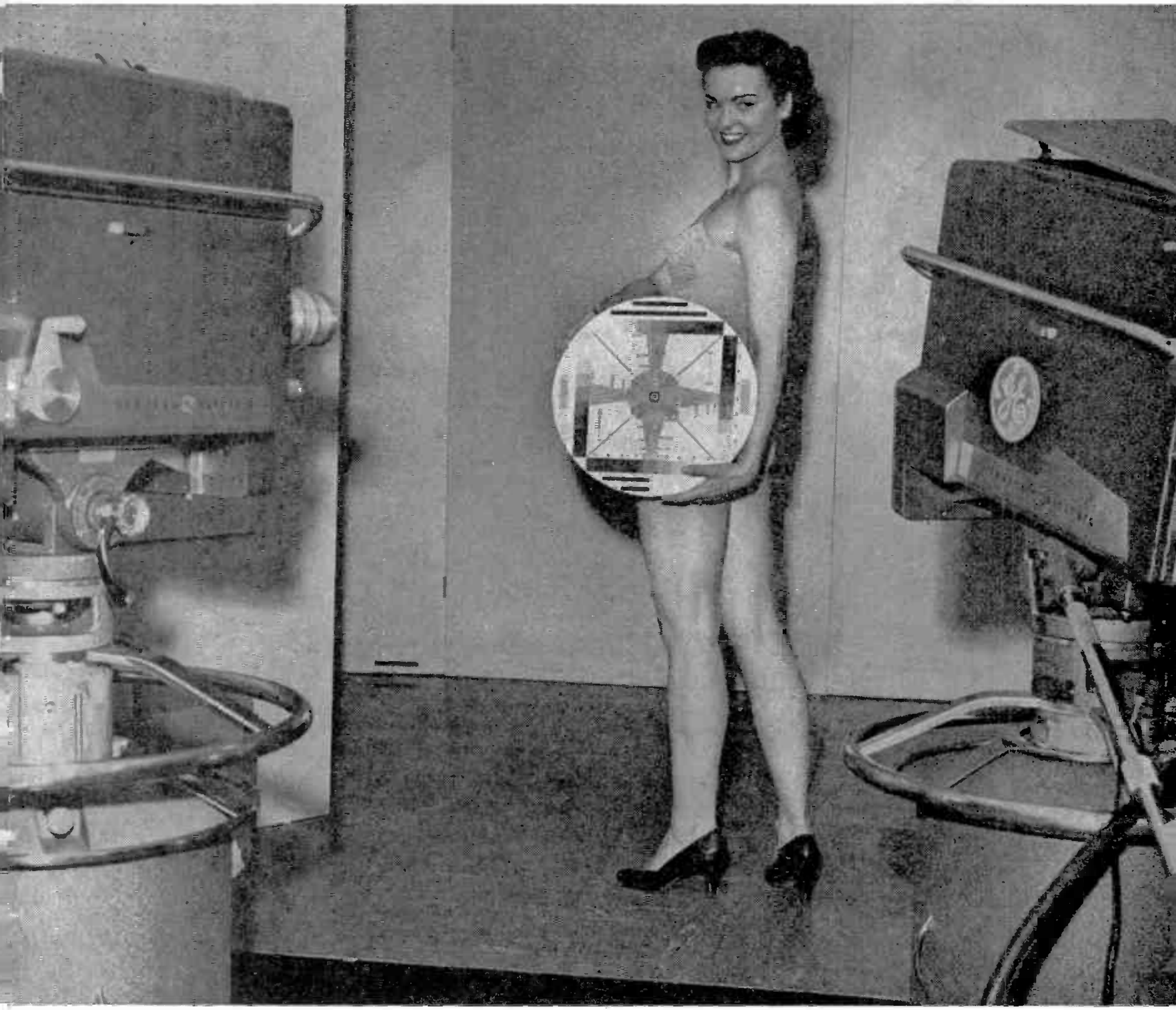
National RADIO-TV NEWS



IN THIS ISSUE

Analyzing an Auto Radio Receiver

How to Use the NRI Professional Signal Tracer

Alumni Association News

Aug.-Sept. 1954

VOL. 16 No. 4

A FUNDAMENTAL RULE TO SUCCESS

PAUL TALBOT in his column "The Backyard," appearing in *United Business Service Bulletin*, recently eulogized Marshall Field as the brightest name on the honor roll of retail merchandising. Mr. Talbot said, "His great Chicago store, which is a living memorial to his genius, is due mainly to his constant adherence to a few simple fundamentals—like this one."

" 'Those who enter to buy, support me. Those who come to flatter, please me. Those who complain, teach me how I may please others, so that more will come. Only those hurt me who are displeased but do not complain. They refuse me permission to correct my errors and thus improve my service'."

Teaching, learning and practicing Radio and Television Servicing is very similar to running a department store—where the idea is to satisfy every customer.

This very simply expressed philosophy places utmost emphasis on service. Anyone can make a mistake, but unfortunately too many people are afraid to *admit* having made one.

In the past forty years in which NRI has served our students and graduates, we have learned many times of mistakes we have made. We are displeased with ourselves when we make a mistake—but we do appreciate having it called to our attention! Our aim is always to put the interest of our students and graduates first.

I unhesitatingly recommend to you this bit of Marshall Field's philosophy as a sound basis for building your own success and future.

J. E. SMITH, *President.*

Analyzing An Auto Radio Receiver

By J. B. STRAUGHN

Technical Editor, National Radio-TV News

J. B. Straughn

STUDY of a complete receiver is always interesting. Not only do you get a chance to check your knowledge of circuit actions but you also have an opportunity to learn the functions of new circuits and to get a different slant on receiver operation.

Even a beginner just starting his studies will find an analysis of receiver operation helpful in understanding future lessons. In this article we are going to analyze an auto radio — the Motorola Model 503.

General Description: (See schematic, Figure 1.) The Motorola Model 503 is a compact automotive type superheterodyne receiver with self-contained speaker. The receiver is designed for installation in any car when used with the appropriate Motorola control head. Flexible shafts on the control head operate the volume control, on-off switch and the tuning. The receiver is supplied with power from a six-volt storage battery and uses miniature type 6.3 volt tubes. The B supply is produced with the aid of a vibrator, a power transformer, a tube rectifier, and the usual filter system.

The tube complement consists of a 6BA6 rf amplifier, a 6BE6 converter, a 6BA6 i-f amplifier, a 6AT6 detector, AVC and AF amplifier, a 6AQ5 power amplifier and a 6X4 high vacuum rectifier, with indirectly heated cathode.

RF gain or sensitivity is obtained by means of the rf amplifier, the frequency converter and one stage of i-f amplification. AF gain is obtained from one voltage amplifier and the output power amplifier stage. A PM speaker is used.

Tracing Signal Circuits: The signal picked up by the antenna causes a current to flow through condenser C1 which is not only in the antenna circuit but is also in the first tuned circuit feeding the rf amplifier tube. This is a form of capacity coupling to the antenna, in contrast to the more usual inductive coupling found in many home receivers.

The voltage applied to C1 is stepped up by resonance in the tuning circuit consisting of C3, L1, C2 and C1. The resonant signal appearing across RF trimmer condenser C3 is applied directly to the control grid, pin 1, of the 6BA6 rf amplifier and to the cathode through resistor R2.

The plate circuit of the RF tube is tuned to the resonant frequency by means of L2 and trimmer C4. At the resonant frequency a large signal will be developed across this plate load and will be transferred through condenser C5 to the mixer grid, pin 7, and through C10 and the cathode coil to the cathode of the 6BE6 converter tube.

Frequency Converter: The local oscillator produces a signal for frequency conversion. The oscillator electrodes in the 6BE6 tube are the cathode (pin 2), the oscillator control grid (pin 1), and the oscillator anode (pin 6).

When the oscillator is working we have a variation in the electron stream passing through the oscillator cathode to the plate of the tube. When the incoming signal voltage is applied to the mixer grid (pin 7), the electron stream is again

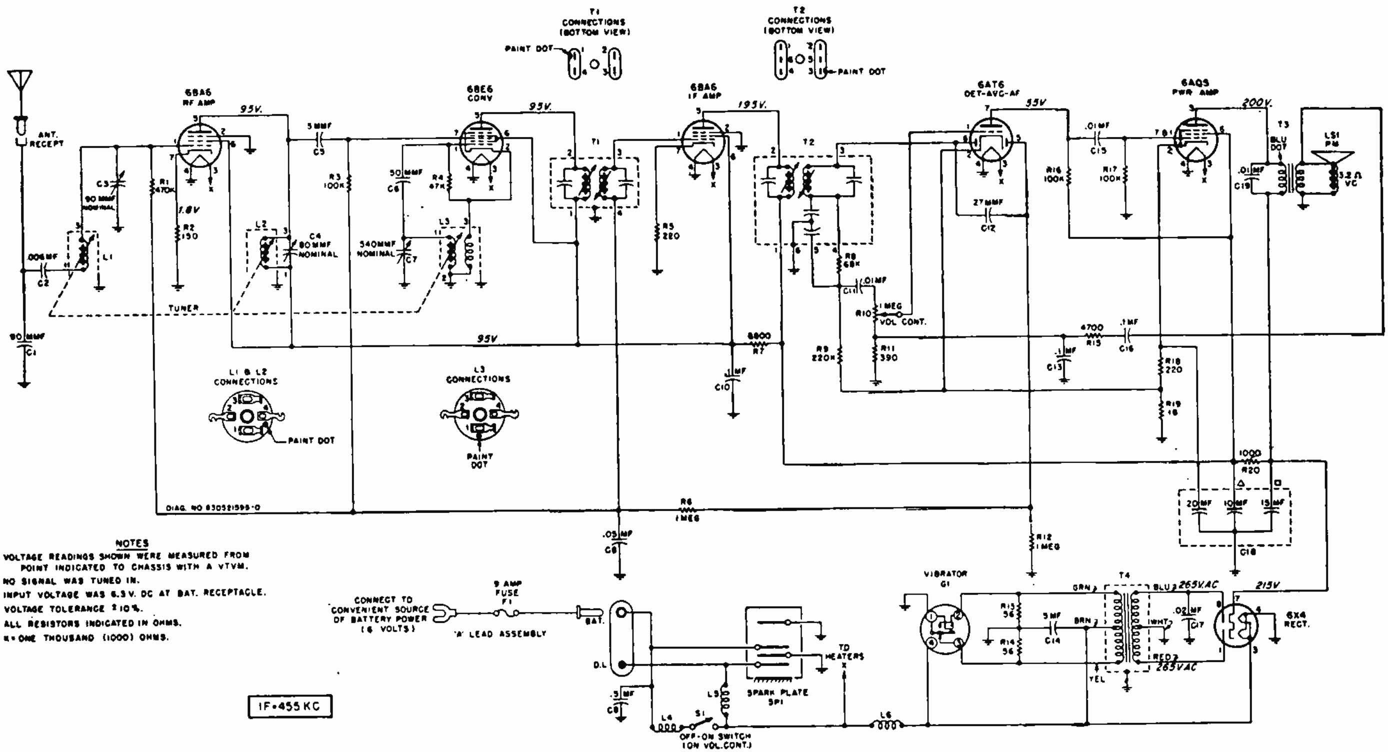


Fig. 1. Schematic diagram of Motorola Model 503 auto receiver.

NOTES
VOLTAGE READINGS SHOWN WERE MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM.
NO SIGNAL WAS TUNED IN.
INPUT VOLTAGE WAS 6.3 V. DC AT BAT. RECEPTACLE.
VOLTAGE TOLERANCE ±10%.
ALL RESISTORS INDICATED IN OHMS.
K=ONE THOUSAND (1000) OHMS.

caused to vary, this time at the signal frequency. Mixing of the two signals takes place in the tube which acts as a detector because of the grid bias voltage produced across oscillator grid resistor R4.

The oscillator frequency is always above the frequency of the incoming signal by the amount of the intermediate frequency, which in this case is 455 kc.

Because of the operating point of the Eg-Ip characteristic curve of the tube established by the bias across R4, a beat frequency is produced in the plate circuit. The resulting 455 kc beat builds up a large circulatory current in the primary of transformer T1. All other frequencies, such as the sum of the oscillator and incoming signal frequencies, the oscillator signal alone and the incoming signal alone, cause only a slight current flow in the primary of the i-f transformer. All signals, including the i-f signal, are returned to ground through plate bypass condenser C10.

I-F Amplifier: By mutual induction, an i-f signal is induced into the secondary of transformer T1, and the resonant i-f signal voltage appears across the secondary coil and its tuning condenser. This signal is applied between the control grid and cathode of the 6BA6 i-f tube, the cathode connection being through condenser C8 and resistor R5.

Because of resonance, a high circulatory current flows in the primary circuit of T2 and produces an i-f voltage across the primary of T2, greatly amplified with respect to the input signal. A signal voltage is induced into the secondary of T2 which is large enough for detection.

Second Detector: The diode plate 6 of the 6AT6 tube is used for detection. When the applied signal makes this plate positive electrons flow from the cathode to the plate through the secondary of transformer T2, through i-f filter resistor R8 and diode load resistor R9 back to the cathode.

The rectified signal appears across diode load resistor R9. This is a combination of DC and the AF signal. The filter, consisting of R8 and the two small bypass condensers inside the shield can for i-f transformer T2, serves to remove the i-f signal from the diode output so that it does not appear across the diode load resistor. The audio portion of the signal across this resistor is applied through coupling condenser C11 and resistors R19 and R11 to the volume control.

First AF Stage: The audio signal is fed from the variable tap on the volume control to the grid of the 6AT6 tube. By changing the position of the slider arm on the control, any amount of the available signal across R10 may be applied to the grid of the tube.

The resulting audio variations in the 6AT6 plate current cause a large audio signal voltage to be built up across plate load resistor R16. This signal appears across R17 and is applied directly to the grid of the 6AQ5 and to its cathode through the 20 mfd cathode bypass condenser.

Power Output Stage: The signal voltage applied to the input of the 6AQ5 tube is amplified and we now have a very large signal current flowing through the primary of output transformer T3. The turns ratio of the transformer matches the voice coil impedance to the tube plate impedence. The voltage induced into the secondary and the resultant current flow through the voice coil causes the voice coil and attached cone to move in and out in step with the audio signal, and in this way the cone produces sound waves.

Signal Circuit Features: From the diagram, it can be seen that the receiver is not equipped with a tuning condenser gang. Instead, tuning is accomplished by varying the inductance of the coils in the antenna circuit, in the plate of the rf tube and in the oscillator tank circuit. The inductance is changed by iron cores which are ganged together and which are moved in and out of their respective coils.

When the cores move into the coils, the inductance increases, causing the circuits to resonate at a lower frequency. When the cores are withdrawn the inductance decreases and the circuits are tuned to a higher frequency. The circuits are peaked to resonance by adjusting trimmer condensers C3, C4 and C7 and by adjustment of the cores of L1, L2 and L3.

By proper choice of the L-C values in the rf and oscillator circuits, tracking between the oscillator and preselector is constant across the dial.

Variable inductance tuning is used in auto sets in preference to ganged tuning condensers because the latter may change capacity due to road shocks.

Low impedance capacity coupling is used in the antenna circuit. This consists of coupling the antenna directly to the junction of the low side of the tuning inductance and the "hot" side of coupling condenser C1 which is connected to ground. The voltage across this coupling condenser is multiplied by the resonance phenomena of the tuned circuit to give appreciable voltage at the grid of the tube.

The circuit is particularly adapted to receivers that must use a high-capacity shielded lead-in such as an automobile receiver. In such a circuit, the shielded lead-in is made part of the coupling capacity because of the circuit arrangement and, practically speaking, causes no loss in voltage as would be occasioned if this capacity would be connected directly across a high-impedance primary. It is of course necessary that the shielded lead-in have a good power factor or else the losses in the lead will slightly reduce the effective Q of the circuit, thereby bringing down the gain in the antenna coil by a corresponding amount.

This type of coupling results in high gain and excellent image-ratio. To obtain good tracking, the value of the capacity in the tuned circuit is made approximately equal to the antenna coupling capacity. This is indicated in the schematic.

Notice that bypass condensers are not used across the bias resistors for the rf and i-f tubes. They were omitted so that a certain amount of degeneration could occur across these resistors thus stabilizing the circuits and avoiding any tendency toward oscillation.

The diagram shows that a portion of the signal across the loudspeaker voice coil is fed back into the grid circuit of the 6AT6 tube. The signal is phased so that it opposes the applied signals. The overall effect is to slightly reduce the signals applied to the input of the 6AT6 tube. Of course any signals present in the output which are not also present in the input will receive a great deal of degeneration and these undesired signals which would otherwise cause distortion will undergo a great reduction in value.

The presence of the network consisting of C16, R15, and C13 in the feedback circuit shows that more degeneration will occur at the lower frequencies than at the higher frequencies. At low frequencies C13 which shunts R11 will have a relatively higher reactance. As the frequency of the signal at the voice coil increases the combined reactance of R11 and C13 will decrease and a smaller proportion of the signals will appear across R11 for degenerative purposes.

Condenser C19 connected across the primary of the output transformer reduces the high frequency response and also prevents parasitic oscillation in the output stage. The plate load, because of this condenser, is essentially capacitive at the high audio frequencies at which such oscillation would normally occur.

The AVC System: The avc circuit is somewhat different from that found in the average set in that "delayed" avc is used. Note that a separate diode (pin 5) is used for avc rectification. The signal is fed to it through coupling condenser C12 and when the diode plate becomes positive with respect to the cathode electrons travel from the cathode, to plate pin 5, through load resistor R12 and cathode bias resistor R19 back to the cathode.

Very weak signals will not make diode plate 5 positive because of the bias voltage present across resistor R19. The cathode is maintained at a positive potential with respect to ground and the signal applied to diode plate 5 must be greater than this bias voltage before rectification occurs. (Due to the fact that the detector plate, pin 6, has a direct dc path to the cathode, the bias across R19 does not affect detector action.)

Because of this, on weak signals no AVC voltage is applied to the rf, converter and i-f stages and the set operates with maximum sensitivity.

When the signals become strong enough to drive diode plate 5 of the 6AT6 tube positive current flows through resistor R12 making the end connected to the diode plate negative with respect to ground. The audio and i-f voltages also existing across resistor R12 are filtered out by means of AVC filters R6 and C8 so that pure dc voltage appears across C8. The stronger the incoming signal the greater the voltage across C8. This reduces the gain in the rf i-f and mixer sections of the receiver.

When the strength of the incoming signal decreases, the rectified voltage across R12 decreases. Since this reduces the negative bias of the rf, converter and i-f tubes the receiver sensitivity increases, thus enabling us to have an automatic control of the volume.

No avc system is 100% efficient, and a change in the incoming signal strength will result in some change in the output sound level from the loudspeaker. For slight changes in signal strength, the sound level will not change perceptibly. Even for large changes in signal strength, the output level changes far less than if avc were not used.

The fact that the incoming signal must overcome the bias between diode plate 5 and the cathode of the 6AT6 tube allows the receiver to operate with maximum sensitivity on all weak signals. This is referred to as delayed avc, because its application to the controlled tubes is delayed until the incoming signal reaches a certain predetermined strength.

Tracing Supply Circuits: In this, or in any other auto receiver, the storage battery in the car is the sole source of power. The tube filaments are fed directly from the battery since they are designed for six volt operation. However, the tube electrodes must also be supplied with the correct dc voltage, which in some cases, will be as much as 200 volts.

DC, as you know, cannot be stepped up by transformer action. Therefore, a vibrator is used to automatically switch the direction of the battery current through the primary of T4, thus changing the current, for all practical purposes, to ac. This ac may be stepped up by a power transformer, rectified by a rectifier tube, and the pulsating dc from the rectifier filtered just as in a home receiver. The rectified and filtered dc is then ready to be applied to the various tube electrodes.

The diagram shows that the vibrator is used solely to interrupt the dc flowing through the primary of power transformer T4. It causes the supply current to flow first through one section of the primary and then through the other, giving the same effect as an ac current.

The hot (ungrounded) battery supply lead connects to the center tap on the primary of the power transformer through the fuse, choke L4, switch S1 and choke L6. Normally the vibrator armature connects to terminal 3, being held in place by spring tension.

When the set is first turned on current will flow from the chassis through vibrator prongs 1 and 3 and the yellow and brown leads of the power transformer primary. At the same time a much smaller current flows through the vibrator armature coil which connects between vibrator terminals 1 and 2. The magnetization produced by the current flowing through the armature coil pulls the armature over against its spring tension, shorting terminals 1 and 2 of the vibrator. This opens the circuit between 1 and 3 and the current flow is through the green and brown leads of the power transformer primary. Since shorting terminals 1 and 2 on the vibrator shorts out the armature coil, magnetization at this point collapses. Then the spring tension pulls the armature back to its original position opening the circuit between 1 and 2 and closing the circuit between terminals 1 and 3. The armature coil is now re-energized and pulls the armature over again for another round trip. This action is repeated as long as the receiver is turned on, and we have a strong flow of current through first one-half of the primary and then through the other half.

As a result of feeding the primary with "alternating current" a large voltage is developed across the secondary of T4 and is applied to terminals 1 and 6 of the rectifier tube. Rectification then occurs in the usual manner and, after filtering, dc is available for application to the plates and screens of the receiving tubes. Note, that as in many receivers, some ripple voltage may be applied to the plate of the output tube (6AQ5) without resultant hum. Any hum voltage induced into the secondary of the output transformer is fed back through the degenerative network and is reduced to the point where it does not cause an audible signal.

Resistors R13 and R14 across the primary of the power transformer are used to prevent excess voltage from being developed across the primary. Condenser C17 is a smoothing or buffer condenser and helps to remove any irregularities in the peaks of the secondary voltage. It is important to use the right size condenser at this point so the vibrator will work smoothly and with a minimum of sparking.

Filter Circuits: You will note from the diagram that the vibrator and the heater of the rectifier tube are fed through choke L6. To avoid vibrator interference, the filaments of all but the rectifier tube are fed in parallel directly from the on-off switch and are isolated from the interference produced at the vibrator by filter choke L6 and filter condenser C14.

The two condensers marked SP1 are called spark plate condensers. They are essentially perfect condensers having very little inductance and practically no resistive losses. Since they do not have any inductive effects at ultra-high frequencies they prevent any ignition interference produced at the car motor from entering the receiver by way of its power supply. The spark plate condensers consist of metal plates separated by sheets of mica. The chassis acts as one of the condenser plates and interleaving metal sheets form the other grounded plates.

Bias Considerations: Resistor R4 is the oscillator grid resistor. The rectified current flowing through this resistor automatically furnishes the correct negative bias for the oscillator section of the 6BE6 tube. Starting bias for the rf and i-f tubes is obtained by means of the voltage drop appearing across their respective cathode resistors.

"Starting bias" refers to the bias voltage present before the avc begins to function. As soon as the avc begins working, additional bias is supplied to the grids of the 6BA6 tubes and also to the mixer grid of the 6BE6.

The grid of the 6AT6 tube is biased by means of the voltage drop appearing across resistor R19 in the cathode circuit of this tube. No bypass condenser is provided across this resistor and degeneration can occur with consequent improvement in tone quality.

The 6AQ5 tube is biased by means of the voltage drop across resistors R18 and R19. The cathode is maintained at ac ground potential by means of the 20 mfd cathode bypass condenser.

Voltage Measurements: The important dc operating voltages are marked on the schematic diagram. Note that 95 volts are applied to the plates and screen of the rf and converter tubes. This same voltage is also applied to the screen of the 6BA6, but the plate of this tube obtains 195 volts dc. You will measure approximately 55 volts dc on the plate of the 6AT6 tube and approximately 200 volts on the plate of the 6AQ5. Note that the screen voltage of the 6AQ5 is not indicated. However, the plate of the 6BA6 which receives 195 volts is essentially at the same potential as of the screen of the 6AQ5 so you would expect to measure approximately 195 volts on the screen of this tube. There is practically no voltage drop in the primary of i-f transformer T2.

215 volts, the highest voltage in the receiver, is present between the chassis and the cathode of the rectifier.

Notice that, while the cathode voltage of the rf tube is shown on the schematic, the cathode voltage of the i-f tube is not marked. Since the cathode resistor of the i-f tube is larger than that of the rf tube and since there is a higher plate voltage you would expect the cathode current to be greater and would expect to measure somewhat more than 1.8 volts between the cathode of this tube and the chassis.

Continuity Tests: With the set turned off, the various supply circuits may be checked for continuity with an ohmmeter.

As you probably know, those points supplied with a positive potential should show continuity back to the cathode of the rectifier, the most positive dc point in the set. As an example, place one ohmmeter probe on the plate of the 6AT6 and the other on the cathode of the 6X4 rectifier. Continuity will be indicated through resistors R15 and R20 and we will read a value of approximately 100,000 ohms on the ohmmeter.

A check between screen pin 6 of the 6BE6 tube and the rectifier cathode will give us continuity through resistor R7 and resistor R20 with a reading of approximately 7800 ohms. A check between the plate (pin 5) of the 6BE6 and the rectifier cathode will again give us a reading of approximately 7800 ohms. The primary winding of i-f transformer T1 has a resistance of approximately 15 ohms and this value would be negligible with respect to the values of R7 and R20. If you suspect a short in this winding it must be checked individually with a low ohmmeter range.

Continuity should also be checked between those terminals supplied with a negative potential and the chassis, the common reference point. Put one ohmmeter test probe on pin 7 of the 6BE6 tube and the other probe on the chassis. This will give a reading through R3, R6 and R12. The cathode of the 6AT6 traces back through resistor R19 while the cathode of the 6AQ5 will trace back through R18 in series with R19.

Alignment: To align this receiver the front and rear housings are removed to expose the various adjustments shown in Fig. 2. You should connect a 6 volt battery to the battery terminal of the receiver and the chassis. A low range output meter (ac voltmeter) should be connected across the speaker voice coil and the receiver volume control set at maximum. For greatest accuracy, keep the output of the receiver at approximately 1 watt (1 watt—1.79 volts on the ac meter across the voice coil) throughout alignment by reducing the signal generator output as stages are brought into alignment. Use a small fiber screwdriver when aligning the i-f transformers. A special tool, Motorola part No. 66A76278 is required for adjusting the tuner cores. It is important when adjusting the tuner cores not to push in on the alignment tool. The slightest inward pressure may move the tuner carriage and result in inaccurate alignment. By following the procedures given in the alignment chart shown in Table 1 the various stages are brought into resonance.

Table I

Step	Dummy Antenna	Generator Connection	Generator Frequency	Tuner set to	Adjust	Remarks
IF ALIGNMENT						
1.	.1 mf	6BE6 grid (pin #7) & chassis	455 kc	High frequency end (cores out)	1, 2, 3 & 4	Peak for maximum in order indicated. Check by repeating step.
RF ALIGNMENT						
2.	See Fig. A	Antenna receptacle through dummy	1610 kc	High frequency end; cores should project 1⅛" from cans (screw out if necessary)	5, 6 & 7	Peak for maximum in order indicated.
3.	"	"	1425 kc	1425 kc-per Fig. 2.	8, 9 & 10	Peak for maximum in order indicated.

4. When receiver is installed in car, extend antenna fully, set dial to approximately 1400 kc and repeak antenna trimmer (7) for maximum volume of a weak station or noise between stations.

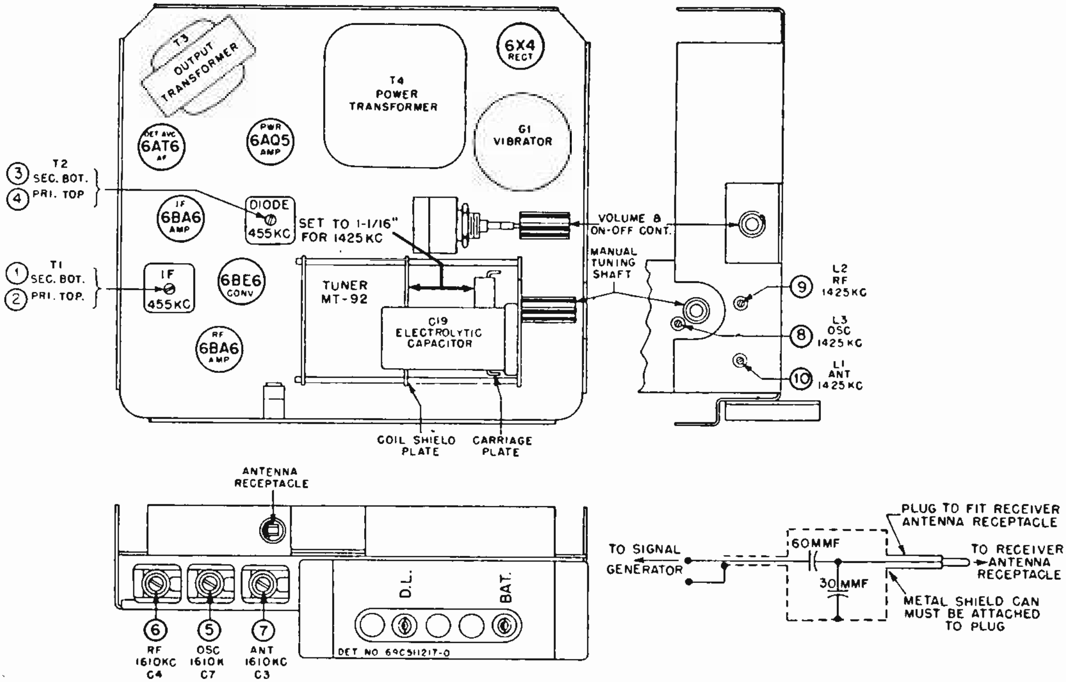


Fig. 2.

The use of the .1 mfd condenser when aligning the i-f amplifier is not particularly important. It is all right to connect the hot lead of the signal generator to the mixer grid (pin 7) of thhe 6BE6 tube and the ground lead of the signal generator to the chassis. The use of the dummy antenna illustrated in Fig. 2 is important when adjusting the oscillator and rf sections of the receiver. The dummy antenna simulates the effect of the actual auto aerial. Notice however. that in Step 4 of the Alignment Chart, the antenna trimmer should be repeaked when the receiver is installed in a car and connected to the car antenna.

Service Hints: Let us suppose that the receiver output is distorted and that by shorting the cathode of the 6AT6 tube to the chassis the distortion clears up. This definitely shows that excess bias is being applied to the 6AT6 tube and points to leakage in coupling condenser C15 as the cause of the trouble.

As we have already found out, the bias is due to the voltage drop across resistor R19. A study of the diagram shows that the cathode current of the 6AQ5 as well as the cathode current of the 6AT6 flows through this resistor. We would immediately suspect the 6AQ5 tube of drawing excess plate current since too much voltage drop occurs across R19.

The diagram shows that leakage in condenser C15 would cause the cathode current of the 6AQ5 to be excessive. Check for this by connecting a voltmeter across resistor R17, with its positive probe going to the control of the tube. If voltage is measured, withdraw the 6AQ5 type tube. If this causes the voltage to disappear, the tube is gassy. If the voltage is still present it is definite proof that C15 is leaky. If there is a drop in voltage, but some is still present, it shows that the tube is gassy and that leakage also exists in the coupling condenser. Both the tube and condenser would then be replaced. Normally no dc voltage should exist across resistor R17.

You might think that a positive voltage applied between grid and ground in the 6AQ5 would cause distortion. Such is not the case, for the increase in plate current increases the voltage across resistors R19 and R18 and maintains a more or less normal bias for the grid of the tube. The increase in voltage across these resistors offsets to a certain extent the positive voltage across R17 caused by gas in the tube or by leakage in C15.

If the receiver squeals when a station is tuned in, you would suspect oscillation in the i-f amplifier or in the rf stage. A glance at the diagram shows that this would most probably be due to an open in i-f screen bypass condenser C10. Check for this condition by letting the set squeal and by connecting another condenser across C10, or from pin 6 of the 6BA6 rf tube to the chassis. If this stops the squealing it's definite proof that C10 is open and should be replaced. There is a possibility that an open in the 10 mfd output filter condenser could cause the same trouble and it is checked in the same manner as C7, by shunting it with another condenser of about the same capacity. Here however an electrolytic condenser is involved and the polarity markings on the test condenser must be observed, connecting its negative lead to the chassis and its positive lead to the postive terminal of the output filter condenser. It is not necessary that the connection be made directly to the positive terminal of this condenser since the screen (pin 6) of the 6AQ5 connects to this point and would do just as well.

If excessive hum is heard, be on the lookout for cathode to heater leakage in the rectifier tube. Cathode to heater leakage in the other tubes will not cause hum although in the case of the 6AQ5 it could cause distortion due to removal of bias from this tube and from the 6AT6. Defective electrolytic filter condensers are also to be suspected as a source of hum just as in a home type receiver. The electrolytic condensers can be checked as stated before by shunting them with others, being sure to observe the polarity markings of the test condensers.

Excessive noise may be caused by worn vibrator contacts. In cases where it is not practical to remove the vibrator housing to see if sparking occurs at the contacts, a new vibrator should be tried. However, first check buffer condenser C17 by replacement. The shielding in the high voltage supply compartment should be carefully checked making certain that it is properly grounded to the chassis. The core of the power transformer is connected to the chassis by means of a braided shield, soldered at the chassis and at the transformer core. If this bonding breaks loose, at either the transformer or at the chassis, vibrator hash (a form of noise) may be heard.

If the receiver is dead and a circuit disturbance test shows all stages to be alive you would immediately suspect failure of the oscillator. This would most probably be due to cathode to heater leakage in the 6BE6 tube which would short the feedback portion of the oscillator coil. You can check on the operation of the oscillator by measuring the dc voltage across oscillator bias resistor R4. The negative lead of your voltmeter should connect to the grid end of the resistor. If no voltage is present across the resistor the oscillator is not functioning. A vacuum-tube-voltmeter or a volt-ohm-milliammeter having a d.c. sensitivity of 20,000 ohms-per-volt should be used in making this test.

Our Cover Photo

HOW'S THIS FOR A TEST PATTERN? Marjorie Adams assists the color TV camermen in adjusting their cameras at the National Association of Radio and Television Broadcasters convention in Chicago. General Electric, assisted by CBS, staged "live colorcasting shows to demonstrate the company's new simplified color television broadcasting equipment. Home color receivers were located about the exhibit for the convenience of viewers.

Job Opportunities

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. National Radio Institute will forward letters immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. National Radio Institute will forward letters immediately to employer who will acknowledge your application direct.

RADIO-TV SERVICEMAN. "I am interested in securing a T.V. and radio serviceman for our town of 2500 population. We can guarantee 90% of this service to the man we secure. We would like a young, sober man who wants to get started in this work. We have a wonderful hunting and fishing country in the White River bottoms. I certainly will appreciate your efforts in helping us secure a good man for our town."

John W. Kornegay
KORNEGAY FURNITURE & APPLIANCE CO.
Clarendon, Ark.

n r i

"As a jobber, I have always cooperated with the beginner in the radio and television field. I should like to make known to any of your students who would care to do business with me that I will give them sympathetic, prompt and reliable service at the best competitive prices.

"I'll help your students get the proper parts to learn and earn."

Eugene A. Hubbell, President
H. & H. ELECTRONIC SUPPLY, INC.
510 Kishwaukee St.,
Rockford, Ill.

An Electric Fan Idea for the Work Bench

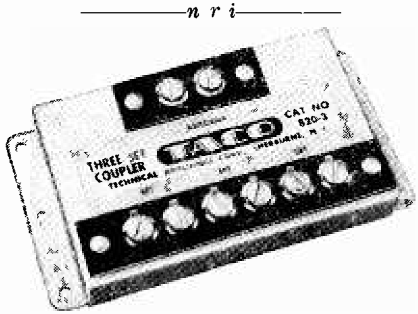
"I have found that sometimes a man wants an electric fan in his shop but most fans are large and must be put up in certain ways.

"A small defroster fan that is used on a car's steering post is perfect for a man's small bench. As these fan motors are A.C.-D.C., they can be hooked up to a 6-volt transformer—any Radio transformer, with a 6-volt winding. The fan can be tilted to any angle and has two speeds.

"You may pass this information on to NRI men so they can work and study in comfort. The fans cost new $4 to $5.

MR. VINCENT L. LEGERE
161 South St.
Athol, Mass.

—n r i—



TACO Announces Complete Line of Multi-Set TV Couplers

The Technical Appliance Corp., of Sherburne, N. Y., announces the availability of a complete line of multi-set couplers, of signal-splitting design. Three models are available for dividing the antenna signal between two, three, or four receivers. A rapidly growing application involves the use of the coupler in connection with TV antenna installations where the antenna will feed signals to a television receiver as well as to an FM receiver. For further information write direct to the above company, not to NRI.

—n r i—

Audio Fans Corresponding by Magnetic Tape

Norman A. Zuehl, of 210 Lamont Ave., Alamo Hts., San Antonio, Texas, writes that he belongs to two tape recording clubs and is enjoying corresponding by tape with members the world over. Information on "The Voicespondents Club" may be had by writing direct to Charles Owen, Jr., of Noel, Virginia. Information on "World Tape Pals" may be had by writing direct to Harry Matthews, P.O. Box 9211, Dallas, Texas.

Auto Radio Serviceman Praises NRI Signal Tracer

"Thanks to you and your staff, I have opened my own auto radio repair shop. I can honestly say that the NRI course gives an excellent training, and I will recommend it to everyone I can.

"The NRI Signal Tracer which I purchased about 2 years ago was a big help toward understanding radio. It has paid for itself a dozen times over."

EDWARD L. LYNCH
52 Vine Street
East Providence, R. I.

—n r i—

Some Suggestions Regarding Long Distance Telephone Calls To NRI

Occasionally we receive a long distance telephone call from an NRI student or graduate—for something that he needs in a hurry, or to discuss an urgent problem.

Because such calls cost the student or graduate quite a bit, we feel that they should be made only when absolutely necessary. And — particularly where a consultation problem is involved, our reply by letter will be more complete, and therefore more satisfactory than an answer given in a hurry over the phone. That's why we suggest that it may be better to write us Air Mail rather than telephone, except where an immediate reply is required.

If you do find it is necessary to call, we shall of course, be glad to help you in any way we can. In that case, please keep in mind the following because it will enable us to handle your call most efficiently and save you money on the cost:

1. Tell *our* switchboard operator—the one who answers "National Radio Institute"—your name, address, student number, and that you are calling long distance. The way the Telephone Company handles calls nowadays, she won't *know* that it is long distance unless you tell her.

2. Explain the purpose of your call. The operator won't be able to give you the information or handle your problem herself, but she must know its nature so as to refer you to the proper individual or department.

3. Remember that the Institute is open from 8:15 AM to 5:00 PM, Monday through Friday —closed completely Saturday and Sunday. Outside of these office hours, the switchboard is also closed, and there will not be anyone here to handle your call.

THESE MANUALS MAKE SERVICING EASY

SPECIALIZED—HOME AND PORTABLE RADIO MANUALS

A New Kind of Rider Manual—Now Available

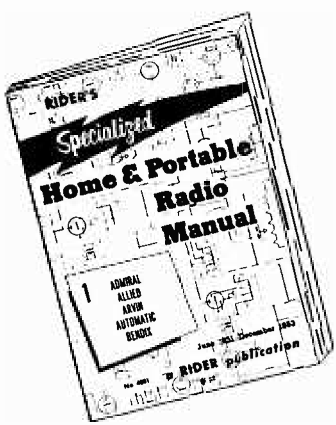
A Terrific Buy!

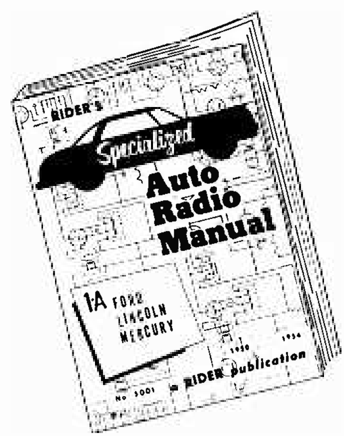
Eleven volumes each containing 2½ years production—June 1951 to December, 1953. John F. Rider, the diagram authority, says "Dollar for dollar these manuals have no equal."

Each volume contains the following data: Schematics, Tube Layout, Voltages, Alignment Data, Cabinet Picture, Dial Stringing Information, Trimmer Location, Parts List, Chassis Views. Individually indexed. It is the MOST accurate service information you can buy. . . . It is factory authorized. . . . factory prepared . . . factory applied methods!

This information protects and builds your technical reputation. With this data in your hands you know as much about the receivers as the manufacturers who made them! You service easily and profitably!

Each volume contains 96 pages, except Volume 7, which contains 194 pages. Each volume covers from 40 to 100 models—only $1.65 per volume (Volume 7 only $2.40).





SPECIAL OFFER

BUY AS MANY OF THESE MANUALS AS YOU WISH. IF YOU BUY THE ENTIRE SERIES OF ELEVEN SPECIALIZED HOME AND PORTABLE RADIO MANUALS—WE SAVE ON POSTAGE AND HANDLING—YOU PAY FOR TEN—**GET ONE FREE.** EXAMPLE—11 VOLUMES, REGULAR PRICE WOULD BE $18.90. YOU SEND ONLY $17.25. YOU SAVE $1.65.

SPECIALIZED HOME & PORTABLE RADIO MANUALS

June, 1951 to December, 1953

Volume	Manufacturers Covered	Price
No. 1	Admiral, Allied, Arvin, Automatic, Bendix	$1.65
No. 2	Bogen, CBS Columbia, Capehart-Farnsworth, Crosley	1.65
No. 3	DeWald, Emerson, Fada, Firestone	1.65
No. 4	Gamble Skogmo, General Electric, Goodrich, Hallicrafters, Jackson	1.65
No. 5	Jewel, Magnavox, Meck, Mitchell, Montgomery Ward	1.65
No. 6	Motorola, Olympic, Packard Bell	1.65
No. 7	Philco	2.40
No. 8	RCA	1.65
No. 9	Radio Craftsman, Raytheon, Sears Roebuck, Sentinel, Setchell Carlson, Sonora, Sparton	1.65
No. 10	Spiegel, Stewart-Warner, Stromberg Carlson, Sylvania, Tele-King, Trav-ler	1.65
No. 11	Wells Gardner, Western Auto, Westinghouse, Zenith	1.65

Also, now available through NRI Supply Division
SPECIALIZED AUTO RADIO MANUALS

Volume	Manufacturers Covered	Price
No. 1-A	Ford, Lincoln, Mercury. 1950-1954. 208 pages, 8½" x 11", illustrated	$3.00
No. 2-A	Buick, Cadillac, Oldsmobile. 1950-1954. 200 pages, 8½" x 11", illustrated	3.00
No. 3-A	Chevrolet, Pontiac, GMC Trucks and Chevrolet Trucks. 1950-1954. 128 pages, 8½" x 11", illustrated	1.80
No. 4-A	Chrysler, DeSoto, Dodge, Plymouth, and Dodge Trucks. 1950-1954. 176 pages, 8½" x 11", illustrated	3.00

Complete factory data giving ALL service information including installation on factory installed radios. This is the finest service information available on auto radio receivers. It's factory complete—factory accurate! Five years coverage in each volume.

USE THIS ORDER FORM

(Or order by letter if you prefer.)

National Radio Institute, Supply Division
16th and U Streets, N. W.
Washington 9, D. C.

☐ I enclose $................. (money order, check or bank draft). Send me by parcel post prepaid the new Rider manuals I have circled below:

1 2 3 4 5 6 7 8 9 10 11 1-A 2-A 3-A 4-A

☐ I enclose $17.25. Send me, postpaid, your SPECIAL OFFER—all eleven Home and Portable Radio Manuals for the price of ten, saving me $1.65. (Does not include auto radio manuals.)

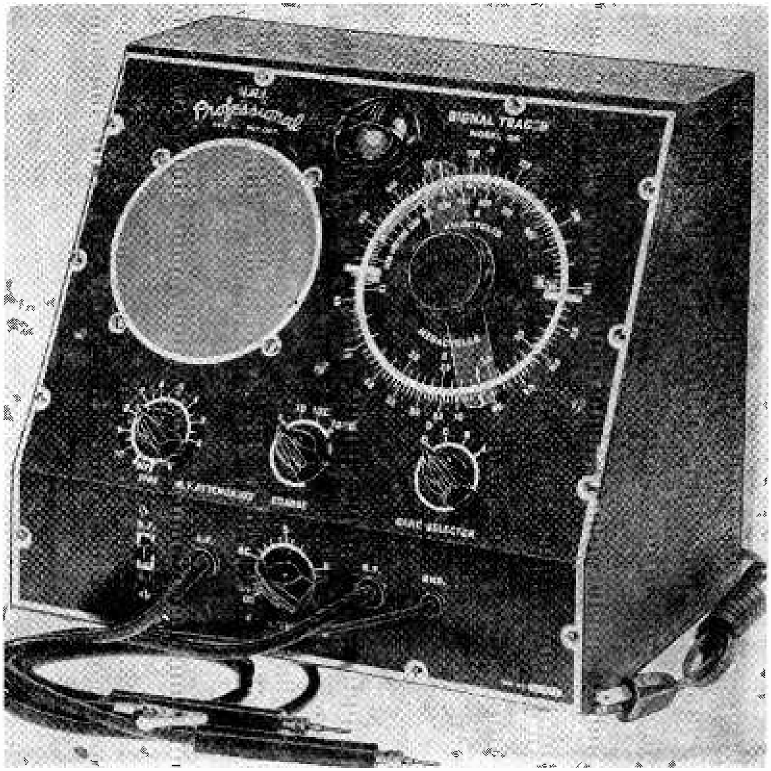
Name .... Student No. ....

Address ....

City .... Zone .... State ....

(Please print name and address.)

If you live in Washington, D. C., add 2% for D. C. Sales Tax.



HOW TO USE THE NRI PROFESSIONAL SIGNAL TRACER

By DON QUADE
NRI Chief Lesson Grader

ALL of the fast, certain, professional methods used by NRI trained service experts are built on the idea of localizing the trouble to the rf section or to the af section of a receiver and then to a single stage in the defective section. There are many ways of localizing trouble, all described in the NRI Lessons, but the best all-around method is, without doubt, Signal Tracing. This method, although the most professional, is especially valuable for the beginner. It not only aids him in doing work like an expert, but also helps him get an expert's understanding of the operation of radio and TV circuits.

What is Meant by Signal Tracing

Signal Tracing means to sample or examine the signal at any point in its passage from the antenna through the various stages in a receiver to the loudspeaker. When you pass from a point of normal signal to the point at which your Signal Tracer verifies or confirms the complaint, you have just passed into or through the defective stage.

The Signal Tracer enables you to examine both the quantity (amount) and the quality of the signal. If the set is dead, you can determine where the signal stops. Or, if the complaint is weak reception, you can find which stage is causing a loss in signal strength. Should distortion, noise, hum or oscillation be the symptom, the Signal Tracer will quickly narrow your

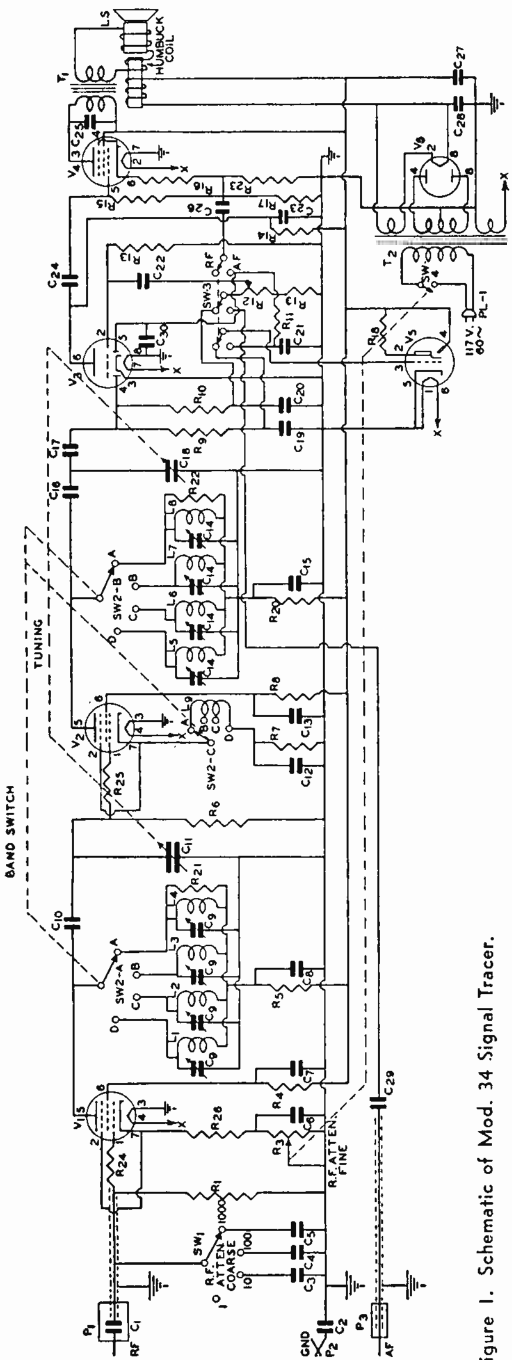


Figure 1. Schematic of Mod. 34 Signal Tracer.

search to the defective stage and in many cases to the defective part itself.

The Signal Tracer's tuning eye and the calibrated attenuator controls will be used to show the relative amount of signal present and the relative gain contributed by each stage. The Signal Tracer's loudspeaker, which enables you to listen to the actual signal as it is traced through the set, is an "ear" check on the signal quality at each sampling point.

There are two types of Signal Tracers. The crude form is an audio amplifier with a crystal type rf probe. The crystal acts as a detector and when trouble-shooting in circuits handling modulated rf or i-f carrier signals the crystal will remove the modulation and feed it to the audio amplifier. The drawback to this gadget is that it will detect all and any carriers present, regardless of frequency including signals which presence have nothing to do with the proper operation of the receiver.

The professional type Signal Tracer uses tuned amplifier circuits ahead of the detector. When you pick up a signal you know its exact frequency. Also a bang-up job of receiver alignment can be done with a tuned Signal Tracer. something which is impossible with the untuned variety. The higher sensitivity due to the use of tuned rf amplifier stages increases the worth of the tuned instrument as a service tool.

Description of the Model 34 Signal Tracer

A wiring diagram of the Model 34 is shown in Fig. 1. As you can see, this instrument is actually a special kind of all-wave, tuned radio frequency (trf) receiver, complete with audio amplifier and loudspeaker. Any one of the following four frequency bands may be selected by the BAND SELECTOR switch.

Band A	170-490 kc
Band B	490-1470 kc
Band C	1470 kc.-3.9 mc
Band D	3.8-11.3 mc

What is normally the antenna lead in a receiver is the signal tracer RF probe. Any rf signals within the frequency range of the instrument may be picked up with this probe. When the RF probe is connected to a resonant circuit, very little detuning will occur because of the 2 micro-microfarad series condenser built into the probe handle. The COARSE RF ATTENUATOR (SW-1) is a capacity type voltage divider which controls the amount of signal fed into the first rf amplifier tube. The FINE RF ATTENUATOR (R3) controls the bias, and hence the gain, of the first rf tube. The use of these controls in measuring gain will be described later.

When the RF probe is used, the tuning eye indicates the relative strength of the rf signal reaching the 6SQ7 diode detector plate (pin No. 4). After demodulation, the audio signal passes on through the af amplifier section to the loudspeaker. When the RF-AF switch is in the AF position, it disconnects the rf amplifier and makes it possible to use the audio section of the Signal Tracer independently. In this case af signals are fed through the AF probe and blocking condenser C29 to the calibrated volume control (AF ATTENUATOR), and are amplified and reproduced by the loudspeaker. Part of the amplified signal is fed back from output transformer T1 and rectified by diode plate 5 of the 6SQ7. This rectified voltage operates the tuning eye indicating the relative strength of the af signal being examined.

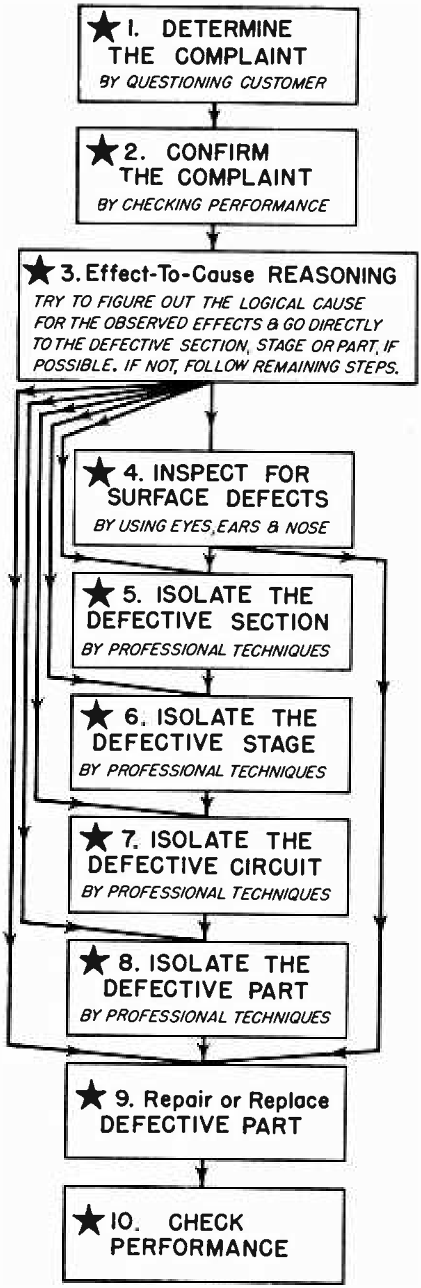


Figure 2.
Complete Professional Servicing Procedure for Radio Receivers.

Servicing With the NRI Professional Signal Tracer—Testing Routine

The NRI Signal Tracer is a powerful tool for the solution of service problems. But, for best results, a systematic method of use should be adopted. There is a definite method of approach to a service job. These steps are shown in Fig. 2. Success in step 3 can make possible the omission of up to five of the next steps, and success in step 4 may permit omission of the next four steps. The Signal Tracer does not invalidate these steps. It is used as a localization tool in steps 5 and 6, and often in steps 7 and 8. Only experience can completely show how much the servicing procedure is speeded up with the Signal Tracer. It suffices to say that no Radio serviceman who has learned to use the Model 34, or any other good *tuned* Signal Tracer, would ever be without this basic instrument.

Now let us see how to trace signals through a receiver, using the Model 34 Signal Tracer. The schematic diagram shown in Fig. 3 will be used for purposes of illustration:

1. Plug the receiver and the Model 34 into an ac power line and allow both to warm up.
2. Clip the "ground" lead of Model 34 to the receiver chassis.
3. Set all three attenuators to their lowest calibration numbers.
4. Throw the RF-AF switch to RF.
5. Tune in a powerful station between 500 kc and 1450 kc on the receiver.
6. Set the Model 34 BAND SELECTOR switch to Band "B," as this band covers the frequency of the station tuned in on step 5.
7. Touch the RF probe to the primary of the antenna transformer (Junction of C_3 and L_1).
8. Tune the Model 34 until you hear the same program as is being reproduced by the receiver's loudspeaker.
9. Move the RF probe to the signal grid of the mixer tube (top cap of the type 6A8 tube). If necessary, re-tune the RECEIVER for maximum signal tracer tuning eye closure. If the tuning eye overlaps, increase the setting of the FINE or COARSE RF ATTENUATOR.

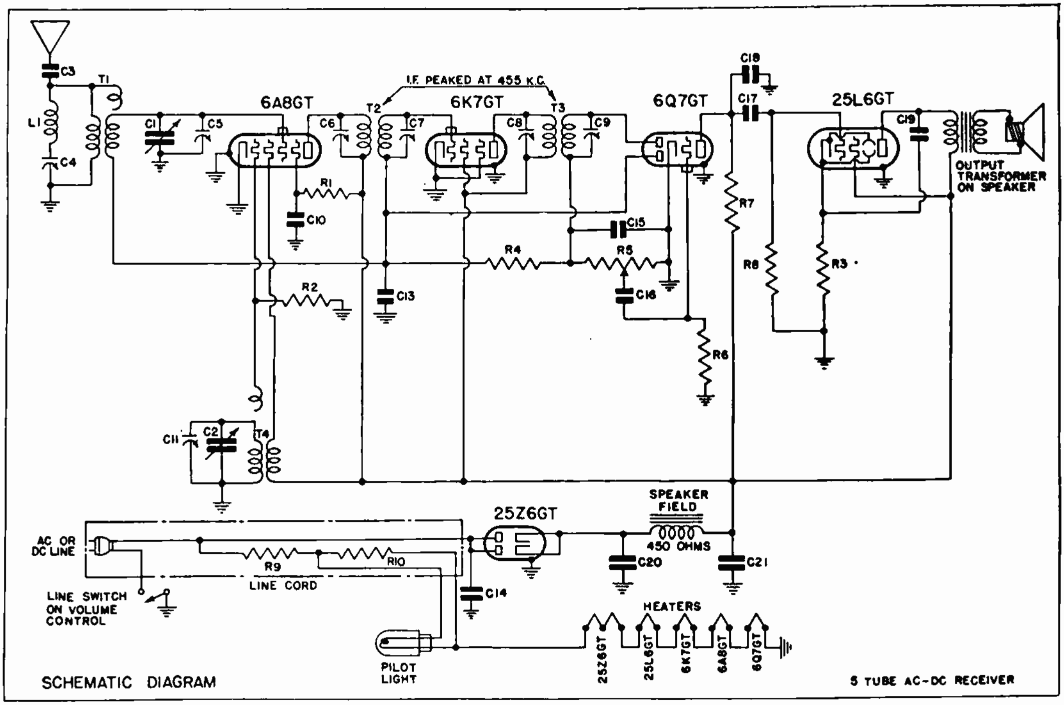


Figure 3. Emerson Model CH AC-DC radio receiver.

10. Remove the RF probe from the 6A8 top cap and re-tune the receiver if you changed its dial setting in step 9.

11. Turn the Signal Tracer BAND SELECTOR switch to Band "A," which covers the i-f frequency of this receiver. Tune the Model 34 to 455 kc.

12. Touch the RF probe to the plate socket terminal of the 6A8 mixer tube. The i-f signal of the receiver should now be audible in the speaker of the Model 34. If not, tune the Model 34 on both sides of 455 kc, as the receiver's i-f may be slightly misaligned. If necessary, adjust the RF ATTENUATORS until the eye just closes and turn the AF ATTENUATOR so the program is audible in the Model 34 loudspeaker.

13. Move the RF probe to the signal grid of the first i-f amplifier tube (top cap of the 6K7). The eye will open up, showing a decrease in amplitude of the receiver's i-f signal. This is correct, as there is normally a loss in a double-tuned i-f transformer.

14. Shift the RF probe to the plate socket terminal of the 6K7 i-f amplifier tube. The tuning eye should overlap due to the gain in the i-f amplifier tube. It should be necessary to turn the COARSE RF ATTENUATOR control from 1 to 10, 100 or even 1000, before you can adjust the closure of the tuning eye with the FINE RF ATTENUATOR. (The i-f tube's gain should also be apparent by increased audible output from the Model 34's loudspeaker.)

15. Touch the RF probe to the diode detector plate of the 6Q7 tube. Some decrease in signal strength will be noted.

16. Next shift the RF probe to the ungrounded side of volume control R_5. Set the RF ATTENUATORS for maximum sensitivity, as only a small amount of i-f signal should exist at this point. This completes the Signal Tracing in the rf and i-f sections of the receiver.

17. Slide the RF-AF switch to the AF position, and now touch the AF probe to the "hot" (ungrounded) side of the volume control R_5, and listen to the audio signal at this point.

18. Move the AF probe to the plate of the 1st af amplifier tube (plate socket terminal of the 6Q7). A large increase in volume should result. This may be decreased to a reasonable level with the AF ATTENUATOR, or by turning down the volume of the receiver.

19. Next, touch the AF probe to the control grid of the 25L6 output tube. The sound from the Model 34 loudspeaker should be about the same as in previous step No. 18.

20. Move the AF probe to the plate socket terminal of the 25L6 output tube. An increase in signal level should be noted.

21. Disconnect the Model 34's "ground" lead clip from the receiver chassis and connect it to one of the receiver loudspeaker voice coil leads. Touch the AF probe to the other voice coil lead. A large drop in signal level is to be expected due to the step-down action of the output transformer.

With the completion of step 21 we have traced the signal through each stage of the receiver, from the antenna to the loudspeaker voice coil.

Servicing A Dead Receiver

The Model 34 is ideal for following the signal from the input of the set to determine where it is interrupted. As an example, we will use the circuit shown in Fig. 4.

The input signal may be either that of a local broadcast station or the modulated output of a signal generator. Turn on the receiver and tune it to the point where this signal would be received if the set were working. Connect the ground clip of the Signal Tracer to the set chassis. Set the RF-AF switch to RF position and the BAND SELECTOR switch to the proper band.

In this example (Fig. 4), start with the RF probe on the control grid of the 12SA7 converter tube. With the BAND SELECTOR switch on "B," tune the Signal Tracer to the frequency of the incoming signal, and re-tune the set to give maximum indication on the Signal Tracer tuning eye. If the signal is picked up at the grid of the 12SA7 tube, the input circuits of the receiver are in good condition.

Next, move the RF probe to the plate of the 12SA7 tube. Set BAND SELECTOR switch on "A," and tune the Signal Tracer to the receiver's i-f frequency of 455 kc. No signal here may mean that there is no B supply voltage, that the 12SA7 tube is not working as an oscillator, that C_6 is short-circuited, that the primary of i-f transformer T_2 is short-circuited, that the local oscillator is not working or is misaligned.

You can check the oscillator with the Signal Tracer by placing the RF probe on the first grid of the 12SA7 tube or the stator of the oscillator tuning condenser. Tune the Signal Tracer over the band covering a frequency 455 kc higher than the receiver dial setting and see if you can pick up the oscillator signal as indicated by closing of the tuning eye. (Since this signal is unmodulated, you won't hear anything in the loudspeaker when you pick up the signal.) If you cannot pick up the oscillator signal, then there is trouble in the oscillator circuit. If you do pick it up, notice the frequency at which you find it on the Signal Tracer dial. This frequency should be equal to the incoming signal frequency plus the i-f frequency of the set.

Assuming that you hear a signal at the i-f frequency at the plate of the 12SA7 tube, move the RF probe to the grid of the 12SK7 i-f amplifier tube. Lack of signal here indicates trouble in transformer T_2, or in its trimmers C_6 and C_7.

If you find the signal at the grid of the 12SK7 i-f amplifier tube, move to its plate. The Signal Tracer must still be tuned to the i-f frequency. Lack of a signal here indicates a defective 12SK7 tube, improper operating voltages, or trouble in the primary of T_3 or in condenser C_8.

Next, move to the plate of the diode detector section of the 12SQ7 tube, leaving the Signal Tracer tuned to the i-f frequency. No signal here probably indicates an open in the secondary of T_3, or a short in C_9. If you find the signal, throw the RF-AF switch to AF, change to the AF probe of the Signal Tracer, and apply it to the grid of the 12SQ7 1st af amplifier tube. No signal here probably means an open in C_{16}, a short in C_{15}, a defect in the volume control or in the diode section of the 12SQ7.

If you find the signal at the grid of the 12SQ7 tube, move to its plate. Lack of signal here indicates a short in C_4, an open in R_7, or a defective 12SQ7 tube.

If a signal is present at the plate of the 12SQ7, move the AF probe to the grid of the 50L6 power amplifier tube. If you find no signal here, but get a signal at the plate of the 12SQ7, then coupling condenser C_{17} is probably open.

Finally, if you find a signal at the 50L6 grid, move the AF probe to the plate of the 50L6 tube. No signal here means a defective 50L6 tube, an open primary of the output transformer, a short in C_{18}, or an open in R_3.

As you can see, the Signal Tracer is used by moving successively from grid to plate circuit throughout the receiver until you find the point at which you hear no signal. At that point, you can stop and resort to your ohmmeter and voltmeter to find the defect.

Servicing Weak Receivers

When it comes to localizing trouble in a weak receiver, there is nothing that equals the Signal Tracer. With it you can actually measure the gain per stage.

In making rf stage gain measurements, it is only necessary to determine how many times stronger or weaker the signal is between the input of a stage and its output. With the Model 34, you do not measure the signal level in volts, but the ATTENUATOR value required to close the tuning eye for the particular frequency in question. Suppose that, to close the eye at the grid of a tube, the FINE RF ATTENUATOR

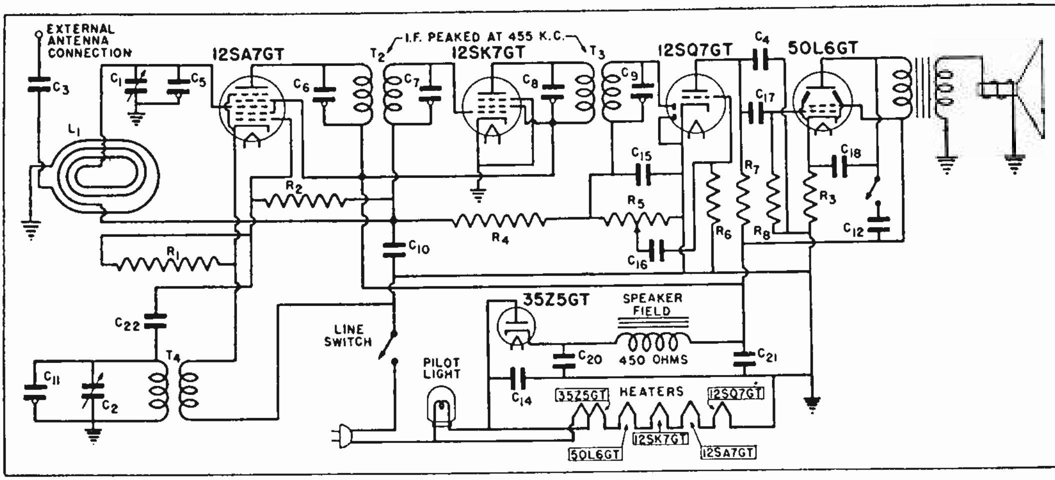


Figure 4.

is set at 3.5. Also, you find that the COARSE RF ATTENUATOR is set to 10. Multiply the COARSE and FINE settings together. Thus 3.5 x 10 equals 35, which is the relative signal strength at the grid of the tube. Now, move the RF probe to the plate of the tube. The signal will be much stronger here and you may find it necessary to set the COARSE RF ATTENUATOR to 100 and the FINE at 7. Again, multiplying the COARSE and FINE settings, we obtain 100 x 7 or 700 as the relative signal strength at the plate of the tube. *The relative plate signal strength divided by the relative grid signal strength is the gain of the stage.* Thus 700 ÷ 35 = 20, and the gain of this stage is 20. But suppose the relative signal strength at the plate were 7. At once you would know that there was less signal at the plate than at the grid, and that a *loss* rather than a gain had occurred. The actual "gain" would still be found by dividing the plate reading by the grid reading. In this case 7 ÷ 35 equals .2, and we say that the gain is .2 times.

Since conversion gain measurements on a superheterodyne mixer stage are taken at two frequencies, division of the output reading by the input reading will not always give the true gain. However, if the gain value you obtain is multiplied by the right correction factor, the results will be quite accurate. The following table gives correction factors for the i-f frequencies found in standard AM receivers. Note that in each case the input frequency must be approximately 1000 kc which may be obtained from a local broadcast station. As a matter of fact, any station between 900 kc and 1100 kc may be used with satisfactory results.

CONVERTER GAIN CORRECTION FACTOR

Input Frequency	IF	Multiply By
1000 kc	175 kc	1
1000 kc	256 kc	2
1000 kc	370 kc	2
1000 kc	456 kc (or 455 kc)	2
1000 kc	470 kc	2

Table 1 gives the manufacturer's gain figures for the set shown in Fig. 5, and Table 2 lists what are considered to be average gain values. Some of the values in Table 1 are within the average, but others are somewhat outside. Therefore, you can't rely on average values absolutely —you will have to supplement them with what you learn from experience with specific receivers.

Examples of Gain Measurements

The gain of the rf and i-f stages in modern receivers depends on the avc voltage. Hence, most manufacturers recommend that the avc voltage be killed while making gain measurements—in the case of Fig. 5 by shorting avc filter condenser C_2. Shorting the avc in this way permits the set to operate with a maximum and fixed sensitivity. Notice in Table 1 that the rf stage gain varies from 1 to 7, depending on whether or not the avc is working. Let's prepare the set for gain measurements by shorting avc filter condenser C_2.

Table 1 shows that the signal strength is increased 2.5 times (the gain is 2.5) between the input and the rf amplifier grid of the receiver in Fig. 5. This measurement, as the table also shows, is to be made with a 1000 kc signal input. Therefore, tune the receiver and the Signal Tracer to a station near 1000 kc. Attach the ground lead of the Signal Tracer to the receiver chassis. Set the slide switch to RF, the BAND SELECTOR switch to B, and touch the RF probe to the antenna post. Adjust the two calibrated RF ATTENUATORS of the Signal Tracer until the indicator eye just closes.

Multiply together the FINE and COARSE RF ATTENUATOR settings. The result represents the relative signal strength at this point needed to close the indicator eye.

Next, move the RF probe to the control grid of VT_1. Adjust the RF ATTENUATORS until the indicator eye just closes and again multiply the COARSE and FINE settings together to get the relative signal strength at this point. The ratio between this attenuator value and the previous one shows the gain or loss in signal strength between the antenna and the control grid of VT_1. (Thus, if the first value were 3, and the second were 8, the gain is 8 ÷ 3, or approximately 2.7.) If a gain of about 2.5 is found, you know that the input section of this receiver is functioning properly.

Next, move the RF probe of the Signal Tracer to the plate socket terminal of VT_1. Adjust RF ATTENUATORS until the indicator eye closes. The ratio between this new ATTENUATOR value and that at the grid of VT_1 should be about 7 to 1 when the avc is not working.

The signal strength at the plate of VT_1 and at the grid of VT_2 is approximately equal, so no measurement need be taken at the grid of VT_2.

Next, reset the BAND SELECTOR switch to "A" and tune the Signal Tracer to 455 kc, the frequency of the i-f amplifier. Touch the RF probe to the plate of VT_2. Adjust the RF ATTENUATORS until the indicator eye of the Signal Tracer closes. The attenuator setting ratio between grid and plate of VT_2 should be about 28 to 1. Multiplying by the "conversion gain" correction factor of 2.5, for an I-F of 455 kc, will give the true conversion gain as 28 x 2.5 or 70.

Next, touch the RF probe to the control grid of VT_3, and adjust the RF ATTENUATORS for closing of indicator eye. The "gain" of this i-f transformer should be about .7 (actually, this represents a loss, which is to be expected in a double-tuned i-f transformer).

Next, move the RF probe to the plate of VT_3, and adjust the RF ATTENUATORS for closing of indicator eye. The gain of VT_3 should be about 125 when the avc is not working (about 60 if

TABLE 1

Gain between points	Tracer tuned to	Approximate gain
1 and 2	1000 kc.	2.5
2 and 3	1000 kc.	1 (A) or 7 (B)
3 and 4	455 kc.	70
4 and 5	455 kc.	0.7
5 and 6	455 kc.	60 (A) or 125 (B)
6 and 7	455 kc.	0.7
7 and 8	400 cycles	30
8 and 9	400 cycles	15

(A) with a.v.c. voltage applied.
(B) with the a.v.c. voltage shorted out.

TABLE 2
AVERAGE GAIN DATA

Section	Gain Min.	Gain Max.
R.F.		
Antenna to 1st grid	2	10
Antenna to 1st grid, auto sets	10	50
R.F. amplifier, supers, broadcast	10	40
R.F. amplifier, t.r.f., broadcast	40	100
R.F. amplifier, supers, short wave	5	25
MIXER		
Converter grid to 1st i.f. grid (single i.f. stage)	30	60
Converter grid to 1st i.f. grid (2-stage i.f.)	5	30
I.F. AMPLIFIER		
I.F. stage (single stage)	40	180
I.F. stage (2-stage i.f., per stage)	5	30
DETECTOR		
Biased detector, 57, 6J7, 6C6, etc. (depends on % modulation)	5	40
Grid leak detector, square law	5	50
Diode detector (a loss—depends upon % modulation)	.2	.5
AUDIO AMPLIFIER		
Triode (low gain)	5	14
Triode (high gain)	22	50
Pentode	50	150
POWER OUTPUT		
Triode	2	3
Pentode and beam	6	20

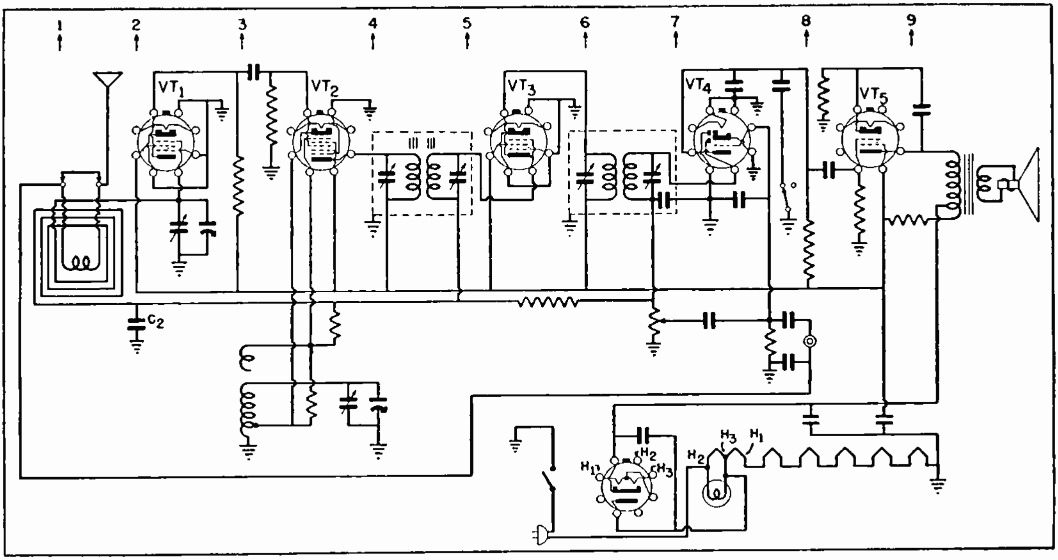


Figure 5.

it is). In this stage, the ATTENUATOR setting at the grid may be 20, and the ATTENUATOR setting at the plate may be 2500. The gain is therefore 2500 ÷ 20, or 125.

Finally, touch the RF probe to the ungrounded diode plate of VT_4. This should show a "gain" of .7—the loss occurring in the second i-f transformer. This completes the gain measurements in the rf-if section of this receiver.

AF Gain Measurements

AF gain measurements are taken in much the same way as RF gain measurements. However, the AF probe is used and there is only one AF ATTENUATOR control. To calculate stage gain, the AF ATTENUATOR reading at the input is divided by the AF ATTENUATOR reading at the output of the stage. (In both readings, the AF ATTENUATOR being set for a position which just closes the indicator eye.)

Servicing Receivers That Distort

The receiver in which distortion is to be localized should be tuned to a station so its loudspeaker will reproduce the distorted signal. With the receiver volume set at a low level, connect the Model 34 "ground" lead to the receiver chassis. Set the slide switch to AF, and touch the AF probe to the ungrounded side of the receiver voice coil. Turn up the Signal Tracer gain, so that the audio output from the Signal Tracer exceeds the output from the receiver. Listen for the distortion. If it is absent in the output from the Signal Tracer, you know at once that the receiver loudspeaker is at fault.

If the distortion is picked up across the speaker voice coil, it is still possible that the loudspeaker is defective. You should proceed to mute the speaker by disconnecting one lead of its voice coil. Substitute a dummy load of a 5 ohm, 5 to 10 watt resistor. Using the Signal Tracer, check the audio voltage appearing across the dummy load resistor for distortion. If normal reception is now obtained, the loudspeaker is definitely at fault.

Should the distortion continue, touch the AF probe to the ungrounded side of the diode load resistor, where the detected audio signals are first developed. If the distortion is not present at the diode load, proceed to trace the audio signal toward the loudspeaker. The first point at which the distortion is present indicates that you have just passed through the defective stage.

Perhaps the most common cause for distortion is a leaky coupling condenser or a gassy tube. Many servicemen who regularly use a Signal Tracer will first, in the case of distortion, check for leaky coupling condensers and gassy tubes with a dc voltmeter, before resorting to the signal tracing procedure.

If distortion is present across the diode load resistor, set the slide switch to RF and prepare the Signal Tracer to pick up the i-f signals.

Touch the RF probe to the plate of the diode detector, and tune in the i-f signals on the Signal Tracer. If there is no distortion at the input of the detector (between the diode plates and chassis), but the af output of the detector is distorted, a new 2nd detector tube should be tried. Also, the resistance of the diode load resistor should be checked with an ohmmeter.

If the distortion is present across the input to the diode detector, touch the RF probe to the input of the i-f amplifier tube driving the 2nd detector. If distortion does not exist here, but is present at the plate of this tube, try a new tube. Also, use a high resistance dc voltmeter to check the avc voltage applied to this i-f tube. Lack of avc voltage can cause this tube to deliver a distorted signal to the 2nd detector. Also be on the lookout for oscillation in the rf or i-f sections of the receiver. Instructions for localizing oscillation are given later.

Servicing Receivers For Excessive Hum

In most sets, excessive hum is caused by defective electrolytic condensers or cathode-to-heater leakage in tubes. It is advisable to check these parts first before trying to localize the point at which hum enters the receiver circuit. The tubes may be checked for leakage in a reliable tube tester, and any method you desire may be used to check the condensers. You can shunt them with good condensers, or check them with an R-C Tester.

The Signal Tracer can be used to check for excessive hum voltage across filter condensers. To do this, throw the slide switch to AF. The "ground" lead is clipped to the negative lead of the condenser under test. (Do not unsolder the condenser leads.) The AF probe is then touched to the positive condenser lead. The AF ATTENUATOR is set so the amount of hum can be readily heard. The hum should be very loud across the input filter condenser. However, hum should be at a low level across the output filter condenser.

Hum present at the cathode but not at the grid of a tube would indicate cathode-to-heater leakage.

After you have made these tests on a few receivers in first-class condition you will know how to interpret their results. When the tubes and filter condensers are not at fault, trace the hum to its point of entry into the receiver and then concentrate on that circuit.

If hum modulation is the complaint, tune the receiver to a powerful local station to produce the hum modulation. Then trace the signal from the antenna towards the second detector, until you find the stage in which the hum modulation first starts.

Servicing Receivers That Squeal Or Motorboat

Make the necessary preliminary inspection for surface defects, being on the lookout for shielding out of place, poor grounding of shields, dirty wiping contacts on the tuning condenser rotor shaft, etc. Disconnect the receiver antenna, or be sure the receiver is not tuned to a station. Next, with the Model 34 tuned to the correct frequency, check for rf voltage across the various plate, screen and cathode by-pass condensers in the rf and i-f circuits. No appreciable rf voltage should appear across a good by-pass condenser. Should you find an rf or i-f voltage exists across some by-pass condenser, that one is probably open and another condenser should be tried.

In all probability, replacing a faulty by-pass condenser will clear up the trouble. If not, check right through the receiver from the antenna to the second detector. Use the RF probe, and tune the Signal Tracer to the correct frequency, just as described for measuring gain in weak receivers. Oscillation in an i-f stage will usually be indicated by closure of the tuning eye with no signal being picked up by the receiver. Since the oscillating stage will not be modulated, no sound will be heard in the Model 34 loudspeaker.

Oscillation in the rf stage will usually be indicated by closure of the Model 34's tuning eye with no signal being fed to the receiver. As in the case of i-f oscillation, no sound will be reproduced by the Model 34 loudspeaker. The frequency of the oscillation will depend on the dial setting of the receiver.

How To Service A Noisy Receiver

Certain clues will lead directly to the noise source. (We are assuming that you have definitely concluded that the noise is originating within the receiver.) A change in noise level when actually moving the waveband switch, a push-button switch, the volume control, the tone control, or the tuning condenser, indicates that this device is at fault. Even if you do not have any of these clues, the noise can be localized to one section rather simply.

In the modern superheterodyne receiver, the volume control is either the diode load resistor, or is in the input circuit of the first af amplifier tube. Therefore, the volume control separates the rf-if section from the audio section of the receiver. If you turn the volume control to the minimum volume position and the noise disappears, the source of the noise is in the rf-if or detector section of the receiver. If the noise remains with the volume control set at minimum, the source of the noise is in the audio amplifier section, or in the power supply of the receiver. (This is not quite always true. Severe changes in current, such as may be caused by a plate circuit defect in an rf or i-f tube, may affect the power supply to the audio amplifier enough to introduce noise—even when the volume control is turned to zero volume. However, in such cases, turning down the volume control will decrease the noise intensity greatly.)

Noise signals pass through the receiver stages in the same way as other signals do. Their source can be readily located with the Model 34 Signal Tracer. To trace noise signals with the Signal Tracer, tune the receiver and Signal Tracer to some quiet point on the dial (set not tuned to a station). Trace from the first stage of the defective section (rf-if section or af section) toward the set's loudspeaker. When you first hear the noise coming from the Signal Tracer speaker, you have located the defective stage.

Remember that noises originating in one stage may feed back into a number of previous stages through a power supply circuit common to these stages. This can occur only when the noise signal is unusually strong, or in sets in which there is insufficient by-passing of the supply leads. Therefore, in rare cases, it is possible to pick up a noise signal in the plate circuit of one tube when the noise is actually originating in a later stage. Short the output of the first stage in which noise is traced, using a .25 mfd condenser. If the noise disappears in the receiver's output, this stage is more than likely introducing the noise. If the noise is still present in the receiver's output, suspect a following stage.

How To Service An Intermittent Receiver

The RF and AF probes of the Signal Tracer cannot actually be used at the same time. However, both may be connected to the receiver at one time. By throwing the RF-AF switch from one position to the other, you can sample the signal in two different sections of the receiver without disturbing the receiver by connecting or disconnecting test probes. It is suggested that the RF probe be clipped to the plate of the mixer tube and the Signal Tracer adjusted to pick up the i-f signal here. With the slide switch in the RF position, adjust the FINE and COARSE RF ATTENUATOR controls so the indicator eye is just closed. The AF probe should be connected to the plate of the first af tube. With the slide switch in the AF position, adjust the AF ATTENUATOR to give normal loudspeaker reproduction. (The amount of eye closure at this point is of little importance since the closure will vary with the carrier modulation.) When the intermittent occurs, check the signal at the RF position and then at the AF position of the slide switch. If it has faded at the RF position, the trouble is between the mixer plate and the antenna. On the other hand, if the signal is a *little stronger* at the RF position and *weak* at the AF position, the trouble is between the mixer plate and the second detector. (The increase in signal level at the mixer plate is due to the drop in avc voltage which permits the RF gain to increase.) If the rf signal level is constant, but the af signal level is weak, the trouble is between the second detector and the plate of the first af tube.

Signal Tracing In An FM Receiver

The "D" band in the Model 34 Signal Tracer will cover the i-f frequencies of FM receivers, and permits tracing of the FM signal from the mixer plate to the plate of the limiter stage. The same tests already described for AM receivers may be made. The FM receiver can be tuned either to an FM station or to a signal from a signal generator. The indicator eye of the Signal Tracer is used to indicate the presence or absence of the signal. Although loss of signal may be easily detected, and stage gain measurements can be made, you cannot listen to the quality of the Frequency Modulated i-f signal with the Signal Tracer, because the AM detector in the Signal Tracer will give somewhat distorted audio reproduction. Signal tracing in the audio section of an FM receiver is no different from tracing in the audio section of an ordinary AM set.

How To Align Receivers With The Signal Tracer

If a signal generator is available, it will probably be used for alignment purposes. However, the Model 34 Signal Tracer may be satisfactorily used to align a receiver. The Signal Tracer is employed to align the i-f amplifier and also the broadcast preselector and oscillator sections. On all-wave receivers, the oscillator frequency may be checked if it falls within the range of band "D" of the Model 34. However, once the receiver i-f is properly adjusted, stations may be used for oscillator and preselector adjustment. To align the broadcast band of a receiver, proceed in the following manner:

1. Clip the RF probe to the plate of the mixer tube.
2. Set the receiver dial to the frequency of a broadcast station in the neighborhood of 1400 kc and tune the Signal Tracer exactly to the same frequency as the station. (Do not tune the Signal Tracer to the i-f frequency of the receiver.)
3. Block the oscillator of the receiver by shorting its tuning condenser.
4. Adjust the receiver rf trimmer or trimmers for maximum closure of the Signal Tracer indicator eye. (If the indicator eye overlaps, adjust the RF ATTENUATORS for some indicator eye shadow.)
5. Tune the Model 34 to the i-f specified by the receiver manufacturer, remove the short across the oscillator condenser and adjust the oscillator trimmer for maximum closure of the Signal Tracer indicator eye.
6. (If the oscillator is not equipped with a low frequency padder condenser, omit steps 7 and 8. Go immediately to step 9.)

Assuming the receiver has a low frequency oscillator padder condenser, adjust it as follows: Tune the Signal Tracer to a station near 600 kc with the RF probe connected to the receiver antenna. Next clip the RF probe on the mixer plate, block the receiver oscillator, and manually tune the receiver for maximum closure of the Signal Tracer eye.

7. Tune the Signal Tracer to the receiver's correct i-f frequency, as in step 5, unblock the oscillator and adjust the oscillator low frequency padder condenser for maximum Signal Tracer indicator eye closure.
8. Tune the receiver to the station near 1400 kc and repeat the oscillator trimmer adjustment in step 5. Now repeat steps 6 and 7.
9. Move the RF probe to the plate of the first i-f amplifier tube, and adjust the first i-f transformer trimmers for maximum Signal Tracer indicator eye closure.
10. Move the RF probe to the ungrounded side of the diode load resistor, adjust the RF ATTENUATORS for maximum Signal Tracer sensitivity. A small signal should be present. Adjust the second i-f transformer trimmers for maximum Signal Tracer indicator eye closure. This completes the i-f alignment.
11. The short-wave preselector and oscillator trimmers can now be adjusted when tuned to known stations, so that maximum gain and proper dial settings are obtained.

TV Trouble-Shooting

It would be very expensive to extend the range of the Model 34 so it could tune to the i-f frequencies commonly employed in TV receivers. The older TV sets use an i-f centered around 23 mc (megacycles) while later receivers have gone to i-f values in the neighborhood of 43 mc.

No problem exists in checking the audio system of a TV receiver. The i-f frequency *after separation* of the video and sound carriers is, in the case of most sets, 4.5 mc. The Model 34 may easily be tuned to this frequency and can trace these signals right through the sound system to the loudspeaker.

This 4.5 mc signal is secured in a TV set by the beating together of the video and sound carriers in the video detector. A frequency of 4.5 mc is always obtained because this is the frequency separation always present between the video and sound carriers throughout the entire picture section of a TV set.

This beat will not be formed in the rf section of the Model 34. However, if one lead of a germanium crystal is wrapped around the point of the rf probe, the 4.5 mc beat will be formed when the other lead of the crystal is touched to a point in the TV set where both sound and picture carriers are present. Thus, with the Model 34 tuned to 4.5 mc you may pick up this beat which depends on the presence of both video and sound carriers. Since it may be picked up at any point in the TV set, from the output of the Front End to the grid of the picture tube, signal tracing, for the first time, becomes feasible in TV sets.

What Should I Purchase First? We often receive letters, from students just starting out, from practicing servicemen, and from graduates, asking our help in deciding which instrument to buy first. Of course, in some cases, the functions of the instruments under consideration do not overlap. The Signal Tracer comes the closest to being the universal service tool. Not only does it perform its own functions but it also does the work of a signal generator and will also substitute for a condenser analyzer because with it you can quickly locate condensers which are open, low in capacity or which have a high power factor. The Signal Tracer will not indicate the degree of capacity loss or the power factor rating but it will tell you if a condenser is working improperly and that a replacement should be tried. With experience you can quickly learn to spot condensers needing further investigation.

The Signal Tracer does not measure potential in volts but it is an rf-af voltage indicator and often you want to know if such voltage is present —not its exact quantity.

When you replace a tube the Signal Tracer can compare the stage gain and signal quality with that previously obtained. The Model 34 is not a "tube tester," but it can tell you more things about the performance of a tube than any serviceman's tube tester.

Yes, a Signal Tracer, such as the Model 34, will do just about everything but polish the receiver cabinet. It should be among the first on your list of test instruments.

n r i

Baltimore Chapter Member Reaches Age of Eighty

Graduate John B. Gough, that venerable gentleman who has for so many years been a faithful and very helpful member of Baltimore Chapter will be accepting birthday congratulations on August 9—just about the time he will be reading this issue. A special event indeed, because on that day Mr. Gough will have reached the age of eighty. For forty-five years, Mr. Gough has been a Sunday School Superintendent. He is a man of fine habits, sunny disposition, human understanding, a tremendous influence for good citizenship. He is deeply interested in Radio and Television and the activities of his Baltimore Chapter friends who hold him in very high esteem.

N.R.I. ALUMNI NEWS

NOMINATIONS FOR 1955

Time marches on. In these exciting days a year seems to slip by quickly. Once again it is time for the members of the NRI Alumni Association to select their candiates to fill offices during the coming year. We will vote for nominees for President and four Vice Presidents.

The two men receiving the largest number of votes for the office of President, will be declared nominees. The eight men receiving the largest number of votes for Vice Presidents will be declared nominees. The names of the nominees will be published in the October-November issue of NR-TV News. That, of course, is our next issue.

Our members then will be asked to choose from among the nominees, a President and four Vice Presidents. The election will take form during the month of October. The final day for voting will be October 25. However, before we get to that we must hold our primary to select our nominees. The final day for voting in the primary is August 25, 1954. So please get your ballot in early.

It might be interesting to our members, at this point, to quote from our Constitution. The following portion of our Constitution is taken from Article VI, pertaining to the election of officers. Here it is.

1. The election of the President and the Vice President shall be by ballot.

2. The President shall be eligible for re-election only after expiration of at least one year following his existing term of office, and when not a candidate for President, may be a candidate for any other office. Other officers may be candidates to succeed themselves, or for any other, but not more than one, elective office in the Association.

3. The election of officers shall be held in October of each year, on the day designated by the Executive Secretary, but not later than the twenty-fifth of the said month.

4. The Executive Secretary shall advise Members by letter, or through the columns of the National Radio-TV News, on or before August first of each year that names of all nominees shall be filed in his office not later than August twenty-fifth following.

5. Each Member shall be entitled to submit, in writing, one nomination for each office, and the two nominees receiving the highest number of votes shall be the nominees for the office for which nominated.

6. The Executive Secretary, before placing any name on the ballot, shall communicate with each nominee, to ascertain his acceptance of the office, if elected. If such tentative acceptance is withheld, the eligible nominee having the next highest number of votes shall be the nominee for that office.

7. The Executive Secretary, on or before October first of each year, shall furnish Members a ballot listing the names of the nominees for each office.

8. No Member shall be entitled to vote if he is in arrears in the payment of dues.

9. Ballots, properly executed and valid according to the instructions plainly printed thereon, shall be returned to the Executive Secretary on or before midnight of October twenty-fifth of each year.

10. The Executive Secretary shall designate three Election Tellers from the staff of the Institute, who shall count the ballots and certify the results, together with the return of the ballots, to the Executive Secretary.

11. In the event of a tie vote for any office, the Executive Secretary shall cast the deciding ballot.

Our very able President, Mr. Oliver B. Hill of

Burbank, California will have fulfilled his term the last day of December. Mr. Hill is very highly regarded by our members throughout the entire country and it was a real pleasure this year to have so able a man from the far west as the head of our organization.

A leading candidate for President during 1955 is Mr. Thomas Hull, Jr., of New York City. Mr. Hull is well-known by a great many of our Alumni members through his exceedingly good work in our New York Chapter. This year would be a good time to move him up into the President's Office.

Floyd Buehler of Detroit is another man who deserves serious consideration for the Office of Vice President. Still another man who is due for recognition is Mr. Elmer Shue of Towson, Maryland. For years Mr. Shue has quietly gone along doing much of direct benefit to members of our Baltimore Chapter and our national organization. Mr. Shue is a man to keep in mind for a national office.

In order that our members may have a list of candidates from which to choose we are submitting some names of members located in various parts of the country. These are submitted merely to be of assistance. See next two columns.

Use your own judgment. Vote for whom you please, just so he is a member of the NRI Alumni Association. This year be sure to exercise your privilege to vote. Fill in the ballot and mail it before August 25.

n r i

"Well, either super circus has pink elephants or my chroma's on the bum!"

Reprinted courtesy, Radio-Electronics Magazine. Copyright 1954, by Gernsback Publications.

Nomination Suggestions

T. E. Berryhill, Pomerene, Ariz.
Gordon E. DeRamus, Selma, Ala.
Don Smelley, Cottondale, Ala.
Edgar E. Joiner, El Dorado, Ark.
A. R. Waller, Keo, Ark.
Jos. E. Stocker, Los Angeles, Calif.
Herbert Garvin, Los Angeles, Calif.
A. W. Blake, Denver, Colo.
Chas. Bost, Leadville, Colo.
Albrecht Koerner, Stamford, Conn.
Joseph Medeiros, Hartford, Conn.
Gary Robinson, Stamford. Conn.
Eric Woodin, Naugatuck, Conn.
Wm. F. Speakman, Wilmington, Del.
Jos. Certesio, So. Wilmington, Del.
Max Yacker, Washington, D. C.
Wm. G. Spathelf, Washington, D. C.
Glen G. Garrett, Bonifay, Fla.
Henry C. Hasse, St. Petersburg, Fla.
Stephen J. Petruff, Miami, Fla.
W. P. Collins, Pensacola, Fla.
Raymond Marsengill, Atlanta, Ga.
R. R. Wallace, Ben Hill, Ga.
Joseph Bingham, Twin Falls, Idaho
H. C. Eskridge, Gannett, Idaho
Erwin Andrews, Batavia, Ill.
R. A. Holtzhauer, Joliet, Ill.
Fred J. Haskell, Waukegan, Ill.
Jerry C. Miller, Skokie, Ill.
Herbert Lausar, Chicago, Ill.
John Janesick, Chicago, Ill.
Harold Bailey, Peoria, Ill.
Dick Michael, Hartford City, Ind.
Chase E. Brown, Indianapolis, Ind.
Paul Knapp, Evansville, Ind.
H. E. McCosh, Charles City, Iowa
E. C. Hirschler, Clarinda, Iowa
C. Hopkins, Hutchinson, Kans.
Wm. B. Martin, Kansas City, Kans.
K. M. King, Wichita, Kans.
George Springmeier, Covington, Ky.
R. B. Robinson, Louisville, Ky.
L. H. Ober, Alexander, La.
Louis E. Grossman, New Orleans, La.
Walter Dinsmore, Machias, Maine
Harold Davis, Auburn, Maine
Ralph E. Locke, Calais, Maine
Elmer E. Shue, Towson, Md.
J. B. Gough, Baltimore, Md.
Woodrow Marks, Hagerstown, Md.
G. O. Spicer, Hyattsville, Md.
Manuel Enos, Fall River, Mass.
Louis Crestin, Boston, Mass.
A. Singleton, Chicopee, Mass.
Omer Lapointe, Salem, Mass.
John I. Babcock, Minneapolis, Minn.
Robert Swanbum, Duluth, Minn.
Arthur J. Haugen, Harmony, Minn.
Ray Williams, Minneapolis, Minn.
F. Earl Oliver, Detroit, Mich.
Chas. H. Mills, Detroit, Mich.
Harry R. Stephens, Detroit, Mich.
Floyd Buehler, Detroit, Mich.

Walter Jenkins, Biloxi, Miss.
Robert Harrison, West Point, Miss.
C. S. Burkhart, Kansas City, Mo.
A. Campbell, St. Louis, Mo.
C. W. Wichmann, Inverness, Mont.
Earl Russell, Great Falls, Mont.
V. S. Capes, Fairmont, Nebr.
Albert C. Christensen, Sidney, Nebr.
C. D. Parker, Lovelock, Nev.
L. R. Carey, Elko, Nev.
Arthur Cornellier, Dover, N. H.
Geo. Stylianos, Nashau, N. H.
J. A. Stegmaier, Arlington, N. J.
Delbert Delanoy, Weehawken, N. J.
Claude W. Longstreet, Westfield, N. J.
C. Evan Yager, Albuquerque, N. Mex.
Solomon L. Ortiz, Raton, N. Mex.
Wm. Fox, New York, N. Y.
David Spitzer, New York, N. Y.
Thomas Hull, Jr., New York, N. Y.
Phil Spampinato, New York, N. Y.
Frank G. Manz, New York, N. Y.
James Outlaw, Greensboro, N. C.
Irvin Gardner, Saratoga, N. C.
Max J. Silvers, Raleigh, N. C.
Arvid Bye, Spring Brook, N. Dak.
Wilbur Carnes, Columbus, Ohio
H. F. Leeper, Canton, Ohio
Chas. H. Shipman, E. Cleveland, Ohio
Byron Kiser, Fremont, Ohio
L. O. Marcear, Tulsa, Okla.
Emil Domas, Ritter, Oreg.
Folia T. Hall, Portland, Oreg.
Jules Cohen, Philadelphia, Pa.
Harvey Morris, Philadelphia, Pa.
Elmer E. Hartzell, Allentown, Pa.
Chas. J. Fehn, Philadelphia, Pa.
Laurent Vanaudenhove, Pawtucket. R. I.
James F. Barton, Greer, S. C.
Edw. K. Lukkes, Springfield, S. Dak.
John Wenzel, Gettysburg, S. Dak.
Newell M. Comer, Tullahoma, Tenn.
Matthew Duckett, Memphis, Tenn.
Oscar C. Hill, Houston, Texas
Dan Droemer, Ft. Ringgold, Texas
N. G. Porter, Cedar City, Utah
M. S. Galloway, Portsmouth, Va.
Wm. L. Cline, Daphne, Va.
Floyd Goode, Richmond, Va.
B. C. Bryant. Alburg, Vt.
C. R. Thompson, Vancouver, Wash.
Alfred Stanley, Spokane, Wash.
G. Bloomberg, Aberdeen, Wash.
Edgar Maynard, Red Jacket, W. Va.
Wm. Wiesmann, Fort Atkinson, Wisc.
Harold Brown, Laramie, Wyo.
Charles A. Smith, Cheyenne, Wyo.
M. Martin, New Westminster, B. C., Canada
E. D. Smith, Winnipeg, Man., Canada
H. V. Baxter, St. John, N. B., Canada
W. F. Arseneualt, Dalhousie, N. B., Canada
Donald Swan, Springhill, N. S., Canada
J. A. Hehir, Smiths Falls, Ont., Canada
G. Favreau, Montreal, P. Q., Canada
Thos. Crooke, Saskatoon, Sask., Canada

Nomination Ballot

L. L. MENNE, *Executive Secretary*
NRI Alumni Association,
16th and You Sts., N.W.,
Washington 9. D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1955.

(Polls close August 25, 1954)

MY CHOICE FOR PRESIDENT IS

....

City ....State ....

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. ....

City ....State ....

2. ....

City ....State ....

3. ....

City ....State ....

4. ....

City ....State ....

Your Signature ....

Address ....

City ....State ....

Student Number ....

Chapter Chatter

Philadelphia-Camden Chapter members are still talking about their twentieth anniversary celebration. They were pleased that five members of Pittsburgh chapter made the long trip to Philadelphia by automobile to attend the celebration. The Pittsburgh group consisted of Chairman Frank Skolnik, Vice Chairman Tom D. Schnader, Treasurer Howard Tate, Librarian Bill Roberts and the well-known Radio and TV expert, Bert Bregenzer, who is an honorary member of Pittsburgh chapter.

Sixty-six members turned out for the Philadelphia party. Door prizes were supplied by local Radio and TV houses and thirteen members went home with valuable articles such as a soldering gun, a tube caddy, a TV lamp, tools and miscellaneous items of value. Food and drinks were plentiful. There were short talks by about a dozen members including past National Presidents Charlie Fehn, Harvey Morris and Norman Kraft.

Much credit is due Chairman Fred Seganti and Secretary Jules Cohen, as well as the members of the entertainment committee. The party was an outstanding success.

Secretary Jules Cohen reports that his books show 112 paid-up members of Philadelphia-Camden Chapter. He also reports the following new members, Irvin Miller, Anthony Zalnich, Felix Brakoniecki, Maxim J. Cagnasso, John H. Showell, Jan Van Eeklen and Wellington C. Woods, all of Philadelphia.

At the twentieth anniversary meeting J. B. Straughn of Headquarters spoke on Analyzing and Servicing AC-DC Receivers. The members rated this talk as "terrific."

Harvey Morris is doing a great job with his talks on TV Servicing. He is a wonderful asset to our chapter.

Instead of suspending meetings entirely during the months of July and August the chapter members voted that one meeting each month be held. In September, of course, the chapter will resume its full schedule of meetings on the second and fourth Monday of each month at the Knights of Columbus Hall, Tulip & Tyson Sts., in Philadelphia. Any student or graduate in the Philadelphia area desiring information regarding chapter activities is invited to telephone Secretary Jules Cohen at FI 2 8094.

Chairman Fred Seganti of Philadelphia Chapter greets Chairman Frank P. Skolnik of Pittsburgh Chapter at Philadelphia 20th Anniversary party. Others in the picture, left to right, are Harvey Morris, Bert Bregenzer, Tom Schnader, and Bill Roberts. Hidden behind Skolnik are Jules Cohen and Howard Tate.

Notice the names of the many supply houses in Philadelphia who donated door prizes.

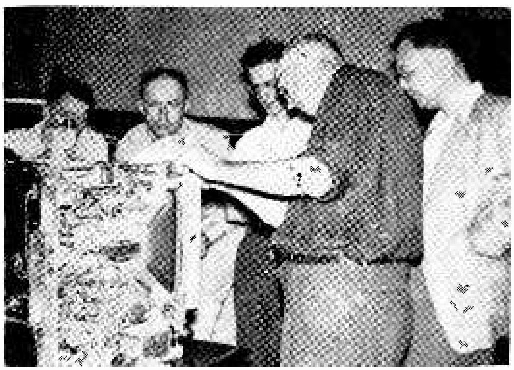
Part of the 66 members who attended the big social party in Philadelphia.

New York Chapter, always prepared to give its members well-planned programs, reports the following: Alex Remer and David Spitzer spoke on TV, I-F and Audio Testing. Frank Manz spoke on Demodulation. Thomas Hull, Jr. conducted the Radio Clinic.

At another meeting Philip Spampinato spoke on Amplifiers for Extension Speakers. Morris Friedman spoke on Basic Color TV. At still another meeting Alex Remer and David Spitzer again combined to give a good talk on TV Servicing. Phil Spampinato spoke on Intercom Amplifiers, William Fox chose as his subject Field Experiences. At each meeting Thomas Hull, Jr. conducted the popular Radio Clinic.

To bring to a close a very successful season, Chairman Bert Wappler arranged a social for the last meeting in June. Refreshments were served and there was the usual entertainment. Meetings are suspended during July and August but plans are already made for a big get-together at the first meeting in September.

Baltimore Chapter, keeping pace with our older chapters, also held a social party. In fact, it could properly be referred to as a banquet. It took place at Munder's Restaurant, 4536 Harford Road, one of the choice eating places in the city of Baltimore. This was perhaps the best of the many good affairs of this nature held by Baltimore chapter.



H. J. Rathbun servicing a TV receiver for benefit of Baltimore Chapter members.

John Harp has made available a TV receiver similar to the 630 Chassis which is very helpful to our leaders in speaking to the chapter on TV problems. Mr. H. J. Rathbun usually leads these discussions. As Mr. Rathbun speaks several defects are purposely introduced in the receiver and Mr. Rathbun elaborates on each with a short talk and demonstration.

The members are very pleased with our meeting place in the O.U.A.M. Hall, 100 N. Paca St. in Baltimore. Students and graduates in the Baltimore area desiring information regarding meetings are invited to communicate with Secretary Joseph M. Nardi, 4157 Eierman Ave., Baltimore 6, Maryland.

New Orleans Chapter through Chairman Louis Grossman is following the NRI Professional Television Servicing course. The members are going through the course step by step. Needless to say the members are coming regularly so as not to miss a single one of these meetings which are proving extremely interesting.

By unanimous vote the members decided to change the meeting dates to the first and third Tuesday of each month. Heretofore the chapter has been meeting only once a month. With our extensive program for the benefit of our New Orleans members it was deemed necessary to meet twice a month. Meetings are held at 2229 Napoleon Ave. beginning at 8 o'clock PM. Please remember the dates—the first and third Tuesday of each month. Secretary Anthony H. Buckley will be glad to have any students or graduates in this area get in touch with him at 2817 Burgundy St., New Orleans.

Detroit Chapter held its annual stag party on June 11 at the Chrymoto Club, 2330 McDougal St. in Windsor, Ontario, Canada. The stag party was the usual big night so greatly enjoyed by Detroit members. A big vote of appreciation is extended to Chairman John P. Kehoe, Vice President F. Earl Oliver, Secretary Bob M. Kinney and Clarence McMaster for the splendid arrangement.

We regret that it is necessary for Leonard Retwowski to drop out of the chapter because of a change in his working hours.

Tom Paterson, our Vice Chairman talked on "Hearing Aids, their application and repair." Paterson is a full-time man in the Electronic field and really knows his subject. Earl Oliver, our National Vice President, put on a show on Alignment using the RCA Dynamic Demonstrator and our newly acquired NRI Vacuum Tube Voltmeter.

Meetings are suspended during July and August. However, arrangements have already been made for a grand opening in September, at which Max Ludtke will speak on "Printed Circuits" and Floyd Buehler will speak on "Servicing Audio Amplifier Systems."

If you do not hold a ticket entitling you to a chance on winning a very fine Electric Drill Kit, ask Secretary Bob Kinney to tell you how you can qualify for a chance. Beginning in September meetings will be resumed on the second and fourth Friday of each month at St. Andrews Society Hall, 431 E. Congress, beginning at 8 P.M.

These very attentive men are one half of the group in our Milwaukee Chapter. The photographer could catch only part of the hall. Chairman S. J. Petrich, not shown in the picture, was the speaker.

Milwaukee Chapter was visited by our Executive Secretary who donated a door prize which was won by Guenter Operman. At this meeting, three sound films were shown featuring Cathode Ray Tubes, Television—How it Works, and Bottle of Magic. Chairman S. J. Petrich, who is in the Radio and Television business on Vliet Street leads the open forum and gives the members some very valuable tips on Radio and Television Servicing.

Treasurer Bettencourt has contributed much to the success of our meetings through literature he makes available for the members, his inspiring letters he sends to all to keep them posted on the doings of the chapter. CBS donated a soldering dispenser for a door prize which was won by Gilbert N. Nelson.

Members John T. Edgerton, Wallace Smith and Joe Reed were among those who took part in an interesting open discussion pertaining to such things as checking Cathode Ray Tubes; Selenium Rectifiers; Causes of Picture Failure; Voltage doublers; Characteristics of Bad Picture Tubes; and Checking the CRT Pin Voltage with a Meter. Chairman Petrich made these talks very interesting through his blackboard drawings and comments.

Meetings are held on the third Monday of each month at 2249 North Humboldt Ave., Corner East North Avenue. Milwaukee chapter now has forty paid-up members and is growing steadily. Students and graduates in this area are invited to communicate with Secretary Robert Krauss, 135 E. Keefe Ave., Milwaukee, Wisconsin.

Pittsburgh Chapter had as its speaker Vice Chairman T. D. Schnader who spoke on General

Left to right, L. L. Menne; S. J. Petrich, Chairman; Robert A. Krauss, Secretary; Ernest V. Bettencourt, Treasurer; Clarence P. Kleier, Alternate Vice Chairman; and Erwin E. Kapheim, Vice Chairman, at a meeting of Milwaukee Chapter.

TV Servicing and Secretary K. J. Shipley who spoke on Defects in Receivers. At another meeting Mr. B. A. Bregenzer who is Vice President of Pennsylvania TV Service Federation spoke on the Oscilloscope. Mr. Bregenzer was assisted by our member W. J. Lundy. Again Mr. Schnader took part in the program, this time giving some valuable hints on servicing a 17-inch TV set.

Pittsburgh Chapter has now passed the 100 mark in strength. They are starting their second year of operation with plans to increase membership by at least 50%. Much credit is due Chairman Frank P. Skolnik, 616 Springfield Avenue and to Secretary Ken J. Shipley, 1009 St. Martin St. either of whom will be glad to hear from any NRI students or graduates in the Pittsburgh area who would like to join the chapter.

Springfield, Massachusetts, one of our newer chapters, is doing remarkably well. At the last meeting they had an attendance of 34. Chairman Howard B. Smith reports an enthusiasm beyond expectation. Their newest member is Paul F. Fisette who drives from Orange, Massachusetts a distance of about 50 miles each way.

The officers decided a good way for all members to become better acquainted would be to hold an outing in August and it has been arranged. Details are not complete as we go to press but all members will be notified by the Secretary of the chapter.

At the last regular meeting Mr. Jenkins of the B. H. Spinney Company, the local Sylvania distributor gave an excellent talk augmented with film.

Treasurer L. Lyman Brown has lined up some interesting material through General Electric which he and Chairman Smith are shaping up for the benefit of members to hear and see at forthcoming meetings. Vice-Chairman Ray Nystrom arranged for the chapter to meet at the U.S. Army Reserve Headquarters, 50 East Street, in Springfield. For the present, the members decided to meet on the third Friday of each month. Chairman Howard B. Smith is pleased with the number of letters and telephone calls he has received from students and graduates in the Springfield area who are interested in attending meetings. He can be reached at 53 Bangor Street. Secretary A. L. Brosseau may be addressed at 56 Gardner Street.

Chicago Chapter is rolling along smoothly with many practical demonstrations. The chapter now has a 5-tube superheterodyne demonstration panel and plans to build another. They likewise have plans for a TV panel. Chairman Charles C. Mead invites members to bring in radios or television receivers along with any other electronic problems they may have. Chicago chapter has gone in very much for practical work rather than lecture periods which is being well received. Acting Secretary V. Brodnicki has had considerable experience in electronics. Mr. Walter H. Nicely, Technician for Delta Airlines, who has had a great deal of experience servicing aircraft electronics, communication units, television and radio receivers is leading our service forum. He describes things in a language which is understood by all.

Chicago Chapter voted unanimously to continue to meet during the summer months which speaks well for the interest of the members. Meetings are held on the second and fourth Wednesday of each month in the Tower Space in the American Furniture Mart, 666 Lake Shore Drive, Chicago. Please use West entrance.

St. Paul-Minneapolis Chapter, our new, healthy baby, already has thirty-one members and it is anticipated that many more will join as soon as they learn that there is now a chapter of the NRI Alumni Association in the Twin Cities. Incidentally, there was some discussion as to whether the chapter should be known as the Twin City Chapter but for the present, at least, it was decided to operate under the St. Paul-Minneapolis designation.

Secretary John I. Babcock is giving a great deal of time and energy toward organizing this new chapter and he is making excellent progress. A planning committee has been organized and there is much in store for the members in the immediate future meetings. At the last meeting Gilman Hystad won the first door prize of a Pix-Eye for checking CRT's and George Thell won the second door prize, a set of the new GE wrenches, both door prizes being donated by Starks Radio Supply Company, with whom Chairman Warren A. Schulze is associated.

The planning committee consists of Max Miller and R. E. Olson. Mr. Miller is part owner of a well established Radio-TV service company known as Miller Brothers Radio and Television. Mr. Olson and Mr. Miller will be a great help to our chapter.

As this issue goes to press the secretary reports that a photograph will be made at the next meeting to include all of the charter members, that a door prize again donated by Stark Radio Supply Company consisting of a soldering iron and a pound of 60-40 solder will go to some lucky member and that meetings will be held on the second Wednesday of each month at 2191 Ford Parkway in St. Paul. Members are reminded that the second Wednesday of each month is a new date decided upon at the last meeting. Please keep this date in mind and by all means, if you live in this area, attend meetings and lend your support.

NATIONAL RADIO-TV NEWS
16th & U Sts., N.W. Washington 9, D. C.

Mr. Francis H. Fingado 25236-G
611 17th St.
Denver 2, Colo.

4

National RADIO-TV NEWS

Vol. 16 August-September, 1954 No. 4

Published every other month in the interest of the students and Alumni Association of the

NATIONAL RADIO INSTITUTE
Washington 9, D. C.

The Official Organ of the N R I Alumni Association. Editorial and Business Office, 16th & You Sts., N. W., Washington 9, D. C.

L. L. MENNE, EDITOR
H. L. EMERSON, ASSOCIATE EDITOR
J. B. STRAUGHN, TECHNICAL EDITOR

Index

Printed in U.S.A.