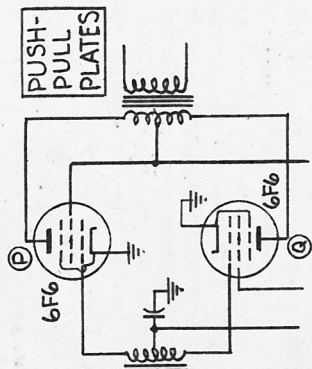
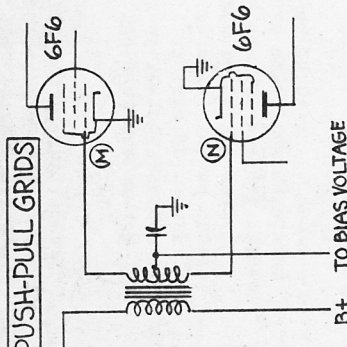
15. At points P and Q, the plates of the power amplifier tubes, there should be a substantial increase in gain. The signal should be of equal strength at both points.

If the signal is defective at either or both points, check the wiring and components affecting the plate signal.

16. If a satisfactory signal was present at points P and Q, yet there is no signal, or a weak or distorted signal from the speaker of the set, then the trouble must be in the speaker or the secondary of the output transformer. If desired, the signal may be checked across the voice coil with the probe tip at one point R and the probe ground clip at the other point R.

17. Checking the filtering action of the power supply filter network:

With the Signal Tracer volume control set at a fairly low level, touch the probe tip to point S, and note the loudness of the hum. Then move the probe to point T. The hum should be very greatly reduced at T. If not, check for a shorted choke or open or leaky filter condenser C4. If C4 is OK check C3.

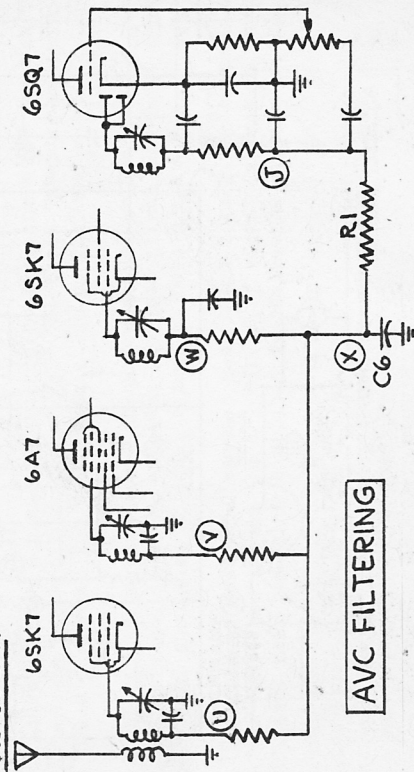


A condenser suspected of being open may be checked by attaching another good condenser of suitable rating across the doubtful one. The exact value of the test condenser is not important as long as it approximates the value of the defective one.

A generous range of condenser values for substitution checking purposes may be had in the Speco Capacitance and Resistance Decade Box.

Note: In general it will be found that the B supply of small mantel sets, particularly A. C. - D. C. sets, is not as well filtered as that of larger sets. Somewhat greater ripple or A. C. hum can be tolerated in small sets because the speaker does not reproduce the low frequencies as strongly as a well baffled speaker in a larger set.

18. Note on AVC:



The negative AVC voltage (which was checked at point J) feeds back to the control grids of the first three tubes, supplying them with controlled grid bias. Therefore if a defective signal is noted at one of these grids, the AVC circuit should not be overlooked in searching for the cause. Lack of AVC bias voltage on the grid could cause distortion; likewise an over-large AVC bias can cause distortion. Improperly filtered AVC caused by defective condensers or resistors in the AVC circuit can result in a weak signal, oscillation or distortion.

To check the presence and filtering of AVC bias at each of the first three tubes, connect test leads to the Signal Tracer external eye tube pin jacks and connect the lead from the red jack to set ground. Then apply the other lead to points U, V, and W, in turn. Watch the eye tube in each case. Unfiltered AVC voltage will cause a flickering or modulation of the eye tube shadow. Well filtered AVC voltage will show very little flickering of the eye tube shadow. If poor filtering of AVC voltage seems to be indicated at point U, V, or W, check the

condenser, and resistor at that point.

If poor filtering is present at all three points, then check point X, which is a point of intermediate filtering between point J and the point where the AVC line branches to the tubes. The AVC voltage should be better filtered at X than it is at J and better still at U, V, and W than at X. If filtering seems no better at X than it was at J, then check condenser C6 and resistor R1.

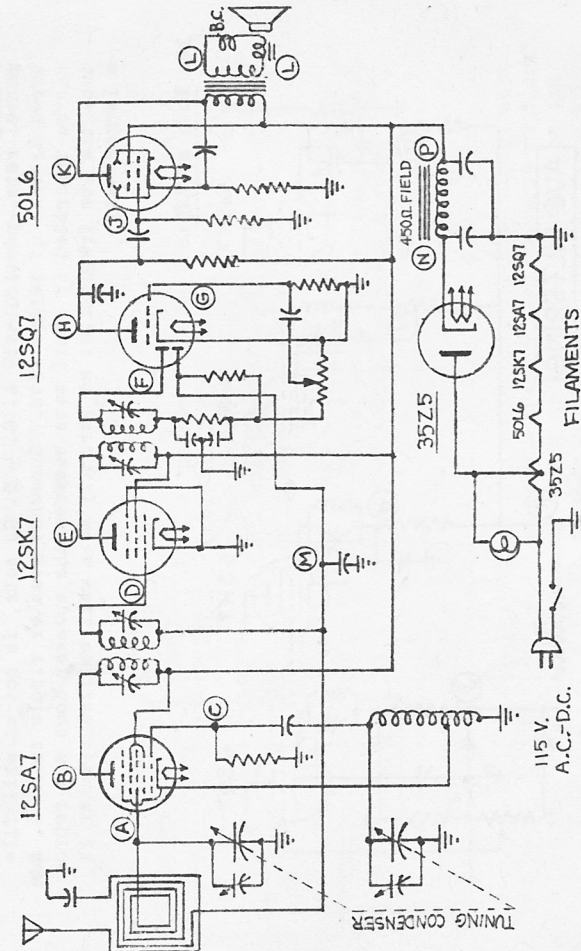


FIGURE 2. TYPICAL SMALL A.C.-D.C. SUPERHETERODYNE CIRCUIT.

19. In Figure 2 is shown a typical small A. C. - D. C. superheterodyne receiver circuit. The usual check points are indicated by the circled letters. Testing with the Signal Tracer follows the same general procedure as in the circuit of Figure 1.

Many servicemen find it convenient and time-saving to make the first check with the Signal Tracer probe at point H, the plate of the second detector. If the signal is satisfactory here, then it is known at once that the preceding R.F., converter and I.F. stages are OK. Trouble can then be run down in the audio stages or in the second detector itself. On the other hand if no signal is had at point H, the trouble will be found in the second detector or in one of the preceding stages.

Another way to save time is to test only at the grid of each tube until a control grid is reached at which there is no signal. Then the plate of the preceding tube can be checked, to further localize the

trouble. For example, if a signal is had at grid point A, but none at grid point D, then check between these two points at plate B. If there is no signal at B, the trouble lies between A and B. If the signal is present at B, the trouble lies between B and D.

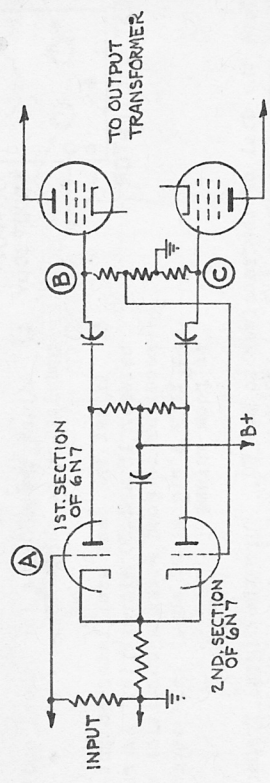


FIGURE 3: ONE TYPE OF PHASE INVERTER FOR AUDIO AMPLIFICATION.

20. Figure 3 shows a phase inverter circuit using a 6W7 (double triode) to feed the push-pull output stage. The phase inverter circuit can be quickly checked for proper operation as follows:

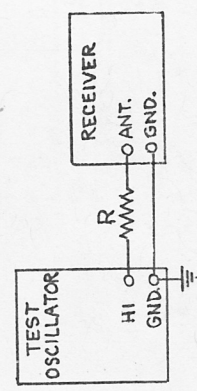
If signal is present at A, check for signal at B and C. A gain in signal strength is to be expected at these points, but most important the signal should be of equal volume at both B and C.

If signal is weak or absent at both B and C look for trouble related to the first section of the 6W7 tube. If signal is weak or absent only at C look for trouble related to the second section of the 6W7.

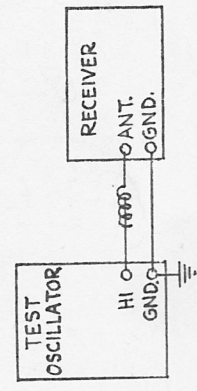
SECTION E

USING A TEST OSCILLATOR WITH THE SIGNAL TRACER FOR RECEIVER TESTING

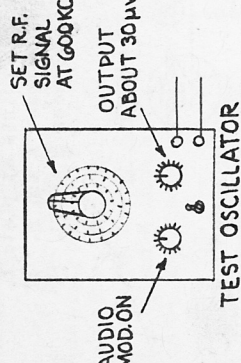
1. Instead of tuning the receiver under test to a local broadcasting station, a signal from a test oscillator may be fed into the receiver.
Connect the test oscillator to the receiver antenna and ground terminals as shown at the left. Resistance R serves as a dummy antenna load. Its value is usually between 100 and 400 ohms.



2. Note: With A. C. - D. C. sets it will sometimes be found necessary to loosely couple inductively to the receiver antenna terminal, in order not to superimpose hum upon the modulated signal from the test oscillator. This inductive coupling can be made as shown, by wrapping several turns of insulated wire around the end of the test oscillator cable (high lead) and connecting one end



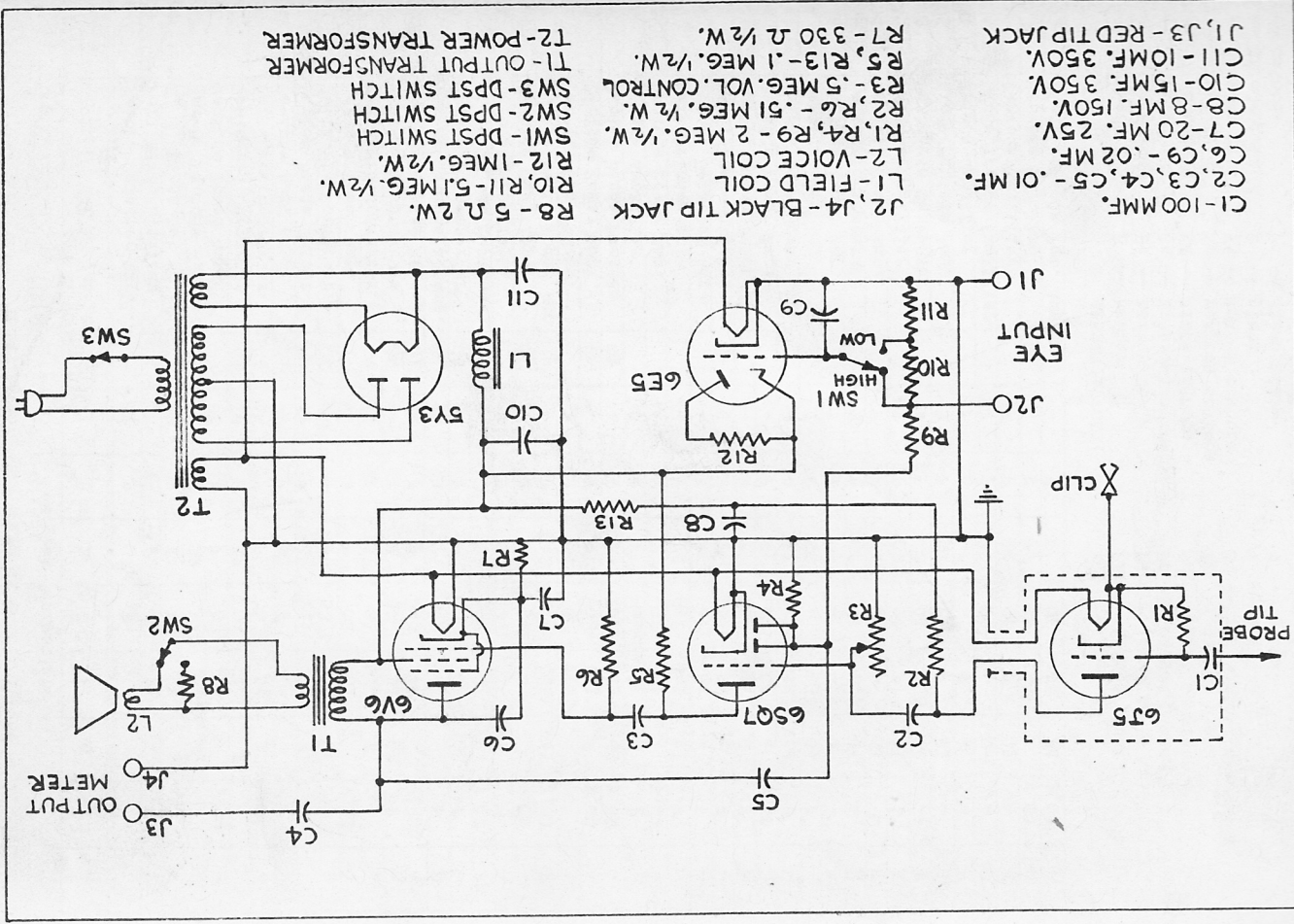
- of this wire to the antenna terminal of the set.
- Turn on the test oscillator and tune it to 600 KC.
 - Adjust the 400 cps (or other) audio modulation to about 30%.
 - Adjust the test oscillator output to between 15 and 50 microvolts. (A radio receiver in good working condition will amplify a signal of about this strength to room volume.)



- Tune the dial of the receiver to 600 KC. Turn the Signal Tracer volume control to about 1/3 or 1/2 volume. Hold the probe tip on the first test point and reduce the test oscillator output if the signal in the Signal Tracer speaker is too loud.
- Proceed with signal tracing as described in Section D, "Testing a Receiver with the Signal Tracer".
- It may be desirable to reduce the test oscillator output somewhat as testing proceeds through the advanced stages of the receiver.

1000000

FIGURE 4 : CIRCUIT DIAGRAM - MODEL STAC SIGNAL TRACER



TUBE CHART

TUBE CHART (continued)

Socket Connections

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
1-1-A	Triode Detector Amp.		F	P	G	F				
2A4	Full Wave Rectifier		S	P	P2		P1			K
2A5	H. F. Diode Det.-Disc.		H	P	K		IC	P	H	
2A6	Var-mu Pentode R.F. Amp.	G1	F	P	G2	F				
2A7	Pentode Power Amp.		S	P	P	G2	G1		F, G3	
2A8	Pentagrid Converter	G4	F	P	G2	G1	G3, 5	F		
2A9	Pentagrid Converter	G4	-	F	P	G2	G1	G2	F	
2B4P	Pentode R.F. Amp.	G1	F	P	G2	F				
2B5/2B5S	Duplex Diode Triode		F	P	Pd2	Pd1	G	F		
2B6	Pentagrid Converter	G4	-	F	P	G2, 5	G1	G2	F	
2B7	Pentode Power Amp.		S	F	P	G2	G1		F, G3	
2B8	Pentagrid Converter	G4	F	P	P	G2	G1	G3, 5	F	
2B9	Var-mu Pentode RF Amp.	G1	-	F	P	G2			F, G3	
2D5	Var-mu Tetrode RF Amp.	G1	-	F	P	G2			F, G3	
2D6	Pentagrid converter	G4	-	F	P	G2	G1	G2	H	
2D7	Pentagrid converter	G4	-	F	P	G2	G1	Pt	F, G3	Pd
2D8	Diode Triode Pentode	Gt	-	F	P	G2	G1	G		
2E4	Triode Amplifier		S	F	P	P				
2E5GP	Pentode R.F. Amp.	G1	-	F	P	G2			F, G3	
2E7	Double Pent. Power Amp		-	F	Pt2	Gt2	Gt1	Pt1	F, G3	Pt
2F4	Pentode Power Amp.		F	P	G1	G2	F, G3			
2F5	Pentode Power Amp.		-	F	P	G2	G1		F, G3	
2F7GV	Duplex Diode Pentode	G1	-	F	P	Pd2	Pd1	G2	F, G3	
2G4	Triode Amplifier		S	F	P	P			F, G3	
2G5	Pentode Power Amp.		-	F	P	G2	G1		F, G3	
2H4	Triode Detector Amp.		-	F	P	P			F, G3	
2H5	Diode High-mu Triode	G	-	F	P	P2	Gt1	P1	F	
2H6	Duplex Diode Triode		-	F	P	P			F, G3	
2J5	Pentode Power Amp.		-	F	P	Pd2	Pd1	G	F, G3	
2J6	Twin Triode Power Amp.		-	H	Pt1	Gt1	Gt2	Pt2	H	
2L4	Pentode R.F. Amp.		F	P	G2				F, G3	
2L4A	Pentode Power Amp.		F	P	G2				F, G3	
2L4B	Pentagrid Converter		F	P	G2	G1	G3, 5	G4		F, G3
2L4C	Pentode Power Amp.		F	P	G2				F, G3	
2L5	Pentode Amplifier		F	P	G2	G1	G3, 5	G4		F, G3
2L5C	Pentagrid Converter		F	P	G2	G1	G3, 5	G4		F, G3
2L5D	Diode Pentode Amp.		F	P	G2	Pd			F, G3	
2L5E	Triode Amplifier		F	P	-	Pd			F, G3	
2L5F	Diode Triode Amplifier		F	P	-	Pd			F, G3	
2L5G	Pentode Amplifier		F	P	G2	G3	F	G1		F, G3
2L5H	Pentode R.F. Amp.	G1	-	F	P	P	G2		F, G3	
2L5I	Diode Pentode Power Amp.		-	F	P	P	G2	G1	Pd	F, G3

ABBREVIATIONS:

-- filament	H -- heater	Phx -- hexode plate
-- grid	Hc -- heater tap	Pin -- input plate
-- grid	IC -- internal connection	Po -- output plate
Phx -- Hexode grid	Kd -- diode cathode	Pp -- pentode plate
Pin -- input grid	Kp -- pentode cathode	Pt -- triode plate
pp -- pentode grid	Kt -- triode cathode	RC -- ray control electrode
-- triode grid	P -- plate	S -- shell
-- cathode	Pd -- diode plate	T -- target

Socket Connections:

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
1P5	Pentode Amplifier	G1	-	F	P	G2			F, G3	
1Q5	Beam Power Amplifier		-	F	P	G2	G1		F	
1R5	Pentagrid Converter		S	F	P	G2, 4	G1	G3	F	
1SA6	Pentode R.F. Amp.		-	F	P	G3		G2	F, IS	P
1SB6	Diode-Pentode Amp.		-	F	P	G1	G2	Pd	F, G3	G1
1S4	Pentode Power Amp.		F, G3	-	Pd	G2	F, G3	G1	F	
1S5	Diode-Pentode Amp.		F	P	G2	-	F, G3	G1	F	
1T4	Pentode R.F. Amp.		-	F	P	G2	G1		F	
1T5	Beam Power Amp.		H	P	K	H				
1V	Diode H.W. Rectifier		F	P	G	F				
2A3	Triode Power Amp.		-	F	P	-	G		F	
2A4G	Gas Triode Relay		H	P	G2	G1	K, G3	H		
2A6	Pentode Power Amp.		H	P	Pd1	Pd2	K	H		
2A6	Duplex Diode Triode	G1	H	P	G3, 5	G2	G1	K	H	
2A7	Pentagrid Converter	G4	H	P	G2	Pd1	Pd2	K	H	
2B7	Duplex Diode Pentode	G1	H	P	G	T	K	H		
2B5	Electron Ray Tube		H	P	G	T	K	H		
2B8	Diode Triode Pentode	G1	Ft, G3	F	P	G2	Gt	Pt	F	Pd
2B8	Beam Power Amplifier		-	F	P	G2	G1		F	Pt
3B6	Pentode Power Amp.		F	P	G1	G2	Ft, G3	P	F	Pt
3C5	Beam Power Amplifier		-	F	P	G2	G1		F	Pt
3S4	Pentode Power Amp.		F	P	G1	G2	Ft, G3	P	F	
5U4	Full Wave Rectifier		-	F	P	P2			P1	
5U4	Full Wave Rectifier		S	F	P	P2			P1	
5V4	Full Wave Rectifier		S	H	P	P2			P1	
5W4	Full Wave Rectifier		S	F	P	P2			P1	
5X4	Full Wave Rectifier		S	-	P2	-	P1		F	
5Y3	Full Wave Rectifier		S	F	P	P2			P1	
5Y4	Full Wave Rectifier		S	F	P	P2			P1	
5Z3	Full Wave Rectifier		S	H	P	P2			P1	
5Z4	Full Wave Rectifier		S	H	P	P2			P1	
6A3	Triode Power Amp.		F	P	G	F				H
6A4/LA	Pentode Power Amp.		F	P	G1	G2	F, G3			K
6A5	Triode Power Amp.		S	H	P	-	G		H	K
6A6	Twin Triode Power Amp		H	Pt2	Gt2	K	Gt1	Pt1	H	
6A7	Pentagrid Converter	G4	H	P	G3, 5	G2	G1	K	H	
6A8	Pentagrid Converter	G4	S	H	P	G3, 5	G1	G2	H	K
6AB5/6N5	Electron Ray Tube		H	P	G	T	K	H		
6AB7	Television Pent. Amp		s	H	P	G3	G1	G2	H	P
6AC5	Triode Power Amp.		S	H	P	G3	G1	G2	H	P
6AC7	Television Pent. Amp		S	H	P	RC	G1	G2	H	P
6AD6	Electron Ray Tube		-	H	RC	RC	T	G2	H	K
6AD7	Triode Pentode Amp	Gt	H	Pp	G2p	G1p	G	Pt	H	K, G3p
6AE5	Triode Amplifier		S	H	P	P	G		H	K
6AE6	Twin Plate Triode		-	H	P1	P2	G		H	K
6AE7	Twin Input Triode		-	H	P	P1	G1	G2	H	K
6AF6	Electron Ray Tube		-	H	RCt1	RCt2	T		H	K
6AG5	Pentode R.F. Amplifier	G1	K, IS	H	H	P	P	G2	G3, IS	
6AG7	Video Beam Power Amp.		G3	H	S	G1	K	G2	H	P
6B4	Triode Power Amplifier		-	F	P	-	G	-	F	
6B5	Direct Coupled Pow. Amp		H	Pt2	Pt1	K	K	H		
6B6	Duodode Ht-mu Triode	Gt	S	H	Pt	Pd1	Pd1	Pd1	H	K
6B7	Duplex Diode Pentode	G1	H	P	G2	Pd2	Pd2	Pd1	K, G3	H

TUBE CHART (continued)

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
6B8	Duplex Diode Pentode	Glp	S	H	Pp	Pd2	Pd1	G2p	H	K, G5p
6C5	Triode Detector Amp.	G1	S	H	P	G3	G	H	H	K
6C6	Triple Grid R.F. Amp	G	H	P	S	Pd1	Pd2	K	H	K
6C7	Duplex Diode Triode	Gt2	-	H	Pt2	Kt2	Gt1	Pt1	H	Kt1
6C8	Twin Triode	G1	H	P	G2	G3	K	H	H	K
6C9	Triple Grid R.F. Amp.	G1	H	P	G2	G3	S	K	H	K
6D7	Triple Grid Amp.	G4	S	H	P	G2	G3,5	G1	G2	K
6D8	Pentagrid Converter	Gt	H	P	G	T	K	H	H	K
6E5	Electron Ray Tube		H	Pt2	Gt2	K	Gt1	Pt1	H	K
6E6	Twin Triode Amp.	G1	H	P	G2	G3	S	K	H	K
6E7	Triple Grid R.F. Amp.	G	S	H	P	G2	G3	P	H	K
6E8	Hi-mu Triode	G	S	H	P	G2	G3	P	H	K
6E9	Pentode Power Amp.	G1p	S	H	P	G2	G1	G	H	K, G5
6F7	Triode Pentode	G1p	H	Pp	G2p	Pt	Gt	K, G5p	H	K
6F8	Twin Triode Amp.	Gt2	-	H	Pt2	Kt2	Gt1	Pt1	H	Kt1
6G6	Pentode Power Amp	G	S	H	P	G2	G1	G	H	K, G5
6H4	Diode Rectifier		-	H	P	P	P		H	K
6H6	Twin Diode Rectifier		S	H	Pd2	Kd2	Pd1		H	Kd1
6H5	Detector Triode Amp.	G1	S	H	P	G2	G3		H	K
6H7	Triple Grid Det. Amp.	G	-	H	P	-	-		H	K
6H8	Hi-mu Triode Amp.	G	S	H	P	G2	G1	G	H	K, G5
6K6	Pentode Power Amp.	G1	S	H	P	G2	G3	Pt	H	K
6K7	Triple Grid Var-mu Amp	G3hx	S	H	P	G2,4hx	Gt1	Pt	H	K
6K8	Triode Hexode Conv.	G	S	H	P	G2	G1	G	H	K
6L5	Triode Amplifier		S	H	P	P	P		H	K
6L6	Beam Power Amp.	G1	-	H	P	G2	G1	G3	H	K, G5
6L7	Pentagrid Mixer Amp.	G1	S	H	P	G2,4	G3		H	K
6M6	Direct Coupled Amp.		-	H	Po	Pi	G	Pt1	H	K
6N7	Twin Triode		S	H	Pt2	Gt2	Gt1		H	K
6P5	Triode Amplifier		S	H	P	P	G		H	K
6Q7	Duplex Diode Triode	Gt	S	H	Pt	Pd2	Pd1		H	K
6R7	Duplex Diode Triode	Gt	S	H	Pt	Pd2	Pd1		H	K
6S7	Triple Grid Var-mu Amp	G1	S	H	P	G2	G3		H	K
6S7	Pentagrid Converter	G1	S, G5	H	P	G2,4	G1	K	H	G3
6S7	Triode Triode Amp.		S	Pt2	Gt2	Gt1	Pt1	K	H	H
6S7	Twin Triode Amp.		S	H	G3	G1	K	G2	H	P
6S7	Tri. Grid Semi Var-mu		S	K	G	P	P		H	H
6S7	Hi-mu Triode		S	K	G	P	P		H	H
6S7	Diode Var-mu Pentode		S	G1	K, G3	G2	Pd	Pp	H	H
6S7	Tri. Grid Semi Var-mu		S	H	K, G3	G1	K	G2	H	P
6S7	Triple Grid H.F. Amp		S	H	K, G3	G1	K	G2	H	P
6S7	Triple Grid Amp.		S	H	G3	G1	K	G2	H	P
6S7	Triple Grid Var-mu Amp		S	H	G3	G1	K	G2	H	P
6S7	Twin Triode Amp.		Gt2	Pt2	Kt2	Gt1	Pt1	Kt1	H	H
6S7	Triode Triode Amp.		Gt2	Pt2	Kt2	Gt1	Pt1	Kt1	H	H
6S7	Duplex Diode Triode	Gt	S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Triode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Duplex Diode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Triple Grid Var-mu Amp		S	H	G3	G1	K	G2	H	P
6S7	Duplex Diode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Triple Grid Var-mu Amp		S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Duplex Diode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
6S7	Electron Ray Tube		S	H	P	G	T	K	H	K
6U6	Beam Power Amplifier		-	H	P	P	G2	G1	H	K
6U7	Triple Grid Var-mu Amp	G1	-	H	P	P	G2	G3	H	K
6V6	Beam Power Amplifier		-	H	P	P	G2	G1	H	K

TUBE CHART (continued)

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
6V7	Duplex Diode Triode	Gt	S	H	Pt	Pd2	Pd1		H	K
6W6	Full Wave Rectifier		-	H	P2	P2	P1		H	K
6W7	Triple Grid Det. Amp.	G1	S	H	P	G2	G3		H	K
6X5	Full Wave Rectifier		-	H	P2	P2	P1		H	K
6Y5	Full Wave Rectifier		-	H	S	P2	K	P1	H	K
6Y6	Beam Power Amp.		-	H	P	P	G2	G1	H	K
6Y7	Twin Triode Amp.		S	H	P2	P2	Gt1	Pt1	H	K
6Z4/84	Full Wave Rectifier		Ht	H	P2	K	P1		H	K
6Z5	Twin Triode Amp.		S	H	P2	Gt2	Gt1	Pt1	H	K
6Z7	Full Wave Rectifier		S	H	P2	-	-		H	K
6Z7	Full Wave Rectifier		-	H	P2	-	-		H	K
6Z7	Triode Amplifier		H	P	-	-	-		H	K
6Z7	Beam Power Amp.		H	P	G2	-	-		H	K
6Z7	Twin Triode Rectifier		H	K2	P2	-	IS	P1	K1	H
6Z7	Remote Cut Off Pent.		H	P	G2	G3	S	G1	K	H
6Z7	Multigrid Converter		H	P	G2	G1	G3,5	G4	K, G6	H
6Z7	Hi-mu Triode Amp.		H	P	-	-	-	-	G	K
6Z7	Pentode Power Amp.		H	P	G2	-	-	-	G1	K
6Z7	Duplex Diode Triode		H	P	G2	K	Pd1	Pd2	K	H
6Z7	Pentode R.F. Amp.		H	P	G2	G3	S	G1	K	H
6Z7	Duplex Diode Triode		H	P	G2	K	Pd1	Pd2	K	H
6Z7	Remote Cut Off Pent.		H	P	G2	G3	S	G1	K	H
6Z7	Pentagrid Converter		H	P	G2	G1	G3,5	G4	K	H
6Z7	Tetrode Power Amp.		H	P	G2	-	-	-	G1	K
6Z7	Duplex Diode Triode		H	P	G2	K	Pd1	Pd2	K	H
6Z7	Pentode R.F. Amp.		H	P	G2	G3	S	G1	K	H
6Z7	Duplex Diode Triode		H	P	G2	K	Pd1	Pd2	K	H
6Z7	Remote Cut Off Pent.		H	P	G2	G3	S	G1	K	H
6Z7	Triode Triode Amp.		H	P	G2	G3	S	G1	K	H
6Z7	Tri. Grid Semi Var-mu		H	P	G2	G3	S	G1	K	H
6Z7	Triode Hexode Conv.		H	P	Pt	Gt2	G3,4,5	G1	K, Gt	H
6Z7	Triple Grid Amp.		H	P	G2	G3	S	G1	K	H
6Z7	Twin Triode Amp.		H	P	Pt	Gt2	Gt1	Pt1	Kt1	H
6Z7	Pentagrid Converter		H	P	Pt	Gt2	Gt1	Pt1	Kt1	H
6Z7	Triple Grid Amp.		H	P	G2,4	G1	G5	G3	K	H
6Z7	Full Wave Rectifier		H	P	G2	G3	S	G1	K	H
6Z7	Triode Power Amp.		F	P	G	F	-	-	P1	K
6Z7	Triode Det. Amp.		P	P	G	F	-	-	-	-
6Z7	Pentode Power Amp.		H	P	G2	G1	K, G3	H0	H	K
6Z7	Beam Power Amp.		-	H	P	G2	G1	G1	H	K
6Z7	Rectifier Amplifier	G1	H	P	G2	Kd	Pd	K, G3	H	K
6Z7	Pentagrid Converter	G4	S	H	P	G3,5	G1	G2	H	K
6Z7	Twin Triode Conv. Amp		Gt1	Kt1	Pt1	Kt2	Gt2	Pd2	H	K
6Z7	Triple Grid Var-mu		H	P	G2	G3	S	G1	K	H
6Z7	Triode Pentode	Glp	K, G3p	H	Pp	G2p	Pt	Kt	H	Gt
6Z7	Duplex Diode Pentode	Glp	S	H	Pp	Pd2	Pd1	G2p	H	K, G5p
6Z7	Triode Amplifier	G	S	H	P	P	G	-	H	K
6Z7	Triode Amplifier		S	H	Pd2	Kd2	Pd1	-	H	K
6Z7	Twin Diode Rectifier		S	H	P	G2	G3	-	H	K
6Z7	Triode Amplifier	G1	S	H	P	G2	G3	-	H	K
6Z7	Pentode Voltage Amp.		G1	S	H	P	G2	G3	H	K
6Z7	Remote Cutoff Pentode		G1	S	H	P	G2	G3	H	K
6Z7	Triode Hexode Conv.	G3hx	S	H	P	G2,4hx	Gt1	Pt1	H	K
6Z7	Duplex Diode Triode	Gt	S	H	Pt	Pd2	Pd1	-	H	K
6Z7	Pentagrid Converter		S, G5	H	P	G2,4	G1	G	H	K

TUBE CHART (continued)

Socket Connections:

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
2SC7	Twir Triode Amplifier		S	Pt2	Gt2	Gt1	Pt1	K	H	H
2SF5	Hi-mu Triode Amp.		S	K	G	-	P		H	H
2SF7	Diode Var-mu Pentode		S	G1	K, G3	G2	Pd	Pp	H	H
2SG7	Triple Grid Var-mu Amp		S, G3	H	K	G1	K	G2	H	P
2SH7	H.F. Pentode Amp.		S	H	K, G3	G1	K	G2	H	P
2SJ7	Pentode Voltage Amp.		S	H	G3	G1	K	G2	H	P
2SK7	Remote Cutoff Pentode		S	H	G3	G1	K	G2	H	P
2SL7	Twin Triode Amplifier		Gt2	Pt2	Kt2	Gt1	Pt1	Kt1	H	H
2SR7	Twin Triode Amplifier		Gt2	Pt2	Kt2	Gt1	Pt1	Kt1	H	H
2SR7	Duplex Diode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
2SR7	Duplex Diode Triode		S	Gt	K	Pd2	Pd1	Pt	H	H
2Z3	Half Wave Rectifier		H	P	K	H				
4C7	Triode Grid Amplifier		H	P	G2	G3	S	G1	K	H
4J7	Triode Hexode Conv.		H	P	G2, 4	G1	S, G5	G3	K	H
4Q7	Heptode Pent.Conv.		H	P	Pd2	Pd1	G2	G1	K, G3	H
4R7	Duplex Diode Pentode		H	P	G2	K, G3	H			
5	B.F. Pentode		H	P	Gt2	Gt1	P1	F		
59	Twin Triode Amplifier		F	P2	G2	K	H			
5A4	Tetrode R.F. Amp.		G1	H	P	G2	G1		H	K, G3
5A6	Pentode Power Amp.		S	H	P	G2	G1	Pd	H	K, G3
5A7	Rectifier Amplifier		Kd	H	P	G2p	G1p	G	H	K
5AC5	Triode Power Amplifier		S	H	P	G2	G1			
5B5	Direct Coupled Triodes		H	Po	P	G2	G1			
5B6	Pentode Power Amp.		S	H	P	G2	G1			
5B8	Triode Pentode Amp.		G1p	K, G3p	H	P	G2	G1		
5C6	Beam Power Amp.		-	H	P	G2	G1			
5D8	Diode Triode Pentode		G1	K	H	P	G2	G1		
5E6	Beam Power Amplifier		-	H	Po	P	G2	G1		
5E6	Direct Coupled Triodes		-	H	P	G2	G1			
5E6	Voltage Doubler Rect.		S	H	Pd2	Kd2	Pd1		H	Kd1
5E6	Voltage Doubler Rect.		H	P2	K2	K1	P1			
5E6	Rectifier Doubler		H	P2	K2	K1	P1			
5E6	Rectifier Doubler		S	H	Pd2	Kd2	Pd1		H	Kd1
5E6	Triode Amplifier		F	P	G	F				
5E6	Triode Detector Amp.		H	P	G	K	H			
5E6	Triode Detector Amp.		F	P	G	F				
5E6	Triode Power Amp.		F	P	G	F				
5E6	Tetrode R.F. Amp.		G1	F	F	F				
5E6	Diode Beam Tetrode		Kd	H	Pp	G2p	G1p	Pd	H	K, G3p
5E6	Pentode Power Amp.		F	P	G1	G2	F, G3			
5E6	Variable-mu Pentode		G1	F	P	G2	F			
5E6	Variable-mu Amp.		G1	H	P	G2	K	H		
5E6	Beam Power Amp.		-	H	P	G2	-			
5E6	Beam Power Amp.		-	H	P	G2	G1			
5E6	Half Wave Rectifier		-	H	-	-				
5E6	Half Wave Rectifier		-	H	HC		P			
5E6	Half Wave Rectifier		-	H	HC		P			
5E6	Voltage Doubler		S	H	Pd2	Kd2	Pd1		H	Kd1
5E6	Tetrode R.F. Amp.		G1	H	P	G2	K	H		
5E6	Triode Detector Amp		H	P	G	K	H			
5E6	Pentode Power Amp.		G1	H	P	G2	K, G3	H		
5E6	Var. mu R.F. Pentode		G1	H	P	G2	K, G3	H		
5E6	Pentode Power Amp.		H	P	G2	G1	K, G3	H		

TUBE CHART (continued)

Socket Connections:

TUBE TYPE	USE	GRID CAP	1	2	3	4	5	6	7	8
42	Pentode Power Amp.		H	P	G2	G1	K, G3	H		
43	Pentode Power Amp.		H	P	G2	G1	K, G3	H		
45	Triode Power Amp.		F	P	G	F				
45Z3	Half Wave Rectifier		H	P	IC	K	-	P	H	K
45Z5	Half Wave Rectifier		-	H	HC	P			H	K
46	Dual Grid Power Amp.		F	P	G1	G2	F			
47	Pentode Power Amp.		F	P	G1	G2	F			
48	Tetrode Power Amp.		H	P	G2	G1	K	H		
49	Dual Grid Power Amp.		F	P	G1	G2	F			
50	Triode Power Amp.		F	P	G	F				
50L6	Beam Power Amp.		-	H	P	G2	G1		H	K
50Y6	Full Wave Rectifier		S	H	Pd2	Kd2	Pd1		H	Kd1
50Z7	Voltage Doubling Rect.		S	H	Pd2	Kd2	Pd1		H	Kd1
53	Twin Triode Amp.		H	Pt2	Gt2	K	Gt1	Pt1	H	
55	Duplex Diode Triode		Gt	H	Pt	Pd2	Pd1	K	H	
56	Triode Amp., Detector		H	P	G	K	H			
57	Triode Grid Amplifier		H	P	G2	G3	K	H		
58	Triode Grid Var.-mu		H	P	G2	G3	K	H		
59	Triode Grid Power Amp.		H	P	G2	G3	K	H		
70A7	Diode Beam Tetrode		Kd	H	Pt	G2	G1	Pd, Ht	H	Kt
70L7	Diode Beam Tetrode		Kd	H	Pt	G2	G1	K	H	Pd
71A	Triode Power Amp.		F	P	G	F				
75	Duplex Diode Triode		Gt	H	Pt	Pd2	Pd1	K	H	
76	Triode Detector Amp.		H	P	G	K	H			
77	Triode Grid Detector		G1	H	P	G2	G3	K	H	
78	Triode Grid Var.-mu		G1	H	P	G2	G3	K	H	
79	Twin Triode Amp.		Gt1	H	Pt2	Gt2	K	Pt1	H	
80	Full Wave Rectifier		F	P2	P1	F				
81	Half Wave Rectifier		F	P2	P1	F				
82	Full Wave Rectifier		F	P2	P1	F				
83	Full Wave Rectifier		F	P2	P1	F				
83V	Full Wave Rectifier		H	P2	P1	H, K				
84/824	Full Wave Rectifier		H	P2	P1	H, K				
85	Duplex Diode Triode		Gt	H	Pt	Pd2	Pd1	K	H	
89	Triode Grid Power Amp		G1	H	P	G2	G3	K	H	
117L7	Rectifier Tetrode		Kd	H	Pt	G1	G2	K	H	Kt
117N7	Rectifier Tetrode		-	H	Pt	G1	G2	K	H	Kd
117P7	Rectifier Tetrode		-	H	Pt	G1	G2	K	H	Kd
117Z4	Half Wave Rectifier		-	H	-	-	P		H	K
117Z6	Voltage Doubling Rect.		S	H	Pd2	Kd2	Pd1		H	Kd1