THE HICKOK ELECTRICAL INSTRUMENT COMPANY

MODEL 810
TRANSISTOR RADIO TESTER

CHOICE OF THE EXPERTS
FOR SPEED, ACCURACY
and DEPENDABILITY . . .

INSTRUCTION BOOK

FOR

TRANSISTOR RADIO TESTER

MODEL 810

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
10514 Dupont Avenue - Cleveland 8, Ohio

TRANSISTOR RADIO TESTER

MODEL 810

TECHNICAL CHARACTERISTICS

1. Power Consumption: 25 Watts at 115 VAC

2. Power Supply required: 105-125 VAC, 50-70 cycles

3. Audio Amp: 10 millivolts RMS, with variable gain of audio signal will produce an audible signal from the speaker.

4. Audio Signal Output: 600 cycle sawtooth waveform. 0-2 volts P - P with 180 ohm drive impedance.

5. Tuned Radio Frequency Receiver:

   Freq. Range:

   Band 1 - 200 KC to 600 KC

   Band 2 - 500 KC to 1600 KC

   Input Sensitivity - 200 Microvolts

6. RF Oscillator - Mod. or Unmod.

   Freq. Range:

   Band 1 - 200 KC to 600 KC

   Band 2 - 500 KC to 1600 KC

7. Input Impedance:

   Cathode Follower input probe

   5 Megohm input resistance

   4 $\mu\mu$f input capacity

8. Output Impedance for RF and Audio: 180 Ohms

9. Transistor Test Circuit:

   Checks leakage in microamperes and relative gain of transistors.

Tube Complement:

1	6X4
2	6AU8
1	6AB4

PURPOSE

The Model 810 Transistor Radio Tester was designed primarily as an aid for servicing of printed circuit Transistor Radios. It has the necessary features for complete troubleshooting and alignment of transistor radios. In addition, a transistor test circuit has been incorporated in this instrument to facilitate checking of transistors.

The application of this tester is not limited to transistor radios. It can be used equally well for servicing of tube type radios and auto radios.

BRIEF DESCRIPTION

The Transistor Radio Tester consists of several functions and they are briefly described below:

1. An RF Oscillator that covers the broadcast range 500 KC to 1600 Kc. This can be used for signal injection or RF alignment.

2. An RF Oscillator that covers the intermediate frequency range, 200 KC to 600 KC. This can be used for signal injection or IF alignment.

3. A tuned radio frequency receiver with a range of 200 KC to 600 KC. Input sensitivity of this receiver is approximately 200 microvolts. Its use is for signal tracing the IF stages of the receiver under test. The IF signal is picked up by a special cathode follower probe to minimize loading, and amplified. The amplification consists of two stages of tuned RF and two stages of audio. The amplified signal is then fed into a speaker for an aural indication. This receiver can also be used to pick up aircraft weather signals which are found in this range.

4. A tuned radio frequency receiver with a frequency range of 500 KC to 1600 KC. The input sensitivity is approximately 200 microvolts. Its use is for signal tracing the RF section of the receiver and for checking resonance of the antenna coil. The signal picked up by the low loading probe is amplified and fed to a speaker for an aural presentation as in the previous IF section. This receiver can also be used as an AM tuner for Hi-Fi audio system because of its wide band characteristics.

5. Audio signal output. This consists of a sawtooth waveform with a repetition frequency of 600 cycles per second. Its maximum amplitude is 2 volts peak-to-peak. This is sufficiently low to prevent damage to transistors used in audio circuits. This signal is used for signal injection into audio circuits. Its low output impedance is particularly suitable for driving audio signals into transistor circuits.

6. Audio Amplifier. The audio amplifier featured in this unit has a sensitivity of 10 millivolts. 10 millivolts of AC signal will give a good aural indication by the speaker. A volume control is incorporated in the amplifier circuit to enable adjustment of sound level. The audio amplifier is used for complete signal tracing of the audio section of the receiver under test. Other uses would be, phono amplifier, auxiliary amplifier, etc.

7. Transistor Test Circuit. This circuit has been incorporated for the purpose of checking transistors.

FUNCTION OF CONTROLS

1. Function Selector.

This selector has six positions and with it the following various functions are selected.

a. 500-1600 KC OSC.

In this position the tester is used as an RF generator covering the range indicated. The frequency desired is adjusted with the tuning dial. The output is taken from the output cable and the level is varied by the output attenuator. To modulate the RF output, the Mod. switch is turned to the ON position.

b. 200-600 KC OSC.

In this position the tester is used as an RF generator covering the frequency range indicated. The frequency desired is adjusted with the tuning dial. The output is taken from the output cable and the level is varied by the output attenuator. To modulate the RF output, the MOD switch is turned to the ON position.

c. 500-1600 KC REC.

With the function selector in this position the tester becomes a TRF Receiver with the frequency range indicated. In this position the tester is used as an RF signal tracer or as a radio. To use it as such, the input probe is connected to the circuit under test or to a short piece of wire 3 ft. long used as an antenna. The output Attenuator to maximum and the Input Gain control varied to adjust to the desired volume level. The MOD switch must be set to the OFF position, otherwise the speaker will be shorted out of the circuit.

d. 200-600 KC REC.

In this position the tester becomes a TRF Receiver with the frequency range indicated. Its use in this position is for signal tracing the IF section of the receiver under test or as a radio. Operation of this range is the same as the above 500-1600 KC range.

e. 600 CPS AUDIO.

This position converts the tester to an audio oscillator. The frequency is as indicated. The Waveform is sawtooth. To utilize the tester as an audio generator, the output is taken from the output cable. The output Attenuator is used to vary the output level and the MOD switch is set to the ON position.

f. AUDIO AMP.

This position utilizes the audio amplifier in the tester. The audio amplifier would be used to signal trace the audio section of the receiver under test. The input probe is used as the AC input and is connected to the audio circuit under test. The amplified audio signal will then appear at the speaker. The volume level is adjustable with either the input gain control or the Output Attenuator. A suitable ground wire should be connected from the circuit to the ground binding post of the tester.

2. Input Gain Control

Controls the input level into the tester and is used on the following ranges of the Functions Selector:

500-1600 KC REC.

200-600 KC REC.

Audio Amp.

3. Output Attenuator

This control varies the level of signal at the output cable on all ranges of the Function Selector. It also varies the volume level of the speaker in the REC and AUDIO AMP positions of the Function Selector. The power ON-OFF is ganged to this control.

4. MOD Switch.

This switch turns on the audio oscillator in the tester. With the switch in the ON position the audio oscillator modulates the RF carrier in the 500 KC-1600 KC OSC and 200-600 KC OSC positions of the Function Selector. The MOD switch should also be ON when utilizing the 600 cps Audio position of the Function Selector. It should be OFF in all other positions because it also shorts out the speaker.

5. Tuning Dial

Selects desired frequencies in the first four positions of the Function Selector.

6. Transistor Test Circuit

Included in this circuit are two transistor sockets, two pin jacks, labeled Meter MA, and a slide switch labeled Gain-Leak. The purpose of this circuit is to check transistors. The operation of this circuit will be described later under checking of Transistors.

OPERATION

Plug the AC line cord into a source of AC power 105-125 V, 50-70 cycles. Turn tester ON by rotating the Output Attenuator clockwise. Allow a five minute warm-up period before putting the instrument into use.

Set up as an RF Generator

1. Set Function Selector to either 500-1600 KC OSC or 200-600 KC, depending on the frequency desired.
2. Adjust tuning dial to frequency needed.
3. Set MOD switch to ON if modulated RF Carrier is desired.
4. Adjust Output Attenuator to level desired.
5. Connect Output cable to receiver under test.

Set up as a Receiver

1. Set Function Selector to either 500-1600 KC REC or 200-600 KC REC, depending on frequency desired.
2. Adjust Output Attenuator to maximum.
3. MOD switch to OFF.
4. Tuning Dial set to desired frequency. For example, if the IF section is being signal traced the frequency is set to the IF frequency 262 or 455 KC.
5. Connect suitable ground wire from circuit under test to ground on tester.
6. Connect input probe tip to the circuit under test.
7. Adjust Input Gain control to volume level from speaker desired.

Set up for 600 CPS Audio Output

1. Set Function Selector to 600 CPS Audio.

2. MOD switch to ON position.

3. Connect Output cable to circuit under test.

4. Adjust amplitude of output level with Output Attenuator.

Set up for Audio Amplifier

1. Set Function Selector to Audio Amp.

2. Set MOD switch to OFF.

3. Adjust Output Attenuator to maximum.

4. Connect suitable ground wire between chassis and tester.

5. Connect input probe tip to circuit under test.

6. Adjust Input Gain control for desired volume level from the speaker.

OPERATION OF TRANSISTOR TEST CIRCUIT

To check transistors proceed as follows:

1. Determine whether transistor is PNP or NPN and plug into appropriate test socket.

2. Switch Gain-Leak switch to Leak.

3. Connect a Milliammeter to MA Meter pin jacks observing polarity-- red is positive, black is minus. A 0-2 MA meter should be adequate. If this type of meter is not available any standard V. O. M. meter can be used.

4. With the meter connected, the leakage current is read and noted.

5. The Gain-Leak switch is then switched to GAIN. The leakage current noted should at least double in value for a good transistor.

INTERPRETATION OF CURRENT READINGS

The leakage currents for some transistors may run as high as 120 to 150 microamperes but should generally be much smaller. If the leakage currents are excessively high or if the readings are erratic the transistor is defective.

In the gain check position, if the reading more than doubles, this indicates that the transistor has extremely good gain. The best transistor will have the lowest leakage and highest gain.

POWER TRANSISTORS

Power transistors will give different current readings than low power transistors on this tester.

Power transistors leakage currents will run as high as 1 MA and have a gain factor of only 30%. For example, a typical good power transistor may have a leakage current of .7 MA and a gain reading of 1 MA.

To check power transistors which have a different socket arrangement, jumper wires with alligator clips have to be used. Three small stubs of wire are plugged into the transistor socket and then the jumpers with alligator clips connect the transistor to the socket stubs.

GENERAL

SERVICING TRANSISTOR CIRCUITS

Most service shops are well equipped to handle repairs involving conventional radio and television sets. With the advent of transistor radios, however, a new approach to the service problem must be faced. Different terms, test equipment, tools and techniques are used.

TOOLS

One of the first considerations when planning to service transistorized radios must be tools. Below is a list of recommended tools.

1. Magnifying glass.
2. Tweezers - two or three different types.
3. Wire cutting pliers, the smallest size obtainable.
4. Long nose pliers.
5. Low wattage soldering iron or gun--not more than 35 watts.
6. Small wire brush for cleaning solder connections on printed boards.
7. Low temperature 60/40 solder.
8. Volt Ohm Milliammeter. The V.O.M. should have the following features:

   a. The milliammeter section should be low resistance so that if current measurements are made the current flow is not limited by the meter resistance. Otherwise an error in measurement will result.

An undesirable feature of a high resistance milliammeter is that it may cause the radio to motorboat when making a total current drain check.

b. The ohm meter section should use a battery no larger than 3 volts so that when making resistance checks no damage will result to the transistors in the circuit. The polarity of the ohmmeter test leads should be determined and labeled. This can be done with the use of another voltmeter. This is because, when making a check on a small low voltage electrolytic condenser, the polarity is important. If the wrong polarity is applied, damage may result to the condenser and the reading obtained will show the condenser shorted.

POWER SUPPLIES

It would be costly for a service shop to maintain a complete stock of batteries for testing transistor radios; therefore, a variable DC power supply is recommended. The ideal supply is one with very low AC ripples so as to not introduce a hum or buzz in the receiver under test. The power supply should also have a good voltmeter and a low resistance milliammeter incorporated in it. A good power supply will enable the technician to:

1. Check current drain of the set under test.
2. Check at what voltage the local oscillator passes out.
3. Check set's sensitivity at various supply voltages.
4. Leave the set on test without using up the life of a good battery.

SERVICING HINTS

Visual Inspection

A very close visual inspection with the aid of a magnifying glass will often reveal troubles such as broken printed wires, cold solder joints, etc.

Spray

The use of printed circuit boards is almost universal in the manufacture of portable transistor radios. One of the final steps in the manufacturing of these sets is to spray the printed boards with a clear lacquer or varnish. This coating must be penetrated when signal tracing and when voltage and resistance measurements are made.

Soldering

When soldering or unsoldering transistors, a heat sink should be used. This is best done by using a pair of long nosed pliers on the transistor leads as they are soldered or unsoldered. The pliers will absorb the heat from the wire and prevent it from entering the transistor.

> CAUTION: When soldering on a transistor radio, all grounds from chassis to test equipment or bench must be removed. The reason for this is because the soldering iron may have a slight amount of AC leakage from the heating element to the soldering tip. If the set or chassis is grounded a complete electrical AC path is formed and damage will result to transistors and the components in the receiver.

SERVICE LITERATURE

The use of reliable service information and schematics are an important factor in servicing transistorized radios. Perhaps the first thing one notices in the initial steps is the unfamiliar location of components on the printed circuit board. It is therefore recommended that service literature, or at least wiring diagrams, be obtained before attempting to service transistor radios. It will greatly aid in locating components and test points for signal tracing.

SERVICING BY SIGNAL TRACING AND SIGNAL INJECTION

Servicing by signal tracing and signal injection are the most effective methods of locating defective stages in printed circuit transistor radios.

The Hickok Transistor Radio Tester, Model 810, will prove to be a valuable aid in servicing. With this instrument both signal tracing or signal injection methods can be employed. When signal tracing, the Model 810 is set up as a receiver and signals in the RF, IF, and audio stages are picked up with the probe, amplified and presented to the speaker of the tester.

When the signal injection method of servicing is employed the Tester is set up as an RF or Audio generator and signals are injected and the speaker in the receiver under test is utilized as an indicator. Both methods are satisfactory, the difference is in the procedure. When signal tracing, the procedure is to start with the antenna and work toward the speaker. With signal injection, the reverse is true. One starts with the speaker and works back toward the antenna.

Before attempting to troubleshoot a transistor radio, the battery should be checked for voltage under load, because with a dead battery, all troubleshooting would be in vain and a lot of valuable time wasted. If the battery is dead, check its polarity--it may have been put in the battery rack backwards accidentally. This would shorten its life considerably and would possibly cause damage to the transistors or electrolytic condensers in the radio. This should be investigated before installing a new battery.

Figure 1, a simplified typical transistor radio, shows the test points that can be used to locate defective stages. Each of these test points will be described in detail along with how the Transistor Radio Tester is applied to these points as a signal tracer or as a signal injector.

SIGNAL TRACING

Test Point 1

This point is the high side of the Antenna Coil or loop stick. The transistor radio tester is set up to receive the broadcast band (500-1600 KC REC). The tuning dial is set to a strong station in the middle of the band. Adjust Input Gain and Output Attenuator to maximum clockwise position.

A suitable ground should be connected between Tester and chassis.

The input probe is touched to this point #1. The transistor radio under test should be turned off for this check so that the local oscillator does not interfere.

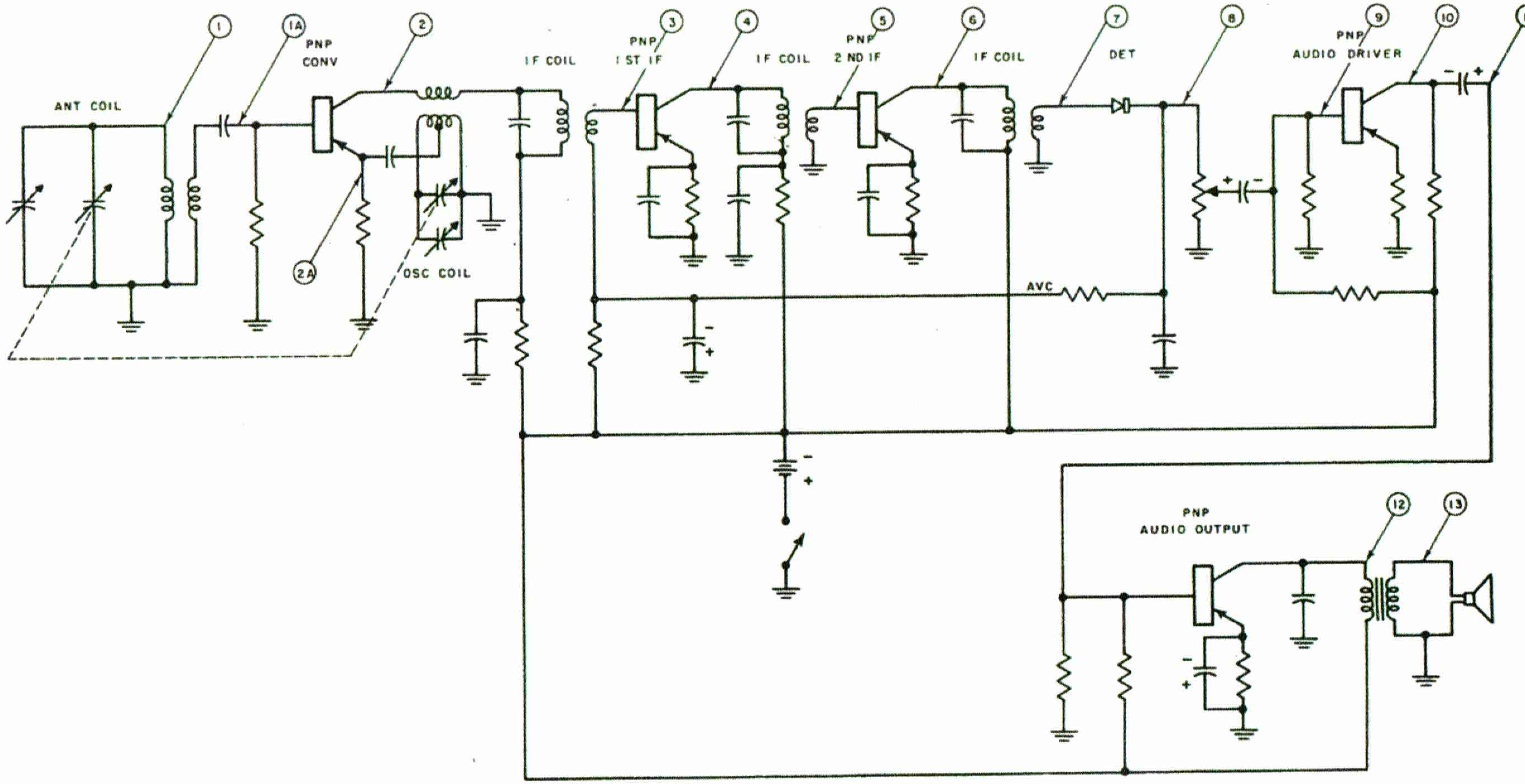


Fig. 1
SIMPLIFIED TYPICAL TRANSISTOR RADIO

The variable condenser is varied until a station is heard on the speaker of the tester. This indicates that the Antenna Coil and variable condenser are functioning properly. If nothing is heard, either Antenna Coil or variable condenser is defective.

Test Point 1A

With the same setup of the tester as in #1, the probe is moved to 1A. Here the signal should be reduced in level. This is because of the stepdown action of the Antenna Coil transformer. Transistors are current amplifying devices and therefore stepdown transformers are used to step down the voltage and increase the current.

Test Point 2

This is the collector of the converter transistor. The radio at this point should be turned on. Two signals are available at this point. The amplified RF signal and a weak IF signal. To pick up the RF signal the tester is set up as for point #1 and the Input probe touched to this point. The variable condenser may have to be retuned slightly for highest output.

To pick up the IF signal, the tester is set up to receive the intermediate frequency. The function selector is set to 200-600 KC REC, the tuning dial is set to the proper frequency, 455 KC or 262 KC. If no IF signal is heard at this point, the local oscillator in the radio is not functioning.

Test Point 2A

This is used for signal injection and will be described later under signal injection.

Test Points 3 - 4 - 5 - 6 - 7

These are IF signal Test points. The tester is set up to receive the intermediate frequency. The input probe is touched to each one of these points in sequence. The Input Gain control should be decreased when proceeding to each succeeding stage of higher gain. It should be noted that when checking the input and output of each IF transformer that a slight decrease in gain will be noted. This is normal and is due to the step down action of the IF transformers. However, if the signal is interrupted at any one of these points, a defective stage is indicated.

Test Point 8

This is the Detector. Audio should be present at this point. The test is set up as an Audio Amplifier. The Function Selector is set to the Audio Amplifier position. Both Input Gain and Output controls are set to maximum. The Input probe is touched to Point 8. Audio should be heard as the radio is tuned. If no signal is heard and point 7 checked out properly, it must be assumed that the crystal diode is defective.

Points 9 - 10 - 11 - 12 - 13

These are also audio test points. The Tester is set up as an Audio Amplifier as for Test Point 8. The Audio Signal can now be traced with the Input Probe from Detector to Voice coil of the speaker. Any interruption of signal would indicate a defective stage or component.

SIGNAL INJECTION

Test Points 8 - 9 - 10 - 11 - 12 - 13

These points are located in the Audio section therefore the Tester is set up as an Audio Generator for signal injection. The Function Selector is switched to the 600 cps Audio position. The Output Attenuator to maximum clockwise position and the MOD switch to the ON position.

As mentioned earlier, when troubleshooting using the signal injection method, the procedure is to start with the speaker and work back to the Antenna. Starting with the speaker, the Output Cable of the tester is connected across the voice coil. A faint but audible 600 cycle tone should be heard in the speaker of the radio. If no tone is heard, the speaker is defective. With a tone present at the voice coil, the Output cable is then moved back to Test Point No. 12 and so on, back to test point 8.

As the Output Cable is moved back toward the Detector, additional gain is picked up. It is therefore recommended that the Output Attenuator be reduced to prevent overloading of the radio. Any interruption of signal as the Output Cable is moved back through the various test points would indicate a defective stage or component.

Test Points 2 - 3 - 4 - 5 - 6 - 7

These are intermediate Frequency test points. The tester is therefore set up as an RF Generator, modulated with a 600 cycle audio tone so that the detected signal can be heard by the speaker of the radio.

The Function Selector is set to the 200-600 KC OSC position.

The Output Attenuator to maximum and the MOD switch to ON. The tuning dial is set to the proper IF frequency either 455 KC or 262 KC.

The Output Cable is connected between point 7 and ground. A tone should be heard from the speaker. If not, the crystal diode is defective.

If a tone is heard from this point, the Output Cable is moved back, point by point to the converter, which is point 2. As the Output Cable is moved back, additional gain is picked up. Therefore the Output Atten. should be reduced to prevent overloading and so that a difference in gain can be noted. Any discontinuity or loss in gain would indicate a defective stage.

Test Point 1. Ant. Coil

The Test is set up as an RF generator at an unused frequency in the middle of the broadcast band. The Function Selector is adjusted to the 500-1600 KC OSC position. The tuning dial to the desired frequency. The MOD switch to ON. The Output Cable should be loosely coupled to the Ant. Coil instead of a direct connection. The radio is then tuned to the same frequency as the Tester. A tone should be heard from the radio speaker. If no tone is heard, the local oscillator is not functioning.

If the tone is weak and is not tunable with the variable condensers, then the Ant. Coil is open.

Test Point 2A

If it is suspected that the local oscillator is not functioning, a substitute RF signal can be substituted for the local oscillator and injected at this point.

The frequency injected must be properly chosen. The frequency used must be 455 KC above the incoming broadcast station. For example, if there is a broadcast station in the area at 1000 KC, the injection frequency should be 1455 KC. The variable condenser in the radio is then varied around 1000 KC for maximum volume.

RF AND IF ALIGNMENT

The Transistor Radio Tester can also be used for alignment.

It is suggested that the radio manufacturer's alignment instructions be used and followed very closely. Alignment procedure of a transistor radio is very similar to that of a vacuum tube radio. However, there are a few peculiarities due to interaction in transistors, therefore a definite sequence of alignment has to be followed. This is best accomplished by using the manufacturer's alignment instructions.

DEFECTIVE STAGE

If a defective stage is found, the stage should be given a good visual inspection first of all, with a magnifying glass, under a good light source. If no broken or unsoldered connections are found, then proceed to make voltage and resistance measurements.

These measurements should be compared with those in the manufacturer's wiring diagram and analyzed to determine the source of trouble. Finally, the Transistor should be removed if it is suspected.

R moving a soldered-in transistor from a printed board is a delicate job and should not be done unless it is almost certain that it is defective. Transistors as a rule don't go bad and should not be immediately suspected.

If the Transistor has to be removed, extreme care should be taken in removing it. Too much heat from the soldering iron may damage it, therefore long nose pliers should be used as a heat sink to conduct the heat from the lead wires. After it is out, it may be checked in the Transistor Test Circuit of this Tester.

Before installing the new or old transistor back into the circuit, the printed board should be cleaned and prepared for the entry of the transistor leads. The reason for these precautions is to insure good solder connections with a minimum amount of heat.

TRANSISTOR BASE CONNECTIONS

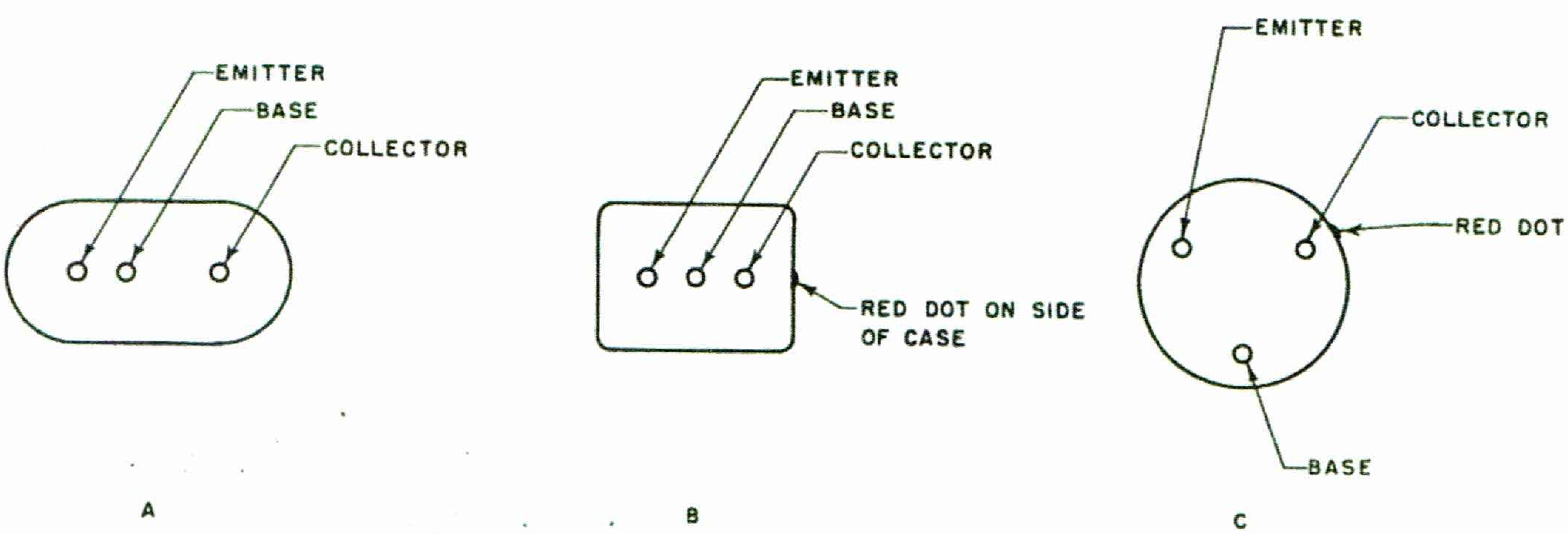


Fig. 2. Bottom view of 3 common types of Transistors

Figure 2 illustrates 3 of the most popular transistor types currently employed in portable radios. The most common type pictured in Figure 2 A, has its base and emitter leads closely spaced at one end of the transistor body while the collector is positioned at the other end. Bearing in mind that the center lead is always the base element, the technician should have little trouble in distinguishing between leads on this type of transistor. Connections for units shown in Figure 2 B and C are determined in a like manner.

SHORT CUTS IN SIGNAL TRACING

After the technician becomes thoroughly familiar with the transistor Radio

Tester, he can save himself a lot of valuable time by applying some of the short cut methods listed below instead of a point-by-point check.

1. The first quick check should be the IF stages because this immediately splits trouble--either the front end is defective or the audio section is defective.

   The tester is set up to receive the IF signal. The Input probe is so sensitive that it need only be held near the IF stages and the IF signal will be picked up and reproduced by the speaker of the tester. Or, if the technician prefers, he can touch each one of the transistor body shields from the top with the Input Probe tip. For each succeeding IF transistor a greater level will be heard from the speaker.

2. The audio section can be signal traced in the same manner as the IF section. In this case, the Tester is set up as an Audio Amplifier and the Input probe tip is touched down on the audio transistor body shields and the audio signal is picked up and reproduced by the speaker of the tester. A suitable ground wire should be connected between the chassis and the tester otherwise hum would be present in the signal. If this method does not work, the technician should check to see if the body shields are grounded.

3. Checking the Ant. Coil for resonance and tracking.

   The tester is set up as a receiver in the Broadcast Band.

   The tuning dial is adjusted to a strong station near the middle of the band. A suitable ground wire connected between the chassis and the Tester.

   The Input Probe tip is held close to the high side of the Ant. Coil. The volume control of the radio should be turned down. The variable condenser in the radio is then adjusted until the signal is at a maximum level. This indicates that the Ant. coil is tuned to resonance. The volume control can now be turned up. If the station is heard, the radio is properly tracked. If the station is not heard or is weak, the receiver is not tracked properly and therefore requires re-alignment.

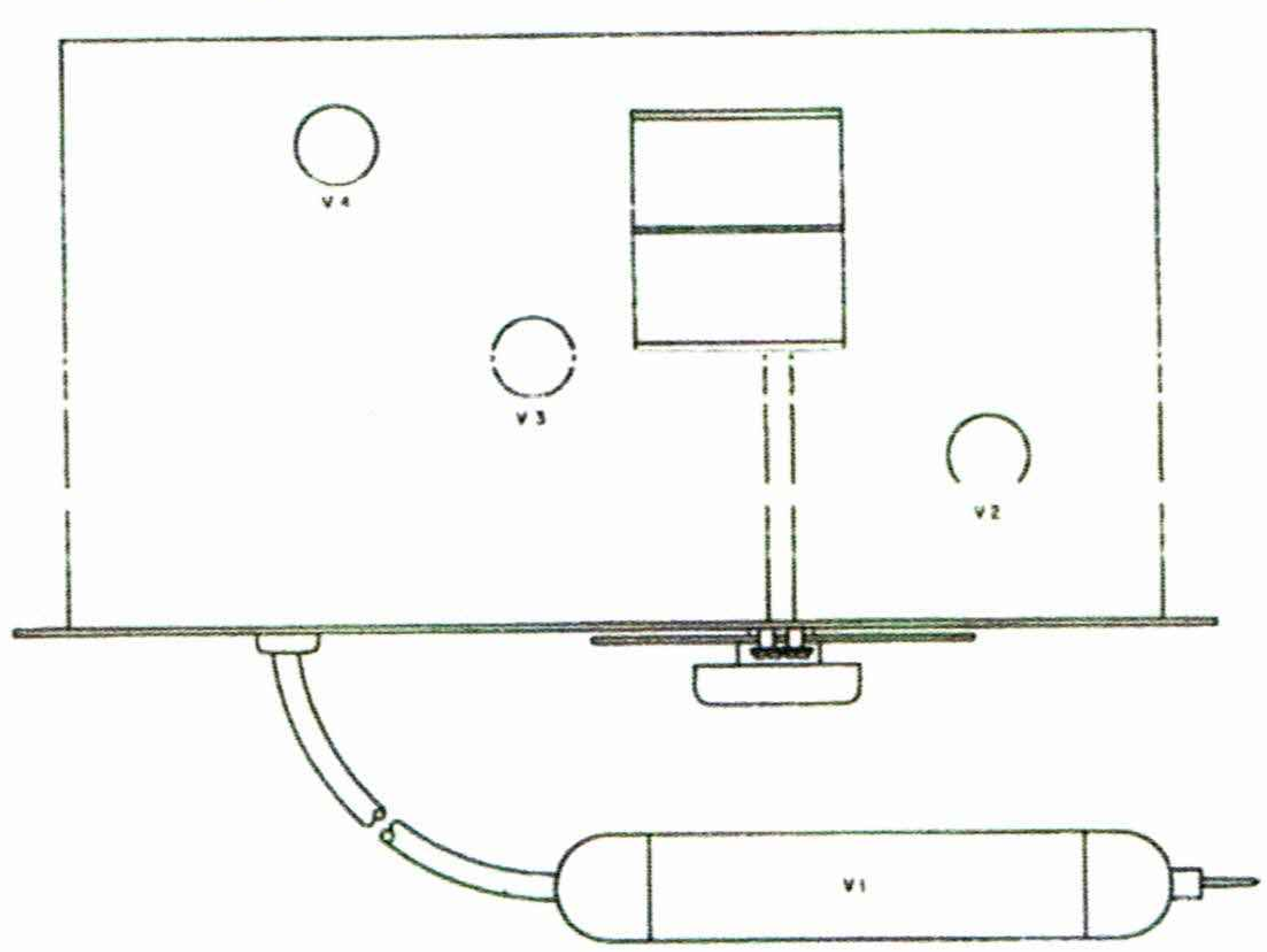


Fig. 3. Illustrates Location of Tubes

MAINTENANCE

In general, the Model 810 Transistor Radio Tester should give long uninterrupted service. Normally, any tube can be replaced with a good standard equivalent tube without the necessity of re-adjustment or re-alignment of the Tester. Figure 3 shows the location of these tubes. It is suggested that if the tester should need maintenance other than routine replacements, the factory service department or one of our authorized service stations be contacted for service or advice.

A wiring diagram is shown in Figure 4 to aid in maintenance work.

Code No. 2490-342

STANDARD EIA GUARANTEE

The Hickok Electrical Instrument Company warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair such instruments which, under normal use and service, disclose the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing any instrument or test equipment which proves to be defective, when returned to us transportation prepaid, within 90 days from the date of original purchase, and provided the serial number has been made known to us promptly for our records.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability, or which have been subject to misuse, negligence, or accident, or which have had the serial number altered, effaced or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories, including all vacuum tubes not of our manufacture, used with this product are not covered by this warranty.

This warranty is in lieu of all other warranties expressed or implied, and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Parts will be made available for a minimum period of five years after the manufacture of this equipment has been discontinued. Parts include all materials, charts, instructions, diagrams, accessories, etc., which have been furnished in the standard model.

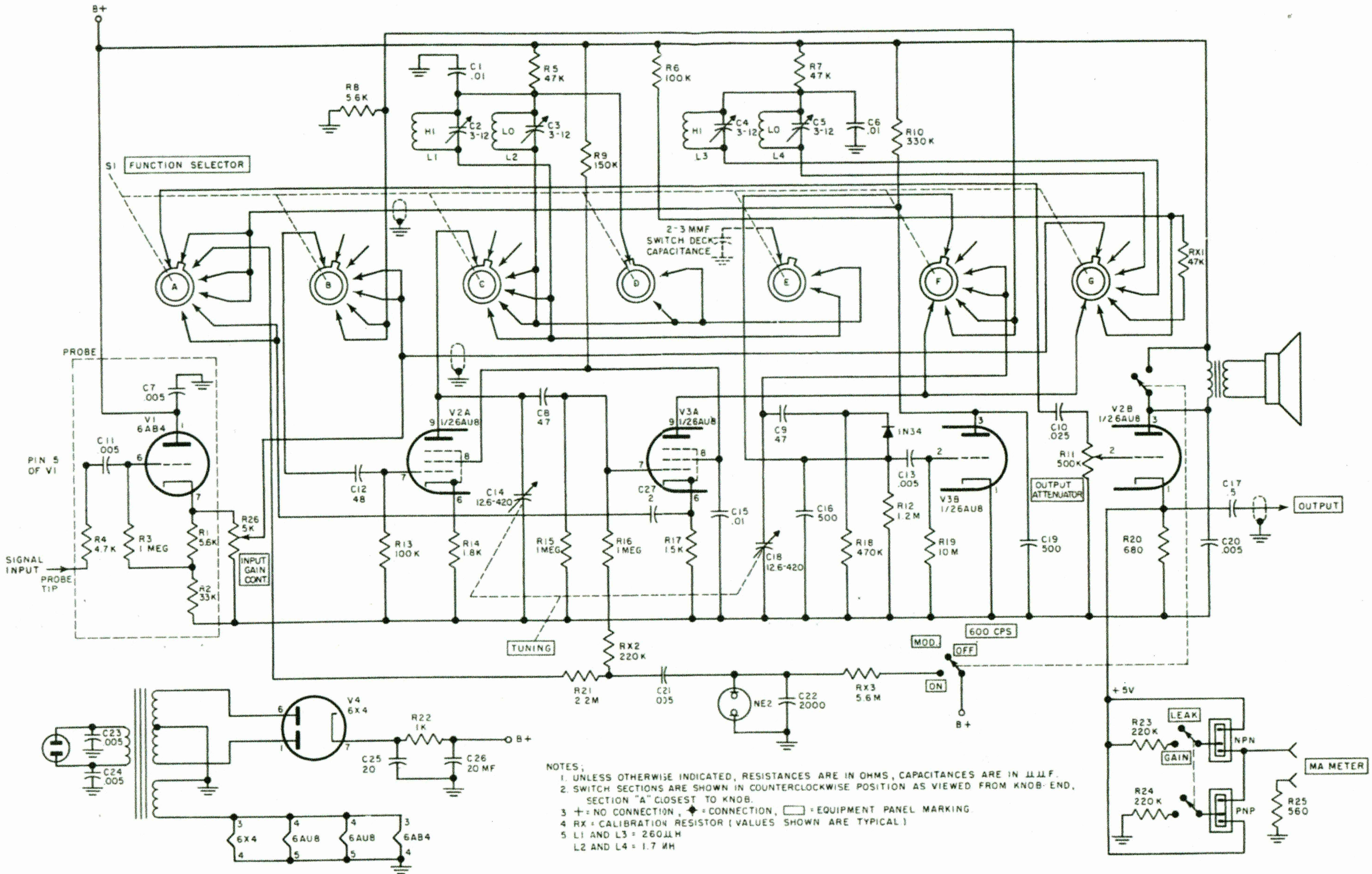
RETURNING EQUIPMENT FOR REPAIR

Before returning any equipment for service, under warranty or otherwise, the factory must first be contacted giving the nature of the trouble. Instructions will then be given for either correcting the trouble or returning the equipment. Upon authorization, this equipment should be forwarded directly to the Hickok factory address, 10636 Leuer Avenue, Cleveland, Ohio, or to a designated service station in your locality. All correspondence pertaining to repairs should be directed to the Hickok office address, 10514 Dupont Avenue, Cleveland 8, Ohio, or to the authorized service station designated.

REGISTRATION CARD

The above guarantee is contingent upon the attached registration card being returned to the factory immediately upon receipt of the equipment.

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
Cleveland, Ohio



NOTES;
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN μμF.
2. SWITCH SECTIONS ARE SHOWN IN COUNTERCLOCKWISE POSITION AS VIEWED FROM KNOB-END, SECTION "A" CLOSEST TO KNOB.
3 + = NO CONNECTION, ✦ = CONNECTION, ▭ = EQUIPMENT PANEL MARKING
4 RX = CALIBRATION RESISTOR (VALUES SHOWN ARE TYPICAL)
5 L1 AND L3 = 260μH
L2 AND L4 = 1.7 MH

DRAWING NUMBER
929 W

TRANSISTOR RADIO TESTER

SCHEMATIC WIRING DIAGRAM - MODEL 810

DRAWN & TRACED		CHECKED	APP'D	DATE
LDD	RB	RRS	WJC	9-4-58

THE HICKOK ELECTRICAL INSTRUMENT CO.
CLEVELAND, OHIO

NOTES on test equipment

informative reports from the lab

by Les Deane

New Radio Troubleshooter

Keeping pace with the ever-expanding electronic servicing field, Hickok Electrical Instrument Co. of Cleveland has recently introduced a new bench instrument specifically for troubleshooting transistor radios. Doing one of the jobs it was designed for in Fig. 1, the Model 810 Transistor-Radio Tester is actually a signal generator, an AM receiver substitute, and a transistor checker all rolled into one neat package.

Applications of the tester are not necessarily limited to transistor radios, however, and it may also be used in servicing tube-type receivers as well as auto radios.

Specifications and features are:

1. Power Requirements—105/125 volts, 50/70 cps; power consumption approximately 25 watts.
2. RF Output—audio modulated or unmodulated frequency ranges of 200 to 600 kc and 500 to 1600 kc; output impedance 180 ohms.
3. Radio Substitute—tuned receiver covering an IF band of 500 to 1600 kc; and an RF band of 500 to 1600 kc; cathode-follower prove provided; input impedance 5 megohms shunted by approximately 4 mmf; sensitivity 200 uv.
4. Audio Output — 600-cycle sawtooth, variable from 0 to 2 volts p-p across 180-ohm load; modulation switch provided on panel.
5. Audio Substitute—AF amplifier with cathode-follower input and built-in speaker; input probe resistance 5 megohms.
6. Transistor Test — checks both p-n-p and n-p-n transistors for leakage and relative gain when used with low-range milliammeter.
7. Size and Weight—9" x 11¼" x 7", 11¼ lbs.

One can probably visualize many uses for the Model 810 from the specifications alone, but to really become acquainted with a new instrument of this type, you should understand its operating principles. When I first examined this piece of equipment and took a look at the function selector, I immediately wanted to find out how it worked.

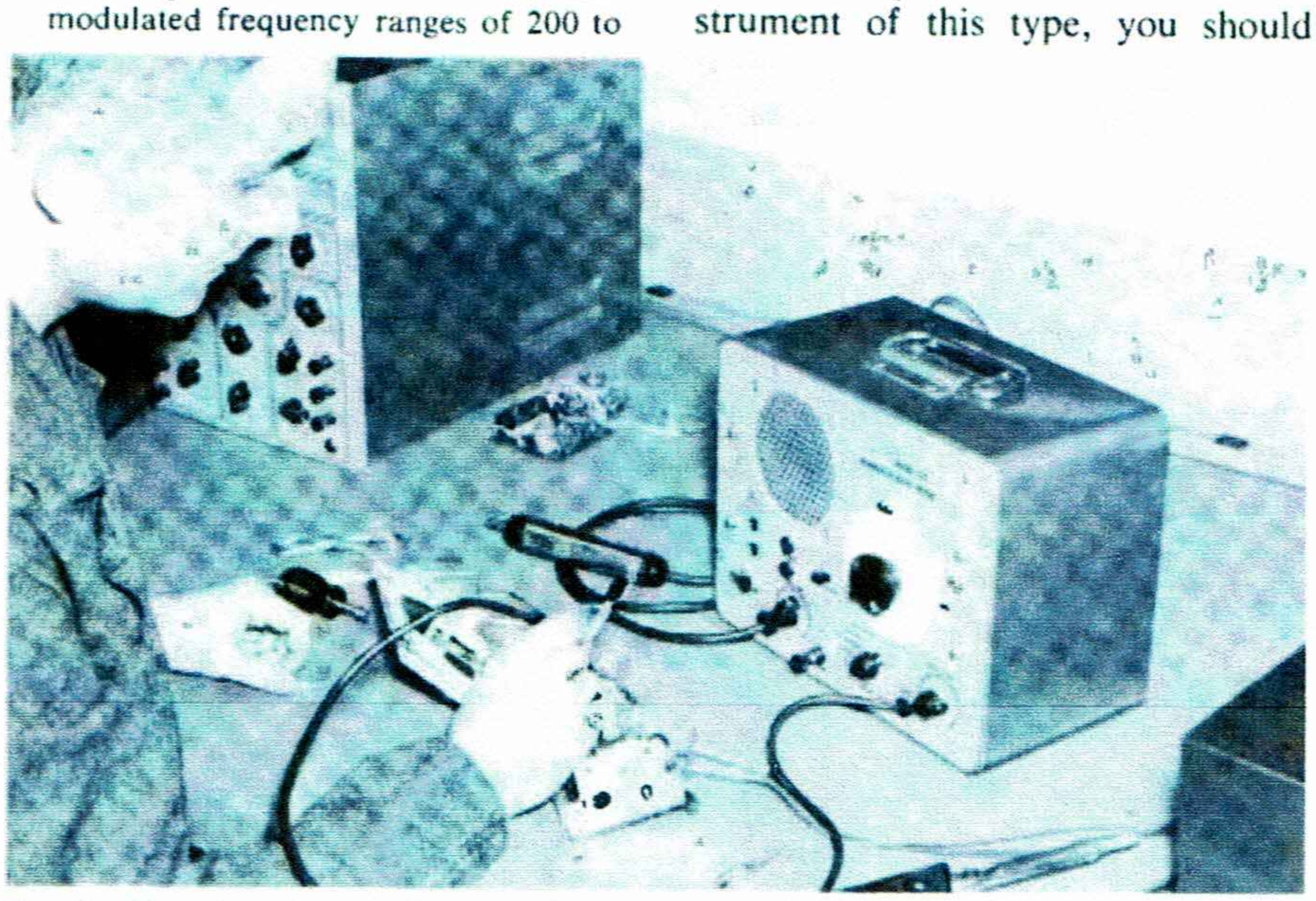


Fig. 1. Signal-tracing, substitution, and alignment of transistor radios is easy with Hickok's Model 810, which also featuers a test circuit for transistors.

Although the tester is basically a service instrument for transistorized equipment, its circuitry employs four vacuum tubes — one 6AB4, two 6AU8's, and a 6X4 power rectifier. This complement represents six separate stages; however, certain stages are used for more than one application, depending on the setting of the function selector.

The function switch has six positions. In one, labeled 500-1600 KC REC., the instrument operates as a complete AM radio, covering the standard broadcast band and reproducing sound on a built-in 4" speaker. Stages involved in this arrangement are shown in the block diagram of Fig. 2A.

The input to this substitute receiver consists of a cathode-follower triode stage housed in a probe at the end of the input cable. The probe may be connected to the RF circuits of a radio under test or, with the use of a 3' length of wire, used as an antenna itself. A gain control is also found in the output of this first stage.

The two RF amplifiers (V2A and V3A) are plate-tuned over a range from 500 kc to 1600 kc by varying the tuning dial on the front panel. Since an intermediate frequency is not used, the circuit operates as a simple TRF receiver.

Audio detection is accomplished by a 1N34 crystal diode which, in turn, supplies a grid signal to the AF amplifier V3B. In the final stage, an attenuator control located on the front panel varies the output signal to the tester's built-in speaker. For this function, the modulation switch is placed in its off position, automatically connecting the speaker across the output circuit.

Turning the function switch to the position marked 200-600 KC REC., the instrument is again operated as a TRF receiver, except that the plate circuits of V2A and V3A (Fig. 2A) are tuned to a range covering the two common IF radio frequencies of 262 kc and 455 kc. Incidentally, with the tester operating in this manner, you can also pick up aircraft weather signals, which are transmitted in this frequency band.

Selecting another function of the

Model 810, I placed the switch in its 500-1600 KC OSC. position, operating the unit as an RF generator. Making use of the stages shown in Fig. 2B, tube sections V2A and V3A form a multivibrator-type RF oscillator. The output frequency is made variable by employing the same tuned circuits used in the TRF receiver setup. The dial on the panel thus selects the generated signal, which is then coupled to the output cable by way of the cathode follower V2B. If desired, the RF output can be modulated with a 600-cycle tone by merely flipping the MOD. switch to its on position. I will describe this modulation source presently.

With the function selector in the position designated as 200-600 KC OSC., the generator circuit of Fig. 2B automatically falls into a tuning range covering the intermediate radio frequencies. This signal, too, can be modulated or unmodulated and used for either signal injection or IF alignment purposes.

The block diagram of Fig. 2C represents operating circuits of the tester when set up as an audio amplifier. In this case, the function switch is in the AUDIO AMPL. position, and the modulation switch is turned off. This functional arrangement is used for complete signal tracing of the audio section of a radio, or as an auxiliary amplifier in itself. An input signal of 10 millivolts or more will normally produce a good aural indication from the instrument's speaker.

Placing the function switch in its one remaining position, namely 600 CPS AUDIO, I discovered that the unit operated as a simple audio oscillator or generator. The stages involved are shown in the block diagram of Fig. 2D. The relaxation oscillator, operating from the B+ supply, consists basically of an NE2 neon bulb, a .002-mfd charging capacitor, and a 5.6-megohm limiting resistor. The fixed frequency of the oscillator is 600 cycles, and its output waveform is sawtooth in nature.

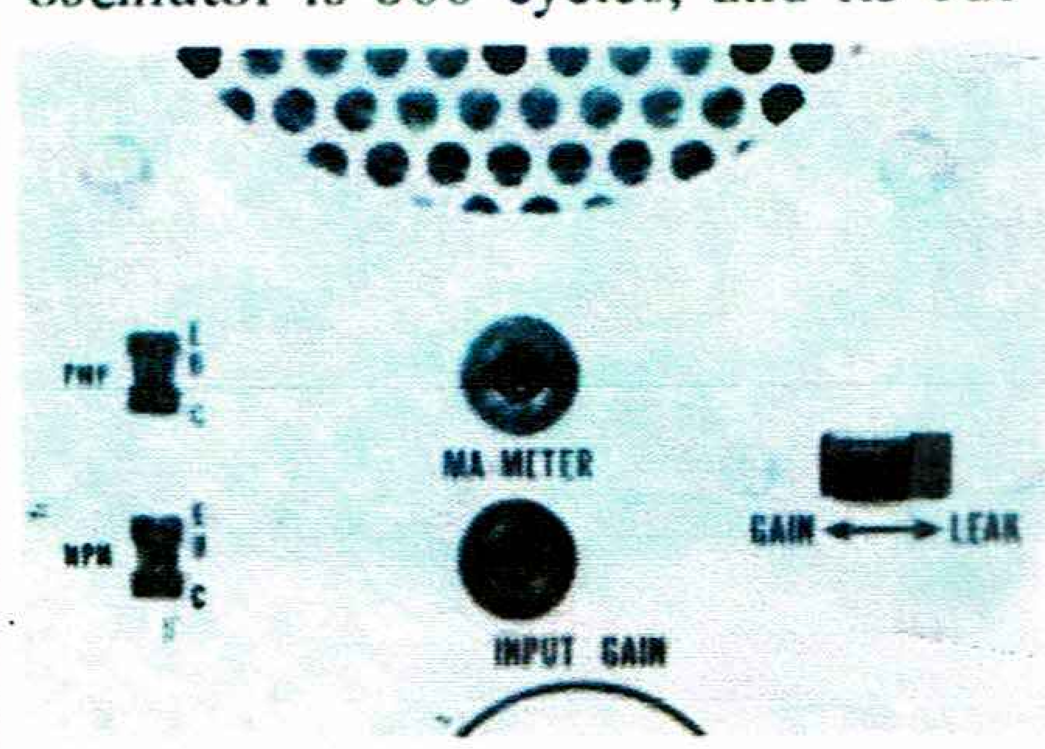


Fig. 3. Front panel provisions of the Hickok tester for checking transistors.

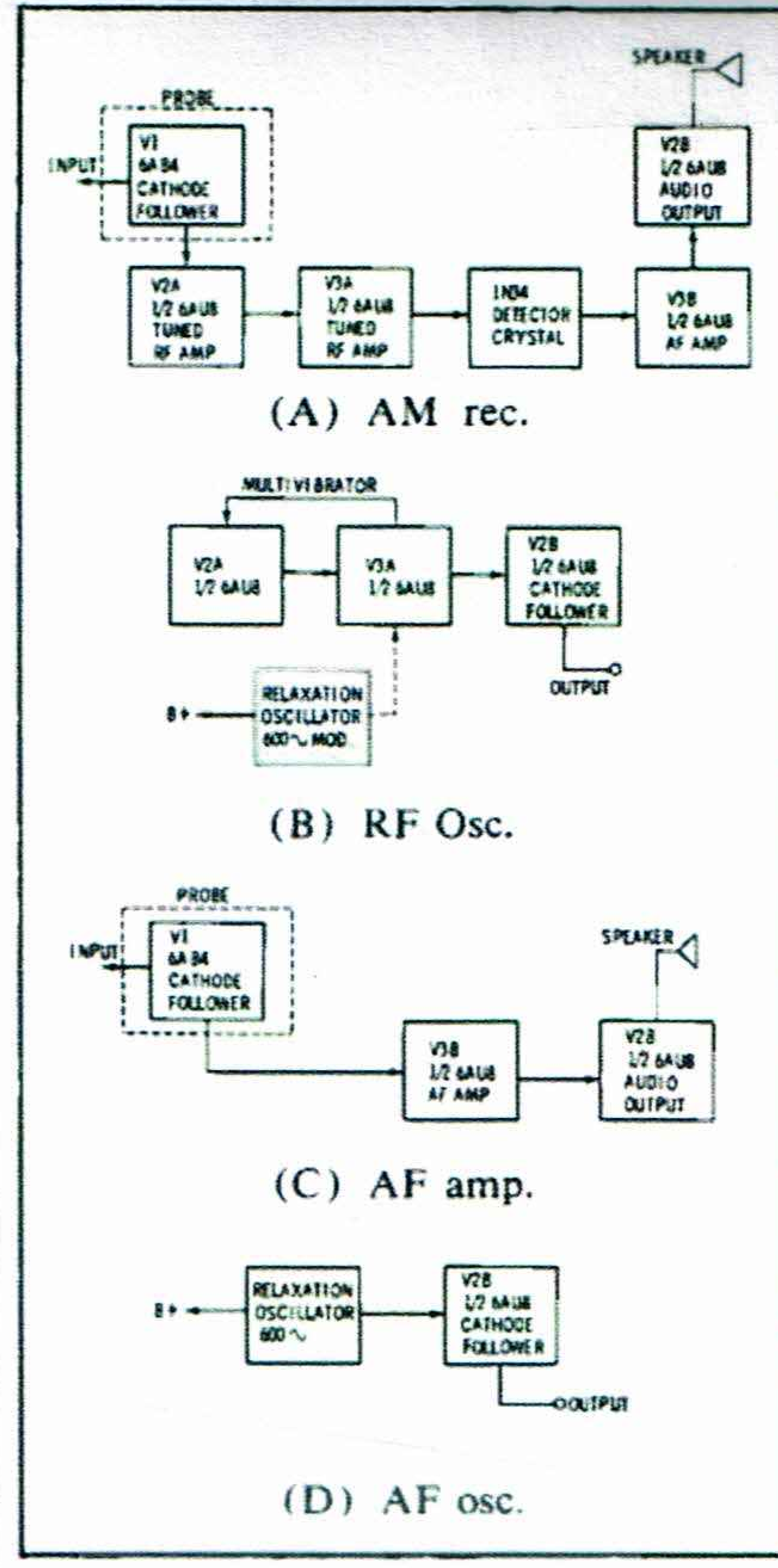
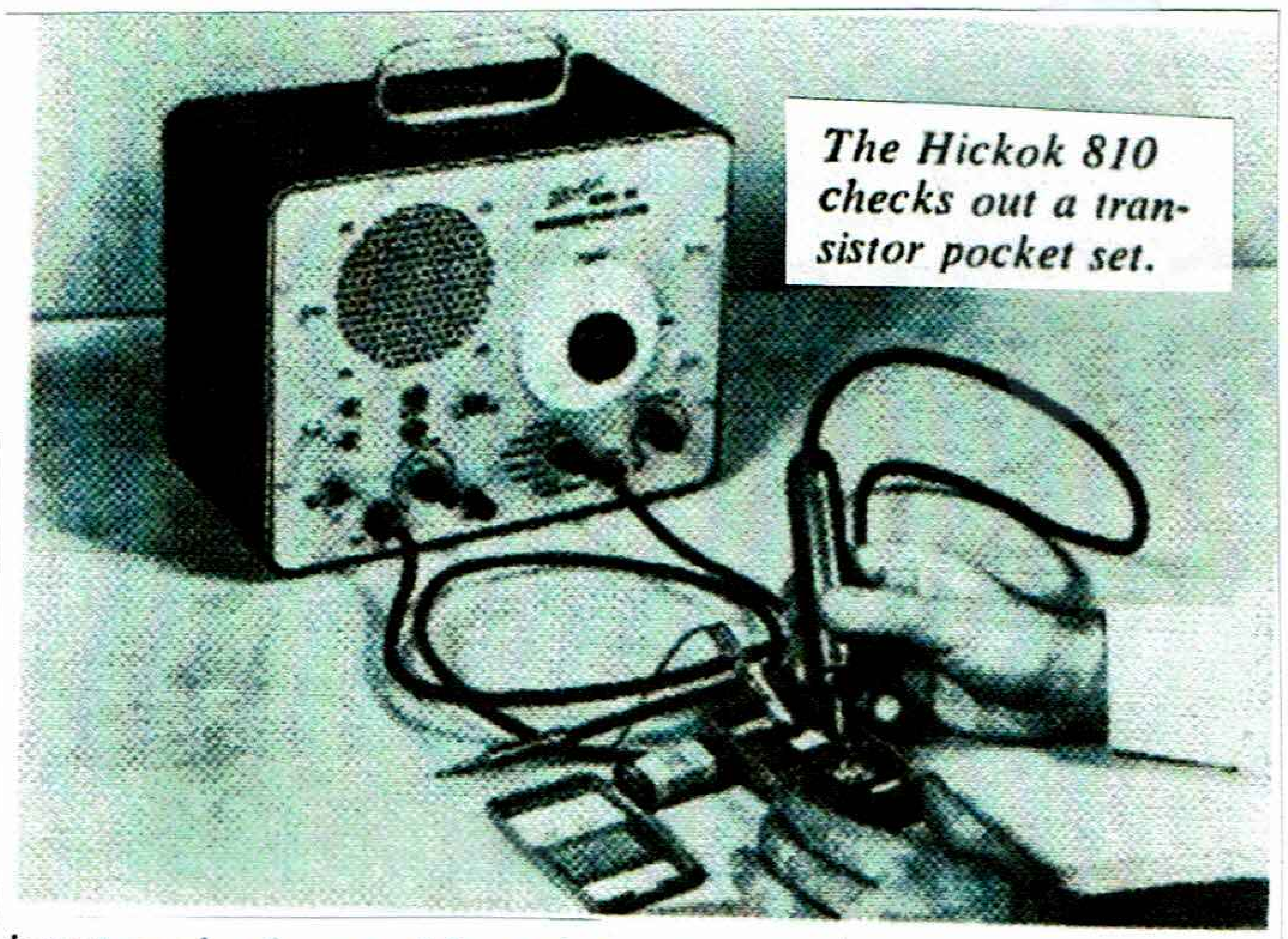


Fig. 2. Block diagrams of Model 810.

For this phase of operation, I also found it necessary to place the MOD. switch in its "on" position, thus applying B+ to the oscillator circuit and shorting out the instrument's speaker at the same time. As shown in Fig. 2B, this same relaxation oscillator is used to modulate the output frequency when the instrument is used as an RF or IF signal generator. The cathode follower V2B offers a low-output impedance, which makes it suitable for driving transistor circuits.

Aside from the signal-tracing and signal-injection functions of the Model 810, it also provides a test circuit for transistors. As shown in Fig. 3, two test sockets, a positive and negative meter jack, and a leakage-gain switch are located on the front panel directly below the speaker grille. In addition to the test circuits, a separate milliammeter must be plugged into the panel jacks and used as an indicating device. The instrument's manual gives step-by-step instructions for checking transistors, as well as general hints on servicing transistor receivers.



The Hickok 810 checks out a transistor pocket set.

Hickock 810

THE HICKOK MODEL 810 TRANSISTOR-Radio Tester is one of the most versatile AM radio test instruments made for the technician since the pre-war Meissner Analyst and the RCA-Rider Chanalyst. It is designed especially for servicing transistor radios but is equally useful for tube-type home and auto broadcast receivers.

The 810's functions include audio, i.f. and rf signal tracing; audio, i.f. and rf signal injection; generating signals for i.f. and rf circuit alignment, and transistor testing. The four-tube unit has a 6AB4 cathode-follower probe to minimize tuned-circuit loading, 6X4 full-wave rectifier and a pair of 6AU8 triode-pentodes. The pentode sections are used as rf oscillator and tuned rf amplifiers for signal tracing. The triode sections are used as af amplifier and cathode follower af and rf output.

The main control is the FUNCTION SELECTOR. When it is in the 500–1600 KC OSC or 200–600 KC OSC positions, the tester is an rf signal generator covering those ranges. The rf or i.f. output—either modulated or not—is used for signal injection and circuit alignment. The signal level is set by the output attenuator in the grid circuit of the output cathode follower.

Throwing the switch to 500–1600 KC REC converts the circuit to a trf receiver for signal-tracing broadcast antenna and rf circuits or for use as a wide-band AM radio. In the 200–600 KC REC position, the function switch converts the 810 to a i.f. signal tracer or to a simple receiver capable of receiving aircraft weather and other broadcasts in this range. The input sensitivity of the trf circuit is around 200 μv on both bands.

When using the 810 as a signal tracer, you can follow a signal from antenna to speaker. You simply move the input probe from grid to plate, stage by stage, until the signal disappears, weakens or distorts. The defective stage is the one that produces the faulty signal at its output.

The 600 CPS AUDIO position of the function switch converts the tester to a 600-cycle sawtooth audio oscillator when the modulation switch is on. The tone generator is an NE-2 neon lamp connected as a relaxation oscillator. Level is controlled by the output attenuator.

The AUDIO-AMPL position connects the input probe to a two-stage audio amplifier for signal tracing in audio circuits. The amplified signal is heard in the 810's built-in speaker. Output level is controlled by the INPUT GAIN and OUTPUT ATTEN controls.

A simple transistor tester is an added feature of the 810. Two sockets, for n-p-n and p-n-p transistors, a pair of meter jacks and a GAIN-LEAK switch are on the front panel. The transistor to be checked is plugged into the correct socket—either directly or through small wire leads with alligator clips on one end. The switch is thrown to LEAK and a milliammeter plugged into the jacks. (A 2-ma meter or the equivalent range of a vom may be used.) The meter now reads leakage current.

When testing low-power transistors, leakage current may run as high as 150 μa but generally it will be lower. Erratic or higher leakage currents generally indicate a defective transistor.

Throwing the switch to GAIN should double the meter reading. A gain reading more than twice the leakage reading indicates that the transistor has extremely high gain. When comparing transistors, the best of the group will have the lowest leakage and highest gain readings.

The leakage current of power transistors may run as high as 1 ma, and the gain factor will only be around 30%. A typical power transistor may have a leakage current of 700 μa and a gain reading of 1 ma.—*Robert F. Scott*

SPECIFICATIONS

Frequency ranges (trf receiver or rf signal generator):
Band 1—200 to 600 kc
Band 2—500 to 1600 kc

Audio signal output: 600-cycle sawtooth, 0 to 2 volts p-p

Audio amplifier: 10 mv input produces audible signal from speaker

Input impedance (cathode follower probe): 5 megohms and 4 pf

Output impedance (rf and audio): 180 ohms

Power input: 105–125 volts, 50-60 cycles. 25 watts at 115 volts

Dimensions: 11¼ inches wide, 9 inches high, 7 inches deep

TRANSISTOR RADIO ANALYZER

MODEL 810

FEATURES:

- *A THREE-IN-ONE TESTER*
- *A Signal Generator—RF, IF and Audio*
- *A Signal Tracer—RF, IF and Audio*
- *A Transistor Tester*

The Hickok Model 810 Transistor-Radio Analyzer has been specifically engineered to fill the need for a time saving instrument necessary to profitable transistor and radio servicing. It has been designed to provide fast, accurate servicing of miniaturized printed circuit, transistorized units. Using the familiar signal tracing method, it quickly checks stage gain and circuit performance, swiftly locates trouble—without slow disconnecting and resoldering—eliminating the chance of damaging "good" transistors in the process. High gain (4 stages) permits probing without the need for actual circuit contact in many cases.

It is ideal for other service jobs, too—servicing small AC-DC portables, audio amplifiers and hard-to-reach automobile radios.

Technical Specifications

TUNED RECEIVER:

- 200-575KC for troubleshooting IF stages
- 550-1600KC for troubleshooting RF stages
- Audio Amplifier for signal tracing audio stages
- Loudspeaker used as signal tracer indicator
- Exclusive cathode follower type signal tracing probe provides minimum loading effect (5 megohms at 5 $\mu\mu f$)

AM SIGNAL GENERATOR

- 200-575KC AM Generator for IF alignment
- 550-1600KC AM Generator for RF alignment
- 600 cycle audio output
- Low Impedance, cathode follower output for effective signal injection into low impedance transistor circuits.

TRANSISTOR TESTER

- Transistor Checking Circuit: Checks leakage and gain

CASE SPECIFICATIONS:

- Furnished in an attractive portable steel case with aluminum panel, 11¼" W, 9" H, 7" D. 11 pounds net.

POWER REQUIREMENTS:

105-125 volts, 50-70 cycles—approximately 20 watts. Furnished complete with instruction book, with simplified schematics and step-by-step instructions for use of the instrument.