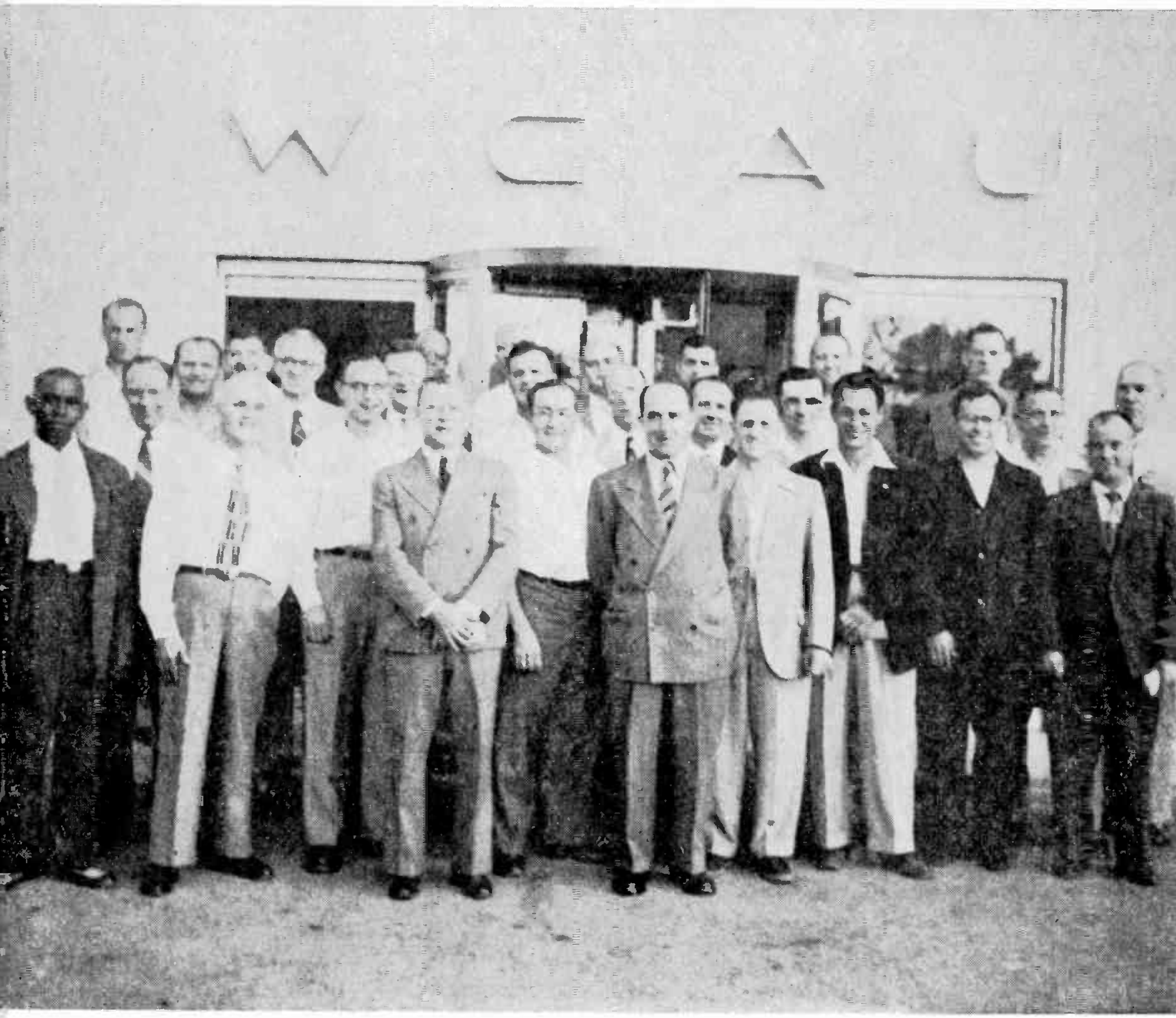
National RADIO-TV NEWS



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Model 89 NRI Signal Generator and Marker
A New Slant on Vacuum Tube Amplifiers
NRI Alumni Association News

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TEN SUGGESTIONS FOR HOLDING AND IMPROVING A JOB

I. Accept and welcome fair criticism. When executives find that certain men resent criticism, they stop criticizing and begin firing.

II. Don't give out unfair criticism. Don't be a chronic grouch or petty complainer. Stop listening to grouchy associates or you'll become like them.

III. Develop a "we" and "our" attitude toward your company. Show an enthusiasm and interest in the company's success. Realize that what hurts company business hurts you also.

IV. Hard work brings success just as fast today as ever. Remember this—if you never do more than you're paid to do, you'll never get paid for more than you do.

V. Prepare yourself to handle part or all of the work of men above you. A good understudy for an executive is too valuable to fire.

VI. Always be ready to lend a hand to others or do new tasks. Willing workers are hard to fire.

VII. Develop confidence in your abilities, but avoid over-confidence. Bluffers eventually get deflated. Confine your clock-watching to alarm clocks, and make a habit of getting to work on time.

VIII. Keep your head when the routine of work is varied or when an emergency arises. Accept responsibility whenever opportunity offers; a refusal kills chances for advancement.

IX. Don't bury your nose in the details of your job. Organize your work and assign routine duties to your assistants whenever possible, so you will have time for more important things.

X. Devote a few minutes of each day to clear thinking about your job, your future and your company's future. Jot down each worthwhile idea immediately, develop the idea in your mind for a few days, then write it up in detail for consideration by your superiors. Initiative of this form is welcomed and eventually rewarded.

J. E. SMITH
President.

How to Use The New Model 89 NRI Professional Signal Generator And Marker

By B. VAN SUTPHIN
NRI Consultant

B. van Sutphin

Many students write to us each year requesting information on how to use a signal generator in servicing. To help those students and graduates who have signal generators but do not have instruction manuals, or who have signal generators with instruction manuals but want additional information, we are reprinting a portion of the instruction manual for the new Model 89 NRI Professional Signal Generator described elsewhere in this issue and shown in Fig. 1.

Throughout this article, the names given for the various controls are those used on the front panel of the Model 89. Because these control names are not necessarily those used on every signal generator, a brief discussion of the purpose of the various controls is in order:

MAIN TUNING: This control adjusts the frequency of the generator over the particular range to which the BAND switch is set. It corresponds to the tuning control in a receiver.

FUNCTION: This control selects the type of signal available from the output jack of the generator. In some signal generators, the function of this control may be covered by two separate controls or separate output terminals. In any case, the FUNCTION control allows you to obtain modulated rf output, unmodulated rf output, or an audio signal.

BAND SWITCH: This control selects the band of frequencies covered by the MAIN TUNING.

COARSE ATTENUATOR. This control varies the amplitude of the signal generator output over a wide range.

FINE ATTENUATOR: This is a continuously variable control used for fine adjustment of the amplitude of the signal generator output.

These terms are used throughout the following article to identify the various controls. If you have some other signal generator that uses a different system of notation, try to determine which of the controls on your signal generator correspond to the controls mentioned above in reading this article.

The Model 89 NRI Professional Signal Generator has a built-in dc blocking condenser that prevents the dc voltage in a receiver circuit from being fed to the signal generator circuits. Not all signal generators have this feature. If you have some other type signal generator and are in doubt, use a .1-mfd, 600-volt condenser in series with the "hot" signal generator output lead.

Getting Acquainted With A New Signal Generator

To get acquainted with any new signal generator, you should obtain a receiver in good working condition; if possible, an all-wave receiver.

Plug the receiver in and turn it on. Turn the receiver volume control to its maximum position. (If it is an all-wave receiver, set the band switch of the receiver to the "broadcast band" position.) Set the receiver dial to some point between 800 kilocycles and 1000 kilocycles where no broadcast signal is heard.

Plug in the signal generator and turn it on. Clip the "hot" lead of the signal generator output

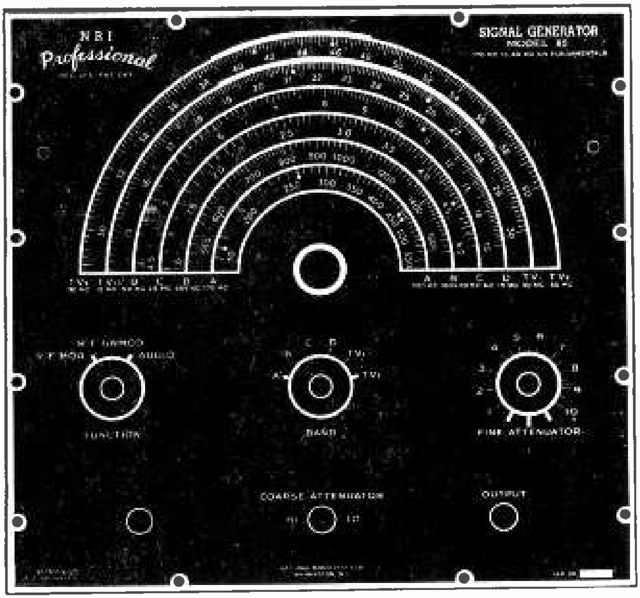


FIG. 1. This drawing of the Model 89 NRI Professional Signal Generator panel shows the arrangement of the various controls.

cable to the "antenna" connection of the set (or clip it to the loop if a loop antenna is used). Connect the ground lead to the ground terminal of the set or, if no ground terminal is provided, to either the set chassis or to "B minus." Set the FINE ATTENUATOR to a mid-position. Set the COARSE ATTENUATOR to the highest output position. Set the BAND switch to the position that allows the MAIN TUNING to cover the broadcast band and the FUNCTION switch to the RF MOD position. Set the MAIN TUNING control to the frequency to which the receiver is tuned. For example, if you tuned the receiver to 900 kc, set the plastic pointer of the signal generator to a reading of 900 on scale B.

After allowing a few minutes for both the set and the signal generator to warm up, gradually turn the FINE ATTENUATOR clockwise. You should hear an audio note through the receiver speaker.

If the receiver is not accurately calibrated, you may find that no signal is heard. In that case, turn the FINE ATTENUATOR to its maximum clockwise position and rotate the signal generator MAIN TUNING knob slowly back and forth until the signal is heard. As you tune toward the exact frequency, the signal will become louder.

With the FINE ATTENUATOR set to maximum, you may wish to reduce the volume by the use of the receiver volume control. After you reduce it to a comfortable level, change the setting of the COARSE ATTENUATOR and note the change in volume.

Once you have seen how the COARSE ATTENUATOR control works, turn it to the maximum position and gradually turn the FINE ATTENUATOR counter-clockwise. You will notice a reduction in volume.

Repeat this general procedure for a number of different frequencies and on different bands if you wish. If you use the higher frequency bands of the signal generator, you must use the short-wave bands of the receiver.

You can also experiment with using harmonics of lower frequency signals to become familiar with the general technique. Set both the FINE ATTENUATOR and the COARSE ATTENUATOR to maximum. Set the FUNCTION switch to the RF MOD position. Set the BAND switch to the position that allows the MAIN TUNING control to cover the broadcast band.

Set the receiver dial at a frequency between 1200 and 1300 kilocycles (where no local station is picked up). Slowly tune the MAIN TUNING control of the signal generator between 500 and 700 kilocycles. You should find one point at which a signal is heard through the receiver loudspeaker. Since the receiver is tuned to a frequency twice that of the signal generator output, you are picking up the second harmonic of the signal generator.

To become acquainted with the operation of your signal generator as an audio signal source, set the FUNCTION switch to the AUDIO position. Set the FINE ATTENUATOR and COARSE ATTENUATOR controls for maximum output as outlined previously. Disregard the setting of the MAIN TUNING knob and the BAND switch; the audio output frequency is fixed at approximately 400 cycles.

If the test receiver has a connection for a phonograph, clip the "hot" signal generator lead to this terminal and clip the ground lead of the signal generator to the ground terminal of the phono connection point, or to the set chassis.

You should now hear a loud audio note; it may be so loud that the set is overloaded so that a distorted note is heard. Reduce the volume by turning the receiver volume control counter-clockwise; by setting the COARSE ATTENUATOR to a lower position; or by turning the FINE ATTENUATOR counter-clockwise.

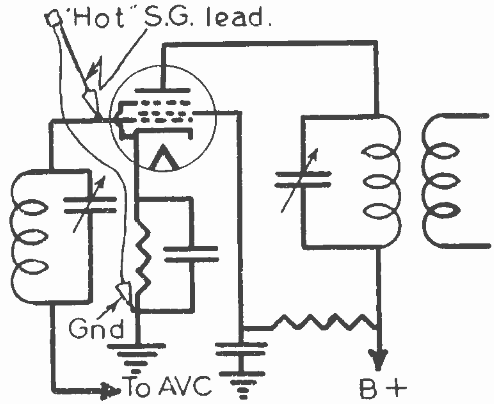


FIG. 2. Typical rf or i-f amplifier circuit.

If the receiver does not have a "phono" connection terminal, you can usually clip the leads of the signal generator output across the receiver volume control. Determine which is the "hot" side by turning the volume control on full and touching each outer terminal with your finger; touching the "hot" terminal will produce a loud hum. The "hot" signal generator lead connects here. Connect the signal generator "ground" lead to the receiver chassis, or to the ground terminal of the volume control.

If you follow the above procedure, you will soon become familiar with the use of the various controls on your signal generator and see how the manipulation of these controls affects the signal generator output signal.

Connecting the Signal Generator to a Receiver

Whether the signal generator is used for alignment or stage-by-stage testing, the signal generator output must be connected to the receiver at some point. Electrically, the point of connection is usually the grid circuit of some stage in the receiver; physically, it will depend upon the type of tubes used in the receiver and the physical construction of the circuit.

The schematic of a typical rf or i-f amplifier circuit is shown in Fig. 2. Consider that you want to connect the signal generator output to the grid of this stage, as shown in the schematic.

If a single-ended tube, in which the grid connection is brought out to a pin on the tube base, were used in the stage, the physical connection would be as shown in Fig. 3. The clips of the signal generator output cable are connected directly to the socket lugs. (To identify the proper lugs on the tube socket, refer to a tube chart which shows the electrode connections in the tube.)

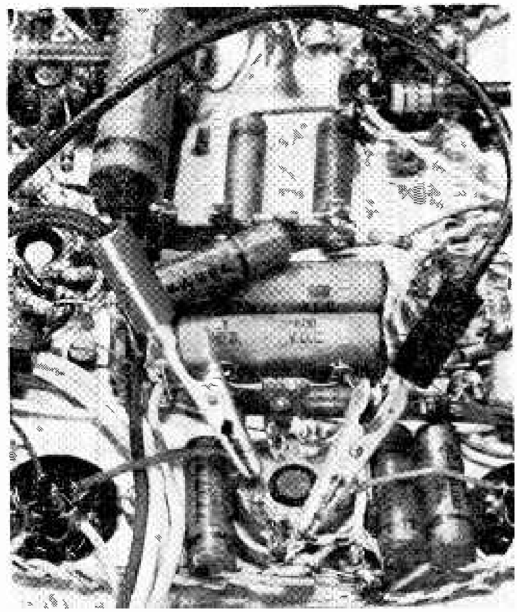


FIG. 3. Typical connection to the tube socket lugs.

If a double-ended tube, in which the grid connection is brought out to the tube top cap, were used in this stage the physical connection would be as shown in Fig. 4. The "hot" lead of the output cable is again connected to the tube grid

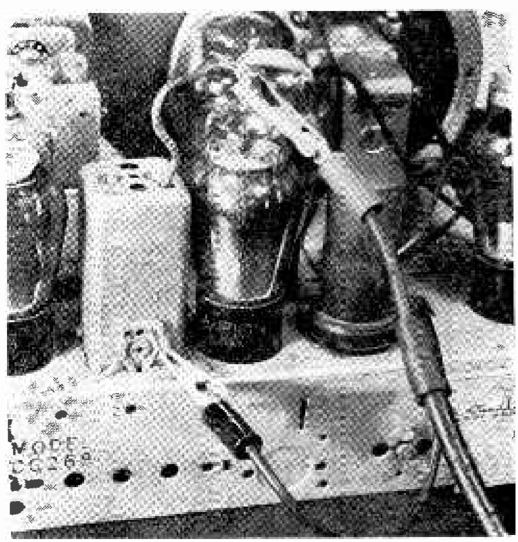


FIG. 4. Typical connection to the tube grid cap and the chassis.

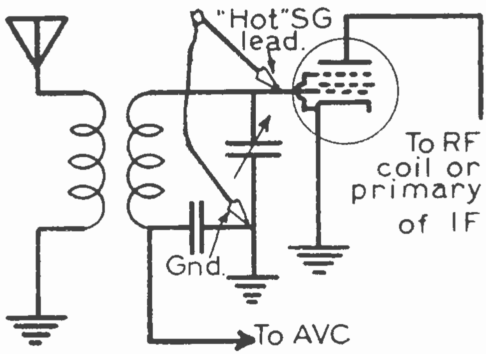


FIG. 5. Signal Generator connection to an rf amplifier or converter circuit.

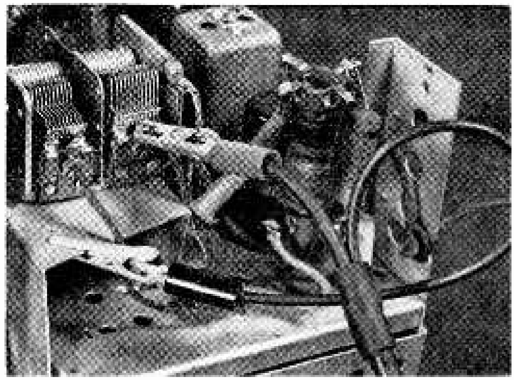


FIG. 6. Signal Generator connection to the tuning condenser stator and the chassis.

and the ground lead is connected to the set chassis.

The schematic of a typical input stage (rf amplifier or converter) is shown in Fig. 5. Consider that you want to connect the signal generator output to the grid of this stage as shown in the schematic.

If a double-ended tube were used in this stage, the physical connection would be as shown in Fig. 4. If a single-ended tube were used in the stage, however, it would not be necessary to connect the signal generator output as shown in Fig. 3. From the schematic in Fig. 5 you can see that the tube grid connects to one section of the variable condenser. This will be one of the stator sections of the tuning condenser and the signal generator output could be connected to this section of the tuning condenser as shown in Fig. 6.

There are a number of ways to connect the signal generator to the input of a receiver with a loop antenna. The method of connection in a particular case depends upon the physical design of the receiver and the degree of misalignment.

If the receiver is badly misaligned, the signal generator output leads can be connected to the grid circuit of the receiver at the loop terminals. If the receiver is fairly well aligned, sufficient coupling can be obtained with a loop of wire wound around the receiver loop. The signal generator output leads must then be connected to the free ends of this "coupling loop." For convenience, you can construct a permanent coupling loop with a single turn of heavy wire mounted on a board with connections for the signal generator output cable. This is very convenient in aligning sensitive receivers that use loop antennas.

When only slight coupling between the signal generator and the receiver under test is desired, the "hot" lead of the output cable can be clipped to the form on which the loop is wound and the ground lead is connected to the receiver chassis.

If no loop antenna is used on the receiver, you can connect the "hot" lead of the signal generator output cable to the antenna post of the receiver under test when maximum coupling is desired. If less coupling is desired you can connect a small condenser—150 mmf—between the "hot" lead of the output cable and the receiver antenna post, or you can connect a wire to the receiver antenna post and clip the signal generator "hot" lead to this wire, over the insulation, so that direct contact is not obtained. For still less coupling, you can lay the antenna wire and the signal generator output lead close together on the bench. The stray coupling between the two will give sufficient signal transfer in many cases.

To inject an audio signal from the signal generator, the basic connections are the same as those used in other stages of the receiver. If a double-ended tube is used in the first audio stage, the "hot" lead of the output cable can be connected to the grid cap of the tube and the

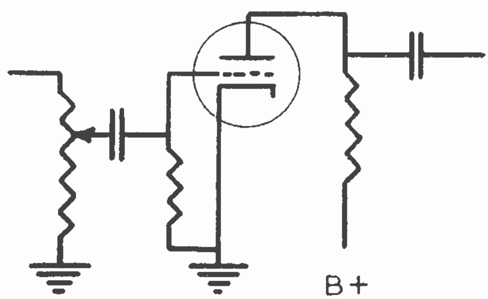


FIG. 7. Typical first audio amplifier stage.

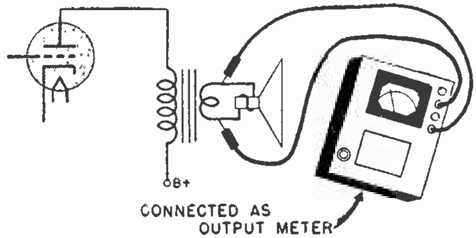


FIG. 8. Output indications can be obtained by connecting an ac voltmeter across the loudspeaker voice coil.

ground lead to the receiver chassis. If a single-ended tube is used in the stage, the signal generator output leads can be connected to the pins of the tube socket.

The first audio amplifier stage of most receivers is like that shown in Fig. 7. The most convenient connection point is frequently the volume control. By connecting the "hot" lead of the output cable to one end of the control and the ground lead to the other end satisfactory injection can be obtained. (Be careful not to connect the output cable to the switch terminals of the control. If this were done, signals would not be injected into the stage. Also, the signal generator would be damaged if a blocking condenser were not included in series with the "hot" signal generator output lead.)

If the volume control is not in the audio stage, identify the first audio tube in the receiver and connect the output cable to the grid of that tube. Connect the ground lead to the chassis.

Output Indicators

In aligning tuned circuits that must be peaked at certain frequencies, a volt-ohm-milliammeter can be used as an indicating device. The meter can be connected to the circuit in a number of different ways. The proper one to use in a particular case is often a matter of personal preference and convenience. You should, however, be familiar with all the methods.

The simplest connection is shown in Fig. 8. In this application, the ac voltmeter section of the test instrument is used. By setting the voltmeter to one of the lower ranges and connecting the leads to the voice coil terminals of the speaker, the ac voltage across the voice coil can be measured. For this purpose, the volume control of the receiver must be set to maximum, and the signal generator attenuators must be set so that a readable voltage indication is obtained.

Connecting an ac voltmeter across the speaker voice coil is not the best, nor the most accurate, means of obtaining output readings. To obtain a readable voltage, the attenuators of the signal generator must be set quite high. The loud audio tone is unpleasant to most servicemen. This method of connection should be used only when no other means is convenient.

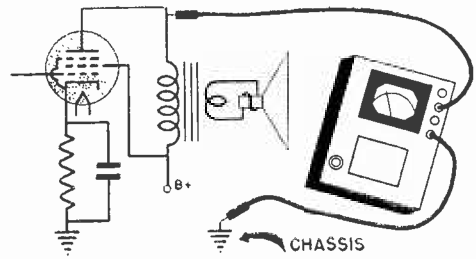


FIG. 9. More accurate output indications can be obtained by connecting an OUTPUT meter, or an ac voltmeter with a .1-mfd condenser in series between the plate of the output tube and ground.

Another method of measuring the audio output voltage is shown in Fig. 9. In this application, the OUTPUT jacks of the voltage measuring instrument must be used to prevent dc voltage in the circuit from affecting the readings and possibly damaging the test instrument. (Connect a .1 mfd condenser in series with one of the ac voltmeter test leads if you are uncertain.) Connecting the output meter from the audio output tube plate to ground will work with both single tube and push-pull output circuits. In the latter case, connect one ac voltmeter lead to the chassis and the other to one tube plate. Set the receiver volume control to its normal position and set the output meter to a medium range; adjust the signal generator attenuators so that a satisfactory voltage reading is obtained.

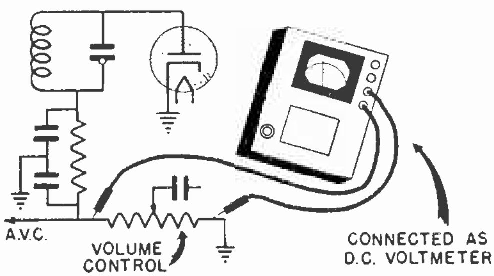


FIG. 10. The most accurate method of obtaining output indications.

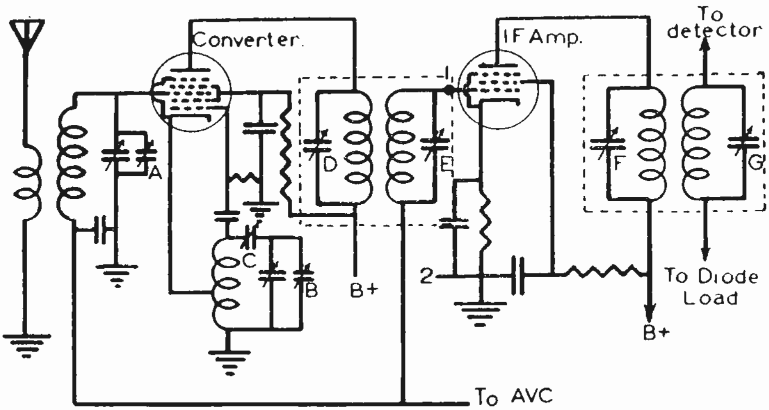


FIG. 11. Typical superheterodyne converter and i-f stages.

The most accurate means of obtaining an output indication is shown in Fig. 10. A multimeter, set for dc voltage measurements, is connected across the detector load (volume control in most modern receivers). The signal generator output is then adjusted so that approximately 3 volts is obtained across the load.

When this type of connection is used, you can turn the receiver volume control down without affecting the reading or you can set the FUNCTION switch of the signal generator to the UNMOD RF position so that no audio tone is produced. (No modulation of the signal generator output is necessary because you are measuring the dc voltage developed by the rf signal.)

Measurement of the dc voltage developed across the detector load is the best and more accurate system of obtaining receiver output indications during alignment. Use this method of connection whenever possible.

If the receiver has a built-in tuning indicator, such as a "magic-eye," you can use it as an output indicator.

The methods of connecting an output meter to an FM or TV receiver will be considered separately.

Superheterodyne Alignment

Introduction: In a trf receiver, most alignment is carried out at only one frequency and consists of adjusting only the trimmers on the condenser gang for maximum output. In a superheterodyne, a number of different circuits are used and a number of different alignment steps at different frequencies are necessary. The general procedure is to align the i-f amplifier first by feeding in an i-f signal to the circuit and adjusting the i-f trimmers (or coil cores) to give maximum output at this frequency, and then aligning the oscillator and preselector sections to give maximum output and proper dial tracking.

The following general information on alignment is presented for use in cases where you do not have the manufacturer's alignment instructions. If the manufacturer's alignment data is available, it should be followed.

In some receivers, variable tuning slugs are provided instead of trimmer condensers. Where trimmer adjustments are mentioned here, the procedure also applies to the corresponding tuning slugs. The basic technique is the same in both cases.

Basic Superheterodyne Alignment

The oscillator-mixer and i-f amplifier sections of a common single-band superheterodyne receiver are shown in Fig. 11. This schematic will be used in this discussion so you can become more familiar with the circuit connections of the trimmers and be able to identify them more readily.

1. Plug in and turn on both the signal generator and the receiver to be aligned; allow a few minutes for them to warm up.
2. Connect the output indicator as described previously. (If possible, connect the dc voltmeter to measure the avc voltage.)
3. Short the oscillator section of the tuning condenser, trimmer B in Fig. 11. This stops the oscillator and prevents the oscillator signal from beating with the signal generator output to produce spurious signals at random frequencies.
4. Connect the signal generator output to the receiver. If the receiver uses an rf stage or is badly out of alignment, connect the signal generator output to the grid of the mixer in the receiver; if no rf stage is used or the receiver is not too far out of alignment, connect the signal generator output to the antenna and ground terminals of the receiver or to the loop antenna as described previously.
5. Set the BAND switch and the MAIN TUNING

control of the signal generator to produce the correct i-f for the receiver to be aligned. Set the signal generator attenuators so that a suitable indication is obtained on the output meter.

6. Adjust the i-f trimmers for maximum response. These are the trimmers D, E, F and G in Fig. 11. The i-f trimmers are usually mounted on the i-f transformer—on the top, the bottom, or the side of the shield can. In some older receivers, however, the trimmers are mounted separately. With the latter, you will have to depend on the manufacturer's instructions or you will have to trace the circuit to locate the i-f trimmers. In some older receivers, the output i-f transformer, the one feeding the second detector, has only one trimmer. In other sets, one trimmer is mounted on top of the transformer and the other on the bottom. Look carefully before you decide there is only one trimmer.

7. Repeat all i-f trimmer adjustments, starting at the second detector, to eliminate the effects of interaction between the adjustments.

8. Remove the short connected across the oscillator section of the tuning condenser.

9. Check the position of the dial pointer on the receiver. A calibration point is frequently given at one end of the dial scale to indicate the correct position of the pointer when the tuning condenser is completely open or completely closed. If such a calibration point is given, make certain it lines up with the dial pointer properly.

10. If the signal generator output was previously connected to the mixer grid, move the connections to the receiver input or to the loop antenna.

11. Set the receiver dial to 1500 kc. (If there is a local station on 1500 kc, set the receiver dial to any frequency between 1500 kc and 1600 kc that can be read accurately from the receiver dial.)

12. Set the signal generator BAND switch and MAIN TUNING to the frequency indicated by the receiver dial. Adjust the oscillator trimmer, B in Fig. 11, for maximum output.

If the recevier is badly out of alignment, you may not obtain an output indication. In that case, rotate the signal generator MAIN TUNING back and forth until an indication is obtained. Then adjust the oscillator trimmer and the signal generator MAIN TUNING until the signal generator is set to the frequency indicated by the receiver dial and maximum output indication is obtained.

13. Without changing the setting of the receiver dial or the signal generator MAIN TUNING, adjust the mixer trimmer, A in Fig. 11, for maximum output.

If the receiver has no padder, this completes the alignment procedure. Most modern receivers use special "superhet tuning condensers" that have the oscillator section smaller than the mixer section and have specially cut plates. No padder is required in sets using that type of condenser. If the receiver has a padder condenser, or an adjustable slug in the oscillator coil, however, the following additional steps are necessary.

14. Tune the signal generator and the receiver to 600 kc. (Use any frequency between 600 kc and 650 kc.) Adjust the padder, C in Fig. 11, for maximum output. This procedure gives best dial accuracy; if maximum sensitivity is desired, use the following procedure, known as "rocking."

Set the signal generator MAIN TUNING to 600 kc. Tune the receiver to produce maximum output indication, regardless of dial setting. *Make a note of the exact output reading.*

Change the setting of the padder slightly. Retune the receiver for maximum output. Make a note of the output. If the output has increased, you are adjusting the padder in the correct direction; if the output has decreased, you are adjusting the padder in the wrong direction.

Continue adjusting the padder in the correct direction and retuning the receiver dial until maximum output indication is obtained. Of course, you must tune the padder slightly beyond the correct point, and then come back to make certain you have the maximum.

15. Set the receiver dial and the signal generator MAIN TUNING to the frequency used in Step 11. Readjust the oscillator trimmer for maximum output indication.

16. Check the padder adjustments by following the procedure in Step 14.

Repeat these adjustments until the dial calibration is correct at the high end of the dial, and the padder is adjusted for maximum response at the low end of the dial. When you have done this, the receiver will track reasonably well and maximum sensitivity will be obtained over the entire tuning range.

Multi-Band Receivers

To align a multi-band receiver properly, you should have the manufacturer's alignment information. Instructions for aligning a multi-band receiver when the service information is not available are given in the NRI lessons.

FM Receiver Alignment

Most modern FM receivers use an i-f of 10.7 mc. Two basic types of detector circuits are commonly used in modern FM receivers: the discriminator and the ratio detector. The two systems will be discussed separately because somewhat different alignment procedures are necessary.

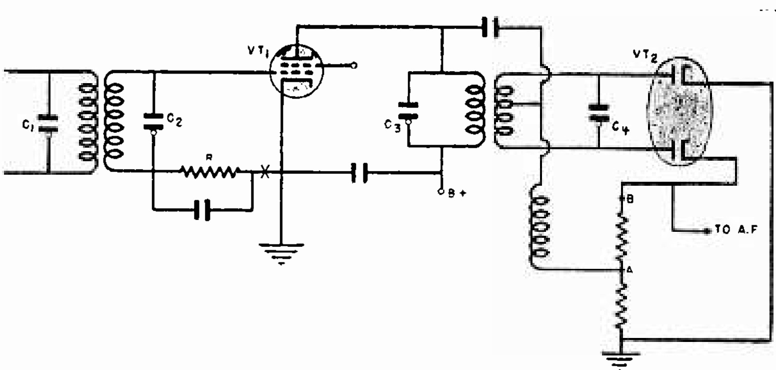


FIG. 12. Typical limiter and discriminator stages of an FM receiver.

The Limiter-Discriminator: In aligning this type of circuit two separate steps are necessary. The i-f stages up to the limiter grid circuit must be aligned first, and the detector aligned separately. The limiter and discriminator stages of a typical FM receiver are shown in Fig. 12.

Either a microammeter or a vacuum-tube voltmeter can be used as an output meter in aligning the i-f stages up to the limiter. If a microammeter is used, it must be conected in series with the receiver grid circuit at point "x" in Fig. 12. To connect the microammeter, the circuit must be opened at that point and the negative lead of the meter connected to the grid return and the positive lead to the receiver chassis, or B—. A .01 mfd. condenser, preferably ceramic, should be connected from the point at which the microammeter connects to R and the receiver chassis to by-pass the meter. If a vacuum-tube voltmeter is used for output indications the meter must be connected across grid resistor R in Fig. 12.

The limiter grid current, or the voltage produced by it, is used as an output indication in aligning these stages. A grid current of 50 microamperes is generally specified for alignment.

If you are using a microammeter, adjust the signal generator attenuators so the correct current is flowing in the grid circuit; if you are using a vacuum-tube voltmeter, compute the voltage that would exist across the resistor if 50 microamperes were flowing through it and adjust the signal generator attenuators so the correct voltage exists. For example, suppose that the grid resistor is 100,000 ohms. By Ohm's Law (E = RI) the voltage would be 100,000 x .00005 = 5 volts. The attenuators should be adjusted so that 5 volts exist across the grid resistor.

Connect the signal generator output to the grid of the mixer tube; set the receiver dial to the low end of its range. The local oscillator need not be disabled.

Set the signal generator MAIN TUNING so the hairline of the pointer is over the mark at 10.7 mc; set the FUNCTION switch to the RF UNMOD position.

Adjust the trimmers in the i-f stages for maximum limiter grid current, or maximum voltage across the grid resistor. As you align each circuit, adjust the signal generator attenuators to maintain the correct current in the limiter grid circuit. After you adjust all the i-f stages, check each adjustment to make certain it is set for maximum grid current.

After the i-f stages up to the limiter have been aligned and checked, disconnect the output indicator from the limiter grid circuit, but *do not* change the setting of the signal generator MAIN TUNING. (If you used a microammeter in the limiter grid, be sure to close the circuit after you disconnect the meter.)

A high-resistance voltmeter or a vacuum-tube voltmeter must be used as an output indicator in aligning the output circuit of the limiter and the input circuit of the discriminator.

Connect the dc voltmeter across one of the discriminator load resistors, in Fig. 12, between point A and ground or between points A and B. (The former connection is preferable.) If the meter reads down-scale, reverse the leads. Adjust the limiter output circuit, C3 in Fig. 12, for maximum voltage across the load resistor. This completes the adjustment of the limiter.

If you are using a vacuum-tube voltmeter with a zero-center range, set the voltmeter for zero-center measurements. If you are using a high-resistance multimeter, set it to the lowest dc voltage range. Connect the voltmeter across the two discriminator load resistors in series, between point B and ground in Fig. 12. If the multimeter reads down-scale, reverse the test leads. Adjust the transformer secondary, C4 in Fig. 12, for zero voltage. If you are using a multimeter, reverse the meter leads to make certain you have the actual zero point. This completes the i-f amplifier adjustments.

Though the *fundamental* ranges of most good signal generators, such as the NRI Model 89, cover only those frequencies up to 60 mc, there is usually sufficient second harmonic output for aligning the rf stages of an FM receiver. Set the signal generator BAND switch to the highest position. The FM band extends from 88 mc to 108 mc; the second harmonic of the 44-54 range covers these frequencies. If you need a 106-mc signal, for example, set the MAIN TUNING to 53 mc. If your signal generator will cover the range between 88 mc and 108 mc, set the BAND switch and the MAIN TUNING to 106 mc.

Connect the voltmeter, or microammeter, to the limiter grid circuit. Set the receiver dial to 107 mc and set the signal generator MAIN TUNING to 53.5 mc. Adjust the oscillator trimmer for maximum output indication. Then, adjust the mixer and preselector trimmers for maximum output. Padders are seldom used in FM receivers, but if one is included, adjust it for maximum response at the low end of the FM band. This completes the receiver alignment. (As a final step, it is wise to check the calibration of the receiver by tuning in one or two local FM stations of known frequency.)

The Ratio Detector: As in the alignment of a limiter-discriminator circuit, two separate steps are necessary in aligning a ratio-detector circuit. The i-f amplifier stages must be aligned first, and the ratio-detector aligned separately. A typical ratio-detector circuit is shown in Fig. 13.

Either a high-resistance multimeter or a vacuum-tube voltmeter can be used in aligning a ratio-detector circuit—current measurements are not necessary. In the first step of aligning this circuit, the meter may be connected across the stabilizing condenser, C17 in Fig. 13, or across the rf by-pass in the audio output circuit, C20 in Fig. 13.

Connect the signal generator output to the grid of the mixer tube; set the receiver dial to the low end of its range. Set the signal generator MAIN TUNING to 10.7 mc and set the FUNCTION switch to the RF UNMOD position. Adjust the attenuators so that 3 or 4 volts are obtained.

Adjust the various i-f trimmers for maximum dc voltage reading. Turn the attenuators down if the reading goes above 4 volts. Repeat all trimmer adjustments to eliminate the effects of in-

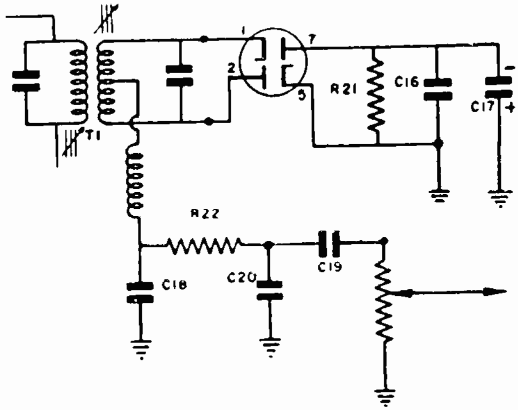


FIG. 13. Typical ratio-detector circuit used in an FM or TV receiver.

teraction between the circuits. Disconnect the voltmeter. *Do not* change the setting of the signal generator MAIN TUNING.

Connect two 100,000-ohm resistors in series and connect ths network across the stabilizing condenser, C17 in Fig. 13.

If you are using a vacuum-tube voltmeter that has a zero-center range, set it for zero-center measurements. If you are using a multimeter, set it to the lowest dc voltage range. Connect the voltmeter from the junction of the two 100,-000-ohm resistors to the ungrounded side of C20.

Adjust the ratio-detector secondary for zero voltage. If you are using a multimeter, reverse the meter leads to make certain you have the actual zero point.

Then connect the voltmeter as you had it when aligning the i-f stages. Connect the signal generator output to the receiver input circuit. Set the receiver dial to 107 mc; set the signal generator MAIN TUNING to 53.5 mc. Adjust the oscillator trimmer, the mixer trimmer and preselector for maximum voltage reading. This completes the receiver alignment.

TV Receiver Alignment

BEFORE DISCUSSING THE GENERAL TOPIC OF TV ALIGNMENT, IT IS IMPORTANT TO MENTION THAT YOU MUST DETERMINE THE ACTUAL NECESSITY FOR ALIGNMENT BEFORE ATTEMPTING THE PROCEDUR... BY ATTEMPTING TO ALIGN A RECEIVER THAT IS OPERATING PROPERLY, YOU MAY CREATE NEW DEFECTS AND MAKE THE SERVICE JOB MORE DIFFICULT. IF YOU

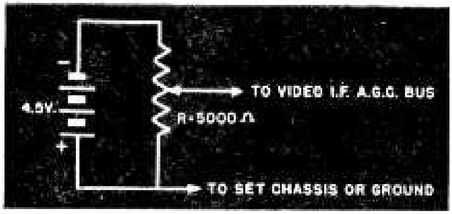


FIG. 14. Bias box for TV alignment.

ARE NOT SURE WHAT EFFECT IMPROPER ALIGNMENT WILL HAVE ON A TV RECEIVER, CONSULT YOUR NRI STUDY TEXT BOOKS.

To align a TV receiver properly you must have the service information. You cannot do a satisfactory job without it. If you do not have the alignment data, you must get it before you attempt alignment. Failure to observe this rule will only lead to further difficulty.

We will not attempt to give a general alignment procedure for every TV receiver. We will, however, give some general information on the topic and some general hints.

General Information on TV Alignment

If the alignment procedure for the receiver specifies a particular value of bias during alignment, use a "bias box" like that shown in Fig. 14. Disable the regular agc system—the exact method depends on the receiver circuit and is usually explained in the service information—and connect the output of the bias box to the agc line. Adjust the control on the bias box so that the proper bias level is obtained. In some of the earlier receivers, an agc switch disables the regular agc circuit and connects the receiver Contrast control as a bias control. In still other receivers, the regular Contrast control provided on the front panel is simply a bias control. Receivers of these two types do not, of course, require a separate bias control network during alignment. Simply set the Contrast control so that the proper bias level is obtained.

As explained in the NRI lessons, the video i-f amplifier must have extremely wide response to pass the range of frequencies required for satisfactory picture quality. One of two tuning arrangements is used to obtain the wide band-pass. 1. stagger-tuning; or 2. complex-coupling, frequently called band-pass tuning.

A stagger-tuned system has a number of different circuits tuned to different frequencies; the over-all response of the entire system will depend upon the tuning of the individual coils.

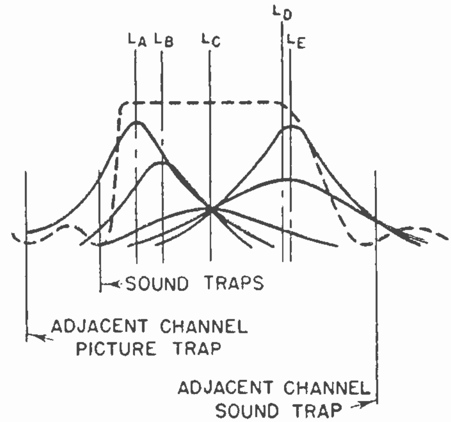


FIG. 15. Graph showing that the over-all response (dotted lines) is made up of the responses of the individual coils plus the dips inserted by the traps.

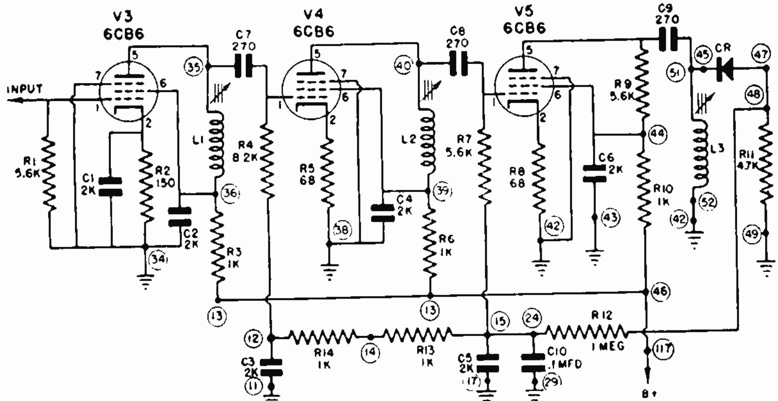
For example, Fig. 15 shows that the over-all response is made up of the separate responses of the individual coils, plus the notches placed in the curve by the various traps. Most modern TV receivers use stagger-tuning in the video i-f circuit.

If you encounter a receiver that uses the band-pass tuning arrangement and the set needs re-alignment, obtain the service information. In some cases, the manufacturer will give special instructions for aligning the equipment with a regular rf generator (like the Model 89) and a vacuum-tube voltmeter. If the instructions tell you to use a sweep generator and an oscilloscope, *do not* attempt to align the equipment with your regular rf generator.

You can, however, use the Model 89 as a marker generator in aligning a complex-coupled video i-f system. If specific instructions for feeding the marker signal to the receiver are given, follow them. If specific instructions are not given, use the general procedure of feeding the marker signal to the mixer stage. Remove the mixer tube from the receiver. Slip the tube out of its shield and put the tube back in its socket. Then push the shield partway down over the tube. Be sure that you do not push the shield down far enough to touch the chassis. Connect the "hot" signal generator lead to the ungrounded tube shield and the signal generator ground lead to the receiver chassis.

Instructions for adjusting the marker generator will be included in the alignment chart for the receiver. General information on using a marker generator is given in the NRI lessons.

FIG. 16. Typical stagger-tuned video i-f section.



Aligning a Stagger-Tuned Circuit

A typical stagger-tuned video i-f strip is shown in Fig. 16. The alignment frequencies for the three coils are as follows: L1, 21.9 mc; L2, 25.3 mc; L3, 23.5 mc. When the three coils are adjusted to the proper frequencies, the correct over-all response curve will be produced.

In this particular circuit, no particular value of bias is necessary during alignment, provided the voltage across the detector load resistor (R11) is kept below 3 volts. A vacuum-tube voltmeter or a high-resistance voltmeter must be used for output indications. Connect the voltmeter directly across R11.

In this recevier, as in most, there is one more adjustment on the front-end tuner. To adjust this the signal generator must be connected to a special "test point" on the tuner. Full information on this is given in the complete alignment instructions for the receiver.

Aligning the Sound Circuit of a "Conventional" TV Receiver

The procedure for aligning the sound circuits of a TV receiver that uses the "conventional" sound system is basically the same as the procedure for aligning an FM receiver, except for the frequencies involved.

Connect the signal generator output to the point specified in the service information and set the signal generator MAIN TUNING to the sound i-f. Adjust the various coils in the sound circuits as instructed in the service information. Where you align the sound i-f and detector circuits, carefully check the alignment instructions to determine whether a sound trap is included in the video i-f circuit. If it is, adjust the sound trap BEFORE you change the setting of the signal generator MAIN TUNING.

Aligning the Sound Circuit of an Intercarrier TV Receiver

In a receiver that uses an intercarrier sound system, the sound signal and the video signal beat together, usually in the video detector, to produce a 4.5 mc signal for the sound circuits. The signal produced by allowing the two carriers to beat together will always be 4.5 mc because the sound carrier is always separated from the video carrier by that frequency.

A typical intercarrier sound i-f amplifier and ratio-detector circuit is shown in Fig. 17. Notice that the 4.5 mc signal is obtained at the output of the video detector. In many circuits, the signal could also be obtained at the video amplifier output; in this receiver, however, coil L4 is self-

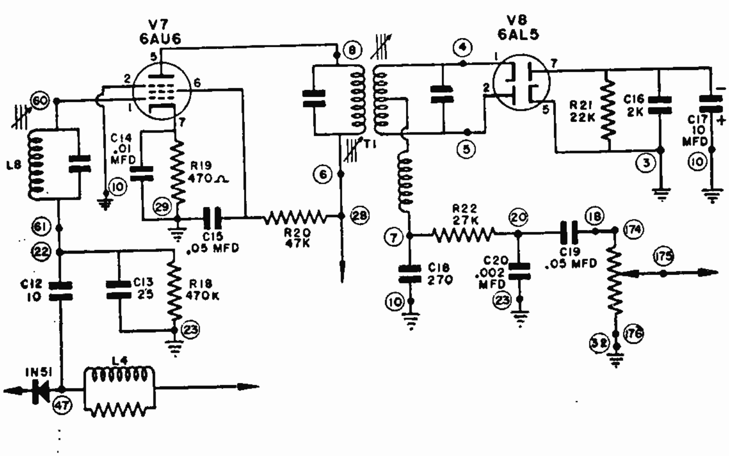


FIG. 17. Typical intercarrier sound i-f and ratio-detector circuit.

resonant at 4.5 mc and prevents the 4.5 mc signal from reaching the video amplifier circuit. Coil L4 therefore serves a dual purpose: a trap to prevent the appearance of a 4.5 mc beat pattern, commonly called "grain," in the picture; a high impedance load at 4.5 mc so that maximum signal will be applied to the sound i-f circuit.

For output indications in aligning the i-f coil, L8, and the primary of the ratio-detector transformer, T1, either a high-resistance multimeter or a vacuum-tube voltmeter is satisfactory. Connect the voltmeter across the stabilizing condenser, C17, or across the rf by-pass in the audio output circuit, C20.

Connect the "hot" signal generator output lead to the junction of the 1N51 crystal diode and coil L4. Connect the ground lead to the receiver chassis. Set the MAIN TUNING to 4.5 mc and set the BAND switch to the proper position. Adjust the signal generator attenuators so that the output indicator shows 3 volts.

Adjust coil L8 and the *primary* of T1 for maximum voltage reading on the output indicator.

Then disconnect the signal generator output lead from the circuit but leave the voltmeter connected. The signal from a TV station should always be used in the final alignment of a 4.5 mc ratio-detector circuit.

Tune in the strongest TV signal in your area. Readjust L8 and the primary of T1 for maximum voltage reading.

Disconnect the voltmeter. Wire two 100K-ohm resistors in series and connect the series network across the stabilizing condenser, C17. Connect one voltmeter lead to the junction of the two 100K-ohm resistors and the other to the ungrounded side of the rf by-pass in the audio circuit, C20. If you have a zero-center range vacuum-tube voltmeter, either voltmeter lead can be connected to either point. Otherwise, some experimentation will be required to obtain an up-scale reading. Adjust the *secondary* of T1 for zero voltage reading. Then reverse the test leads to make certain you have the actual zero. This completes the intercarrier sound circuit alignment.

Aligning Trap Circuits in TV Receivers

Trap circuits are used in TV receivers to prevent undesirable interference and to shape the receiver response curve. These traps must be adjusted when the receiver is aligned.

Traps are commonly used in the video i-f stages to prevent interference from adjacent channel signals, and, at the same time, shape the response curve. To adjust these traps, feed the signal generator output to the grid circuit of first video i-f stage; connect a voltmeter across the video detector load for output indications. Set the signal generator MAIN TUNING to the frequency specified for the trap. Adjust the trap for *minimum* voltage across the load. If more than one trap is used in the circuit, set the MAIN TUNING to each trap frequency in turn and adjust each trap for minimum voltage across the load. The instructions for adjusting the traps are usually included in the regular alignment procedure because the bias applied to the circuit and the order for adjusting the traps is sometimes important.

Trap circuits designed to prevent the 4.5 mc beat note from reaching the picture tube are included in some TV receivers. The general procedure for adjusting such a "grain trap" is as follows.

1. Tune the receiver to an unused channel and connect the signal generator output to the stage preceding the trap. Set the signal generator controls to produce a 4.5 mc unmodulated output signal.

2. Turn the signal generator attenuators up until the grain pattern is evident on the picture tube screen.

3. Adjust the "grain trap" for minimum grain pattern.

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KOREAN VETERANS —NOTICE

As this went to press, Congress had just amended the Korean Bill and the President signed it into law. Copies of the bill were not yet available but we understand the main revision is this:

"Veterans who are eligible for educational benefits under PL 550 have until three years after date of discharge to initiate courses of training."

This means any person who was discharged less than three years ago can still start courses. Some of the other provisions were changed but we believe this is the most important change to you.

If you are studying one course under the Korean Bill and hope to take another—anywhere—you should schedule your study (if you possibly can) so that you will finish your present course in time to start the additional training *before* three years from your date of discharge. If a course is started by that time, you may continue in training for quite some time after.

If you are uncertain what this new law means to you, contact your Regional Office.

Announcing the NEW

Model 89 NRI Professional AM-FM-TV Signal Generator and Marker

Fundamental Frequencies 170 KC. to 60 MC.
Average Accuracy better than ± 1% on all bands

Designed for Rapid, Easy Alignment of Receivers. Controls simplified to speed up alignment work and help eliminate errors. Large, easy-to-read dial scale gives accurate frequency readings. Ample output to force signal through weak receivers, simplifies signal injection.

Gives Greater Accuracy in Alignment. Accuracy of receiver alignment can be no better than that of the Signal Generator you use. Each instrument is hand calibrated at the factory. Guaranteed accuracy: ± 1% on all bands. Average accuracy is even better due to the precise spot calibration of "most used" frequencies.

Wide Frequency Coverage. Covers i.f. and r.f. frequencies necessary in aligning all types of A.M. receivers, from simple AC-DC sets to complex all-wave consoles. Also covers i.f. frequencies of F.M. and Television receivers on fundamentals. Strong 2nd harmonic easily covers the 88-108 Mc. F.M. band and a worthwhile portion of present Television bands.

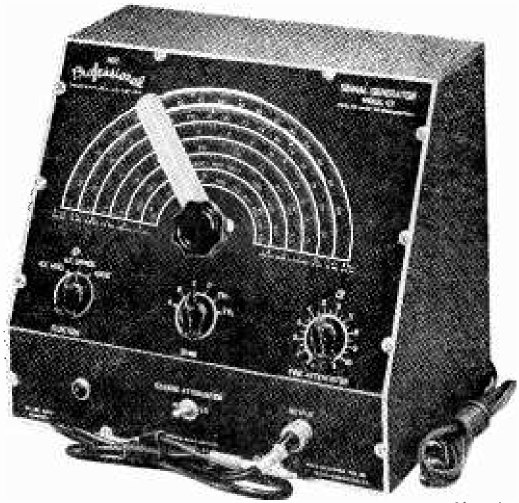
Six Carefully Chosen Frequency Bands. To simplify use, band A covers all basic i.f. frequencies used in A.M. superheterodyne receivers, and Bands TV1 and TV2 cover the basic i.f. frequencies used in TV receivers. Other bands were also appropriately chosen.

Quickly Isolates a Defective Stage. Localize trouble in r.f., i.f., or a.f. sections of "dead" receivers by the "Signal Injection" method—a truly professional servicing technique.

Checks Audio Amplifiers with Ease. To quickly isolate trouble, inject the 400 cycle A.F. test signal at various points in an A.F. amplifier and observe results. This 400 cycle test signal has a sine wave form for use in testing A.F. amplifiers for distortion with an oscilloscope.

Single Coaxial Output Jack with Detachable Coaxial Lead. No need to shift test leads for various outputs. Merely flick a selector switch for Unmodulated r.f., Modulated r.f., or 400 cycle Audio test signals. The attenuator varies amount of output, regardless of type of test signal selected.

Coarse and Fine Attenuation. All three types



of test signals variable over a wide amplitude range.

Reliable Marker For Use with TV Sweep Generator. Will inject accurate marker Signals in a TV receiver when the video r.f. response curve is formed with a Sweep Generator and is examined with an Oscilloscope.

A Complete Instruction Manual. Tells you *when* and *how* to use the Model 89. Like all NRI instruction manuals it is complete and does not assume you know all about the use of this signal generator. If you find special help is ever needed an NRI Consultant will aid you, free of charge

USE THIS BLANK TO ORDER YOUR SIGNAL GENERATOR

NATIONAL RADIO INSTITUTE
16th and You Streets, N. W. **89**
Washington 9, D. C.

☐ I enclose $45.00 (certified check, money order, or bank draft) for which send me, express collect, one Model 89 NRI Professional Signal Generator. (50-60 cycle, 110-120 volt A.C.)

☐ Tell me how I can buy this Signal Generator on monthly terms.

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

Address ....

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

Express Office ....

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

Please Note—Will not be in stock until about Oct. 15th

These Graduates Say NRI Training Really Pays Off

Specializes in Servicing of Marine Radio Equipment

"I work for Moores' Electric Company, Ltd., Cape Breton. My boss, and owner of our company took NRI training in 1923.

"We are on the very edge of the Atlantic, serving a fishing area. We are the only shop on the Island capable of coping with all problems in Radio. Spanish and Portuguese trawlers carry considerable equipment of all types, from Sonar, Loran, telephone and CW transmitters to all types of home-made and commercial gadgets. A new item on the scene is the installation of radar on passenger boats.

"I have taken no other courses since finishing yours and it certainly has enabled me to advance and hold up my end of things in this branch of electronics."

LLOYD C. LANTZ,
c/o Moores' Electric Company,
North Sydney, N. S., Canada.

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Now Full Time Television Technician

"I have been employed since January 1, 1953, as a TV technician with a firm owned by a friend of mine, also an NRI graduate. His encouragement prompted me to take your course.

"I suffer greatly with sinus and was forced to leave wood working in a cabinet mill. Being a TV technician is so clean, and easier for me each day. I have gained 16 pounds since I have my new job and also have a better salary.

"Thank you for the patience and help which you gave me throughout the course."

CONRAD J. KOLODEJACK,
2310 Texas Ave.,
San Antonio, Texas

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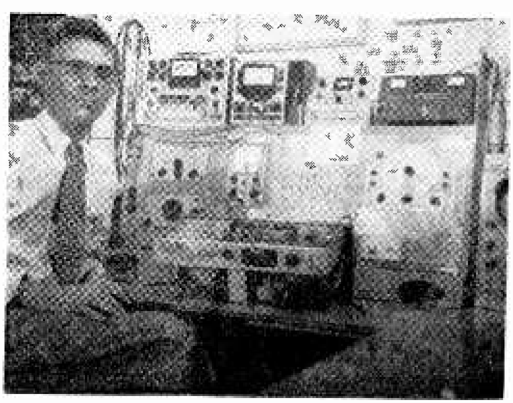

Salesman for Wholesale Radio Supply Company

"My regular work is as a salesman for a Radio Wholesale Supply Company. Besides travel and spare-time servicing for a town of 1200 I have TV service for two dealers in another town. This year I built a new shop, bought some new equipment, and have taken a vacation through six states.

"My position as salesman was gained through the knowledge of Radio theory, thanks to NRI."

WILSON F. SOEHLIG,
c/o Glick's Radio-Electronics,
Oran, Missouri.

Makes $25 to $30 per Week in Spare Time

"After the first few lessons I started fixing radios for a few of my friends. I have been getting along very well since completing the course. Am now making $25 to $30 per week and sometimes more in my spare time fixing both radios and television receivers. Business is growing.

"I hope to have a full time business in the near future, thanks to NRI which gave me a very good start."

ROBERT M. MILLER,
Main Street,
Luckey, Ohio.

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Spare-Time Service Work Helped Purchase New Six Room Home

"After about the twentieth lesson, I obtained three test instruments from your school and set up a part-time radio shop. I knew nothing at all about Radio when I started studying.

"With the help of your course, I have purchased a new six room home and have more than enough service work. I am handling the sale of two popular makes of radio-TV. I contemplate going into full-time business.

"Thanks to you and your staff for all that you have done for me."

MURRAY J. SMITH,
216 Winnikee Ave.,
Poughkeepsie, New York.

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Now Has Successful Full-Time Business

"I started repairing radios six months after I began your course and was able to open a very successful business even before I had completed my training. Without NRI's valuable training, this would never have been possible.

"I urge all who are interested in the electronics field to definitely take advantage of this course. I have all the work I can take care of and then some. Thanks for your unlimited cooperation."

RUDY SCHNELL,
744 Buckminster Circle,
Orlando, Florida.

As space permits, from time to time, we plan to devote a page or two in NR-TV News to short success stories such as above. They are taken from testimonial letters we have on file. Photographs and letters of this kind are always greatly appreciated by us. We feel we should pass them on to our readers for the inspiration to be gained from a reading of them.

THE BETTER YOU KNOW AMERICA . . . THE BETTER THE FUTURE LOOKS

By L. L. MENNE, Editor

LOOK into America's future, and you can set your hopes high.

This dynamic country of ours has been in a period of tremendous growth. This has meant more jobs, more money, more security, more homes and more opportunities for everyone.

As you look into the future, all that can be seen is promise of even greater growth for our country, and for you. This is the big promise, and the arithmetic that proves it is simple, dramatic, and as sure as two and two make four.

Since you opened this booklet, a baby has been born. By this time tomorrow, our country will have 11,000 new Americans. By next month, a city the size of Syracuse will have been added to the strength of our nation.

Every three seconds of the working day, a baby is born.

This adds up to a third of a million a month. Each is naked, unfed . . . needing all of the things that can make jobs for the rest of us.

All these babies need food—and how! A job first for the farmer, perhaps. And to meet it efficiently, farmers must buy machines, and that can help create new jobs all over America. Just to keep pace with recent population growth, farmers have increased output per man-hour 52% through mechanization and improved farm methods. In doing so, the farmer has raised his own standards of living—and has helped raise ours, too.

In America today, there are almost 70% more children under 5 years of age than we had in 1940.

This creates a tremendous need to build new schools. Billions of dollars worth of new schools are needed—because we must nearly double the existing system.

It is estimated that we should spend some 40 billion dollars for schools and hospitals alone. And right away! Money spent in this construction creates work for bricklayers, masons, plumbers, architects, real estate brokers, construction workers and many others. In turn, everything they buy for themselves just adds new UP to everybody's opportunity for prosperity.

Literally everything must grow faster and faster to keep up with the fantastic snowballing population growth ahead.

Business today faces an outlay of hundreds of billions of dollars just to modernize plants and replace worn out or outmoded machines. Future population growth will call for even greater investments—a dramatic challenge and opportunity that can mean good times ahead for everybody!

This tremendous backlog of needs that must be met does not even include the billions that the electrical industry needs to invest. Demand for electrical energy is expected to increase by 250% by 1975. Employees in this industry by the hundreds of thousands can be kept busy just trying to keep up with this need for growth.

The impact of this almost explosive growth is tremendous upon other industries, too.

Growth in population adds a brand new major city to the sales territory of businesses every month. The major problem is to keep up . . . to expand fast enough.

Highway transport, which employs one American in seven today, is one industry to benefit. Just two, for example, of the automobile manufacturers have immediate plans to spend over a billion and a quarter to expand, while just one oil company expects to spend $500 million.

Even without our new millions of babies we'd have to remodel our entire highway system right now . . . a 60 billion dollar enterprise that can mean almost unlimited opportunity for all directly or indirectly employed in highway construction industries.

This need is pressing, too, for today's roads are carrying 55 million vehicles, 72% more than in 1940.

We're adding new families to our nation faster than ever before, as yesterday's bumper crop of babies come to altar age.

A larger proportion of our adult population is married than ever before, and people marry younger and have larger families.

New families need homes (and everything that goes into them)! Since 1950, we have built three million new homes. But this is not nearly enough. 67% of our homes are now over twenty years old, 50% are over thirty years old. Right now we need 100 billion dollars worth of new homes . . . the only trend that can be seen ahead is up.

Americans have, in spite of inflation, over twice the spending power today that we had in 1940.

Savings have risen from $68.5 billion in 1940 to an estimated $250 billion today.

The long range trend in employment is up. Even though employment in some areas has fallen off, we still have twenty million more jobs than we had in 1939.

American science continues to give us miraculous developments in electronics, jets, rockets, chemistry, which are opening broad new fields of opportunity. We stand at the very beginning of the new atomic world. And this alone may be the most tremendous personal and industrial opportunity of all time. Millions of today's youngsters can prosper in jobs that parents have never even heard of right now.

The phenomenal growth of the electronic field has made the radio-TV industry a major factor in our nation's technological structure. A prime source of entertainment and information, Radio and Television has given work to many thousands of men and women. We now have in use about 125 million radios, 30 million TV sets, 25 million phonographs, plus untold numbers of recorders, public address systems and other electronic units that require maintenance by skilled personnel. The infant electronic art is growing at a much faster rate than other fields giving livelihood to thousands upon thousands of men and women. The future of this fast growing industry is unpredictable, except, that it offers untold possibilities for service and employment.

Not only are more people getting married . . . and having more children . . . but our people are living longer.

By 1960 our population over 65 years old will number over fifteen and a half million people.

And today, old people are more active, travel more, and have more money to spend.

Resorts, steamships, motels, and a host of small businesses are already benefiting. An opportunity of unprecedented scope can open up for our vast and varied entertainment industries . . . an opportunity enormously increased by the greater leisure time of young and old alike. For instance, forty million Americans get paid vacations today.

We are the most fortunate people in the world—the best off nation. Yes, we can look into the future of America and set our hopes high.

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AMATEUR RADIO PUBLICATIONS NOW AVAILABLE FROM THE AMERICAN RADIO RELAY LEAGUE

Each year many NRI students and graduates write to us asking the question, "How can I become a Radio Amateur?" We believe that one of the best possible answers to this question is found in the literature published by the American Radio Relay League (Better known as ARRL), of West Hartford 7, Conn.

The ARRL has just announced that a new literature package entitled "Gateway to Amateur Radio" is now available from them for $1.25, postpaid. This package consists of the following booklets:

(1) *How to Become a Radio Amateur.*
(2) *The Radio Amateur's License Manual.*
(3) *Learning the Radiotelegraph Code.*
(4) *Operating an Amateur Radio Station.*

THESE PUBLICATIONS ARE NOT AVAILABLE FROM NRI. ENCLOSE $1.25, AND SEND YOUR ORDER DIRECT TO:
The AMERICAN RADIO RELAY LEAGUE, INC.
West Hartford 7
Connecticut

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Two veteran marines were bragging about their respective outfits.
"When we presented arms," said one, "all you could hear was slap, slap, click."
"Pretty fair," said the other. "With us, it was slap, slap, jingle."
"Jingle? What was that?"
"Our medals!"

A NEW SLANT ON VACUUM TUBE AMPLIFIERS

By J. B. STRAUGHN

Technical Editor, National Radio-TV News

J. B. Straughn

THE statement that a tube amplifies a signal is often puzzling to beginners. Old-timers have heard and thought of it so often that they have just accepted amplification as a fact.

What does an ordinary dictionary say about the word "amplify"? It says, among other things, that to amplify is to enlarge or to expand. That's where the trouble comes in. A signal is just a varying voltage. How can we make a voltage larger or how can it be expanded? The answer is, that this cannot be done! A tube does not take a signal and stretch it in some mysterious way. With a tube we actually make a new signal, larger than the original. The original signal is used only as a pattern. Since the new signal is an enlarged duplicate of the original it is the commonly accepted practice to say the original signal has been amplified. Actually it is all right to say and even eventually think this as long as you have a clear idea of the real operation of a tube.

Let's see how we can make a big signal, using a little one as a pattern. Amplification can be explained in terms of resistance, current, and voltage that are no more difficult to understand than Ohm's Law. To understand this we will have to explore a few simple circuits, but you will find this well worthwhile.

A simple battery and resistor circuit is shown in Fig. 1. It consists of a 90-volt battery we have marked B for purposes of identification, a resistor marked R, connecting wires and a voltmeter. The full B battery voltage of 90 volts is applied across R, causing current to flow.

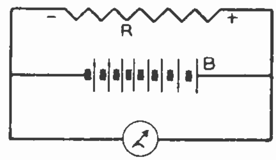


Fig. 1.

Now for purposes of our story only, let's suppose we can break resistor R exactly in half—so exactly in half that the resistance of each half will be equal. Now let's splice the two ends together with a piece of wire and put the unit back in the simple circuit as shown in Fig. 2A. Next let's re-draw the circuit slightly as shown in 2B. The two circuits are identical—we have just made a slight change in the physical position of the resistor symbols. Actually there is no difference, as far as current flow is concerned, between Fig. 2B and Fig. 1. The total resistance is the same and the 90-volt B supply is applied across the resistors.

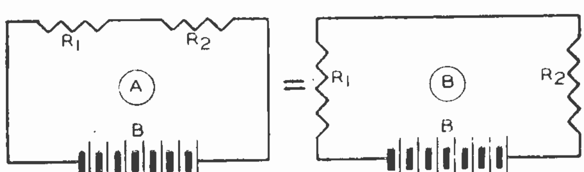


Fig. 2.

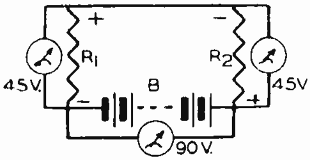


Fig. 3.

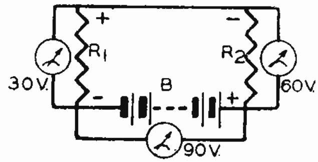


Fig. 4.

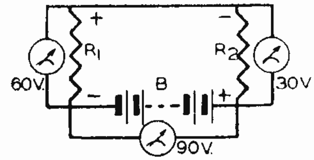


Fig. 5.

In Fig. 3 let's connect a voltmeter across the B battery which still reads 90 volts and which is the voltage across resistors R1 and R2. Next let's put voltmeters across R1 and R2. What will they read? Originally resistor R in Fig. 1 had 90 volts across it and this same voltage is across both R1 and R2. However, only half of the B supply voltage will appear across each resistor because each resistor is only half as large as R in Fig. 1. Consequently, each voltmeter reads 45 volts. This seems natural but there is a very important fact involved. This fact is that we have caused the source voltage to divide between R1 and R2.

In reading the meters in Fig. 3 note that the one across the source reads 90 volts. The readings on the other two meters have dropped to 45 volts each. For this reason we call the readings across R1 and R2 VOLTAGE DROPS to distinguish them from the source voltage. In other words, a voltage drop is just that part of the source voltage used in sending current through a part in a complete circuit. One other point of which you will be aware, if you have finished the fifth lesson in your course, is that in a complete circuit the voltage drops when added together always exactly equal the source voltage.

Now after this slight side trip let's get back to our circuit with the divided resistor.

If, instead of breaking the resistor in half, we broke it so that one was two-thirds of the original and the other one-third, we would have the condition shown in Fig. 4. Here R1 is one-third of R in Fig. 1 and R2 is two-thirds of R. This means that R2 is twice as large as R1. As you would expect, R2 has twice as much voltage drop across it as R1. This is shown by the voltmeters. Note that the voltages across R1 and R2 added together equal the source voltage.

The values of R1 and R2 have been reversed in Fig. 5 and there is now 60 volts across R1 and 30 volts across R2. A further point of interest is the polarity of the voltages across R1 and R2. These may be found with the meter test lead polarity, reversing the test leads if necessary to make the meters read upscale. However, it's easy to figure polarity if you know the direction of electron flow. Here is the rule which always holds true: *The end of a RESISTOR or PART at which electrons enter is always negative with respect to the end at which they leave.* Remember electrons flow out of the negative terminal of a *source,* through the circuit and back to the positive *source* terminal. This rule has led to the common misstatement that the current flowing through a part causes the voltage drop across it. Actually the current flow is the result of the voltage drop but since both always occur together it is all right to say the current produces the voltage drop as long as you really know what happens.

Now that we have taken our second side trip to straighten out our ideas, let's get back again to Fig. 5. You can see from Figs. 4 and 5 that the voltage will divide between the resistors in proportion to their resistance value. This means that if one of the resistors is twice the size of the other it will have twice as much voltage drop across it. If R1 in Fig. 5 is one-fifth the size of R2 there will be one-fifth of the source voltage across R1 and four-fifths of the source voltage across R2.

Going a step further, let's substitute a variable resistor for R1 as we have done in Fig. 6. As we vary the value of R1 the voltage across R2 will vary, going up and down as R1 changes in value. A signal voltage goes up and down as it varies in value. This means that if we could vary the resistance of R1 in the same manner as the signal voltage varies we would have a similar variation in voltage across R2. In other words, we would have manufactured or created a signal voltage across R2. Of course it's not possible to vary the value of R1 even ten times a second, corresponding to a 10-cycle audio signal, which is a very low frequency indeed. However, the principle is sound. All that we need is a device that varies in resistance in accordance with the variation in a signal voltage. Then we can make signals bigger than the original and use the original signal voltage as a pattern.

Let's see how this can be done with a tube. The most elementary tube is the diode, so named because it has two electrodes. These are the *plate* which, when made positive, attracts electrons from the cathode. Electrons will flow from one to the other without any physical connection because the tube is evacuated. The cathode is made of materials rich in free electrons. When heat is applied to the cathode (by means of an electrically heated wire, called a filament, and encircled by the cathode) the electrons in the cathode material speed up in their movements

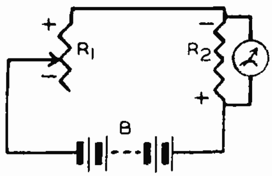


Fig. 6.

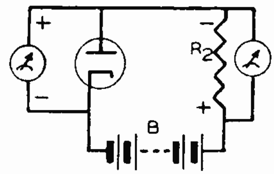


Fig. 7.

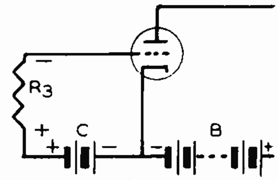


Fig. 8.

around their atoms. If enough heat is furnished electrons will leap right out of the cathode and into the vacuum. We could say that they have been boiled out. These electrons are attracted to the positively charged plate and stream across to it. The electrons lost by the cathode are replaced by those arriving from the negative side of the cathode to plate voltage supply.

By increasing the voltage, more electrons will flow to the plate. If the voltage is reduced the current flow decreases. In other words, the cathode-plate path in the tube has resistance and acts much like a resistor. As a matter of fact we can replace resistor R1 in Fig. 5 with a diode tube and the B supply voltage will divide between the tube and R2 as shown in Fig. 7. The cathode is negative with respect to the plate because electrons enter the cathode (from B—) and leave the plate. We have now replaced the fixed resistor in our voltage divider system with a diode tube.

It only remains to get some means of varying the resistance of the cathode-plate path in the tube and we can then make signal voltages appear across R2.

The Grid. The addition of another electrode in the tube called a grid makes it possible to use signal voltages to vary the cathode-to-plate resistance. We now have three electrodes in the tube—the cathode, the plate and the grid. This tube is called a triode, because it contains three electrodes.

Let us see what the grid can accomplish. First we will connect a low dc voltage source between the grid and cathode, omitting the larger supply voltage to the plate as shown in Fig. 8. The battery in the grid circuit is marked C to distinguish it from the B battery. The grid consists of parallel spaced wires, somewhat as shown in Fig. 8, all electrically connected together.

To show what happens, the grid by itself is illustrated in Fig. 9. Being quite close to the cathode the small positive charge on the grid has more pulling power on the electrons than does the higher plate voltage in Fig. 7. The electrons rush toward the grid. A very small percentage score a direct hit and land on the grid wires. By far the greatest number miss their mark so to speak, and pass right through the grid wires. The grid promptly attracts them back and since their speed has not had time to build up they finally land on the grid. All electrons which land on the grid wires flow through R3 and back to +C. The C supply voltage divides between R3 and the cathode-grid path in the tube.

Now we will reverse the connections to the C battery as shown in Fig. 10. This makes the grid negative with respect to the cathode and no electrons are forced through the tube and R3 by the C battery. Since there is no electron flow through R3 and through the tube there is no *voltage drop* across the grid-cathode path and no voltage drop across R3. *All* of the *C voltage* is applied across the grid and the cathode, making the grid negative with respect to the cathode.

Fig. 11 shows what happens in the tube. The electrons have enough speed when they leave the cathode to travel an appreciable distance from the cathode. They are repelled by the negative charge on the grid and none can land on it. The electrons traveling in a path which would normally pass between the grid wires are also turned back.

With the grid still negative let's connect up the

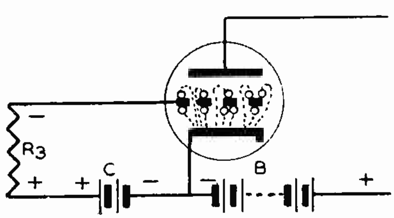


Fig. 9.

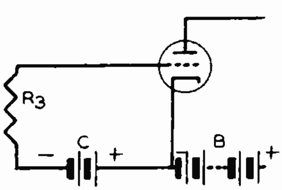


Fig. 10.

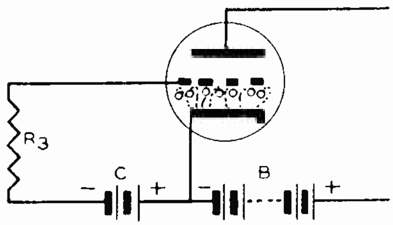


Fig. 11.

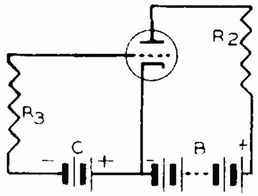


Fig. 12.

plate circuit as shown in Fig. 12. The grid still has a repelling effect on the electrons, turning many back to the cathode. However, the attractive force from the plate acts through the spaces between the grid wires and some electrons are drawn over to the plate. The action of the grid is shown in Fig. 13. If the grid is made more negative with respect to the cathode, fewer electrons reach the plate and if the grid is made sufficiently negative no electrons can pass and we say the plate current is cut off. Thus, varying the grid-to-cathode voltage varies the cathode-to-plate resistance in the tube and consequently the voltage drop across R2. The grid is usually kept at a negative potential so it will not steal electrons that would ordinarily reach the plate.

If we apply a signal voltage, say from a microphone, across grid resistor R3 in Fig. 14, the microphone voltage will alternately add to and subtract from the C battery voltage. Thus the grid-to-cathode voltage will become alternately more negative and less negative. When the grid is more negative the tube resistance goes up and the voltage drop across R2 decreases. When the grid is made less negative the tube resistance decreases and the drop across R2 increases. By dividing the B supply in this manner between the tube and R2 we make a signal voltage appear across R2. Since the signal across R2 is greater than that across R3 we say that the signal has been amplified.

Because the grid is so much closer to the cathode than the plate it has, volt for volt, more effect on the passage of electrons through the tube than the plate voltage. As a matter of fact, a voltage change of 1 volt on the grid may cause a voltage change of 12 volts across R2. In this case we would say that the amplification or gain of the stage is 12 times. With some tubes a stage gain of over 100 times may be readily obtained.

Before closing this article there are one or two more points about amplifier tube circuits which can be cleared up. Often letters are received asking why the electrons from the negative terminal of the B battery are not attracted to the positive terminal of the C battery. Remember that if electrons enter the positive terminal of a battery an equal number must leave the negative terminal. The C battery connects to an open circuit and electrons cannot get off the grid and go to the plate. For this reason no electrons flow from B— to C+. The electrons from B— all go to the cathode, across to the plate, through R2 and back to B+.

Let's go back to fundamentals again and see how the C battery can be eliminated. In Fig. 15 we have three resistors across the B battery, R1 corresponding to the plate-cathode path in the tube, R2 to the plate resistor, and a small resistor marked R. The polarity of the voltage drops indicated by the meters is shown. Note carefully that point 1 is negative with respect to points 2, 3 and 4. Point 2 is negative with respect to points 3 and 4 but is positive as far as point 1 is concerned.

Now let's replace R1 with the cathode-plate of a triode tube as shown in Fig. 16. Again point 1 is negative with respect to points 2, 3 and 4. However, grid resistor R3 connects to point 1 and since no electrons flow from the cathode to the grid none flow through resistor R3. There-

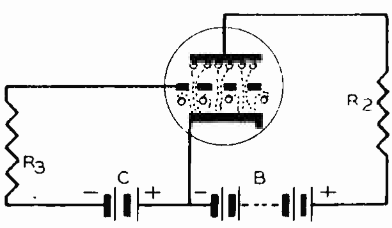


Fig. 13.

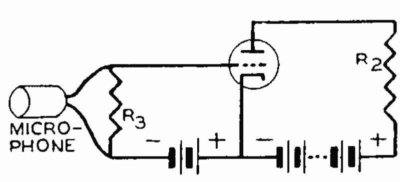


Fig. 14.

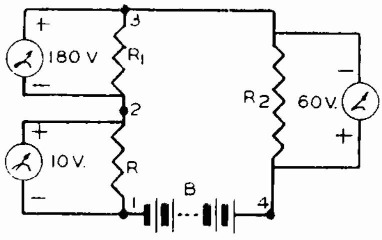


Fig. 15.

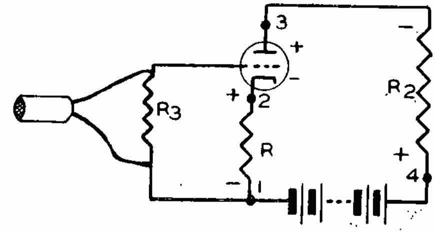


Fig. 16.

fore the grid is at the same potential as point 1 and is also negative with respect to point 2 (the cathode). For this reason there is no need to use a C battery to make the grid negative with respect to the cathode. The voltage across R can be held constant, even though the voltage across the tube and across R2 varies, by connecting a condenser across R2. The way the condenser does this job, however, is not a part of this story.

When signals are applied to R3 by the microphone electrons do flow through R3 but not through the cathode-grid path. The microphone voltage across R3 adds to and subtracts from the steady grid to cathode voltage, varies the tube resistance and hence the voltage division between the tube and R2.

This is not the complete story of tubes by any means but here's hoping it clears some things up for you and makes more advanced ideas easier to grasp. Vacuum tube circuits and their functions are often easier to understand if you reduce them to their simple equivalent circuits as we have done here.

——— *n r i* ———

How You Can Help NRI Give Faster Service

When you write to NRI—whenever you send a payment, lesson or order, please be sure to give your full name, complete address *and* your NRI Student Number. If you are a *graduate,* write "Grad" after your name or "G" after your student number. If you will remember always to do this we will be able to give you quicker service.

——— *n r i* ———

SCIENCE QUESTION BOX

By Scientists of the General Electric Company

Q: How did the ancient Egyptians get the enormous stone blocks of the pyramids into place without using modern machinery?

A: It is believed that huge ramps, probably made of sun-dried brick, were built and the blocks were pulled in place, on rollers, by the efforts of swarms of men. Probably the bottom of the ramps extended to the banks of the Nile, so that the blocks could be brought on barges from the quarries.

Q: Does light exert a push when it falls on an object?

A: Yes, light does have pressure and this has been used to explain the way the tail of a comet always points from the Sun. It is the pressure of the Sun's light on the material in the tail that pushes it away. In 1900, the pressure of light was demonstrated experimentally, by E. F. Nichols and G. F. Hull in the U. S., and by Lebedew in Russia. Two thin, silvered glass vanes were suspended on a fine quartz fiber inside a bell jar from which air had been exhausted. When a bright light was focused on one of the vanes, it caused the fiber to twist a little, on account of the pressure of the light.

Q: I understand that in a plant in which atomic energy is turned into power, some of the actual matter that makes up the atomic fuel is converted to energy. If matter and energy are thus interchangeable, wouldn't it be true that in ordinary burning of coal a minute amount of the coal is similarly converted?

A: Yes, it is quite true. When coal is burned, by allowing it to combine chemically with oxygen from the air, about 1/10,000,000,000th of the mass of the oxygen and the carbon in the coal is converted to energy.

N.R.I. ALUMNI NEWS

Oliver B. Hill	President
F. Earl Oliver	Vice Pres
Harvey W. Morris	Vice Pres
Louis E. Grossman	Vice Pres
Thomas Hull, Jr	Vice Pres
Louis L. Menne	Executive Secretary

Thomas Hull, Jr. of New York and Charles C. Mead of Chicago are Candidates for President to Serve Our Alumni Association During 1955

OUR members in New York who have been whooping it up for Tommy Hull and those in Chicago who have been equally enthusiastic regarding their candidate, Chas. C. Mead, will be pleased to know these men have been nominated. It is too bad both cannot be elected. Speaking in the vernacular, it could not have happened to two finer fellows.

Tommy Hull is completing his second year as a Vice-President of the NRI Alumni Association. He is also Vice-Chairman of our New York Chapter. He is a very capable Radio and Television instructor. His talks which are given regularly at chapter meetings in New York have contributed much to the success of that chapter.

Charles C. Mead has been Chairman of our Chicago Chapter for several years. He is a doer. It is through his influence in the Furniture Mart in Chicago that we have our meeting place in that fine building.

Mead is highly regarded by our Chicago Chapter members.

From these sketchy remarks we may feel sure that either Hull or Mead will make an excellent President for our NRI Alumni Association to serve during the calendar year of 1955.

Eight candidates have been nominated for Vice President. They are F. Earl Oliver of Detroit, Harvey W. Morris of Philadelphia, Elmer E. Shue of Baltimore, Oscar C. Hill of Houston, Louis E. Grossman of New Orleans, William Fox of New York City, John I. Babcock of Minneapolis, and Herbert Garvin of Los Angeles. This gives us a fine slate of candidates for Vice-Presidents coming as they do, from the East, the Central States, the West and the South. Of these eight candidates, four will be elected.

A brief word or two regarding the candidates for Vice-President. Earl Oliver and Harvey Morris are well known to all of our members. Elmer Shue long has been a very active member in Baltimore where he has done much for our Association. Louis Grossman is chairman of our New Orleans Chapter and the success of that organization is due to his great interest in arranging programs. William Fox often is on the program in New York Chapter. He is a real "bread and butter" Radio and TV Technician. His talks are always interesting. John Babcock has been the prime mover in our chapter in St. Paul and Minneapolis. He has tremendous energy and as time goes on we are sure to hear much from Babcock. Oscar C. Hill of Houston, Texas and Herbert Garvin of Los Angeles, California are the real dark horses in this election. Both have been nominated without the support of a local chapter Both are from sections where our association might well be represented with a national officer.

Please mark your ballot on page 27. Vote for one candidate for President and four candidates for Vice President.

It is earnestly requested that you vote. All members of the NRI Alumni Association are eligible to cast a ballot. Your support will be appreciated. The polls close at midnight October 25, 1954. Results of the balloting will be announced in the next issue of NATIONAL RADIO-TV NEWS.

CHAPTER CHATTER

Baltimore Chapter is primed for some very important meetings during the fall season. Chairman Henry C. Voelkel, assisted by Vice-Chairman Joseph B. Dolivka have things lined up in good shape.

Mr. H. J. Rathbun continues to conduct his very popular question and answer period at each meeting. Every member is given an opportunity to participate in these discussions. Questions cover problems encountered by the members in the course of their Radio-TV work. Mr. Rathbun, who is an expert Radio and TV technician, not

H. J. Rathbun, on right, assisted by R. F. Thompson, prepares to conduct an Open Forum at a Baltimore Chapter meeting.

only supplies the answer but very often gives an actual demonstration

Meetings are held on the second Tuesday of each month at the O.U.A.M. Hall, 100 N. Paca Street, Baltimore, Md. All students and graduates in the Baltimore area are invited to attend meetings. Additional information may be had by communicating with Secretary Joseph M. Nardi, 4157 Eierman Ave., Baltimore 6, Md.

Philadelphia-Camden Chapter members continue to meet at the Knights of Columbus Hall, Tulip and Tyson Streets, on the second and fourth Monday of each month. If you live in this area and are not attending meetings you really are missing something worthwhile.

Harvey Morris continues to do a swell job with his lectures on television servicing. The fellows keep him mighty busy answering their questions. He has a nice way of putting something over that makes it easy to follow. Secretary Jules Cohen has something big in mind for the fall

Election Ballot

All NRI Alumni members are urged to fill in this ballot carefully. Mail your ballot to National Headquarters immediately.

FOR PRESIDENT (Vote for one man)

- ☐ Thomas Hull, Jr., New York, N. Y
- ☐ Charles C. Mead, Chicago, Ill.

FOR VICE PRESIDENT (Vote for four men)

- ☐ F. Earl Oliver, Detroit, Mich.
- ☐ Harvey W. Morris, Philadelphia, Penna.
- ☐ Elmer E. Shue, Baltimore, Md.
- ☐ Oscar C. Hill, Houston, Texas
- ☐ Louis E. Grossman, New Orleans, La.
- ☐ William Fox, New York, N. Y.
- ☐ John I. Babcock, Minneapolis, Minn.
- ☐ Herbert Garvin, Los Angeles, Calif.

SIGN HERE

Your Name ....

Your Address ....

City .... State ....

Polls close October 25, 1954. Mail your completed Ballot to:

L. L. MENNE, *Executive Secretary*
NRI ALUMNI ASSOCIATION
16th & U Streets, N.W.
WASHINGTON 9, D. C.

The tall gentleman on the right is Mr. John Gallagher, of WCAU, who conducted our Philadelphia Chapter members on a tour through the Studios. A fine chap who does credit to a very fine station.

season to give Harvey Morris a breather.

Our cover photograph shows the Philadelphia-Camden group on a tour of studios WCAU in Philadelphia. Arrangements are being made for a somewhat similar tour but this time through the transmitting station of WCAU.

Mr. Henry Lapinski, service Manager, Motorola Corp. and Mr. Floyd Myers, Service Manager, Stuart Locheim Company, Zenith Distributors, were made honorary members of Philadelphia-Camden Chapter. These men have been extremely cooperative concerning servicing of their products, attend our meetings regularly and from time to time give lectures and demonstrations. Our members are glad to welcome them as honorary members.

At long last, a photo of Sec'y Jules Cohen (right), who is always in the thick of things in Phila. Here he is handing a gift from the members to Treasurer Chas. J. Fehn, a twenty year member.

Information regarding meetings will gladly be supplied by Secretary Jules Cohen, 7124 Souder St., Philadelphia 49, Penna., telephone FI 2-8094.

Milwaukee Chapter considered all angles of the licensing of Radio and TV servicemen. The conclusion was that licensing, at the present time, does not seem to be a practical solution to the problems of either the public or technician. Chairman S. J. Petrich led the discussion. Other members who took part were Walter Haag, E. J. Keller and Edward Schumacher. There was also a general discussion by the members.

A bulb type continuity tester was offered as a door prize and was won by Stanley A. Roblee. Another matter discussed at a meeting was the giving of discounts without discrimination.

The entire membership will visit Station WTMJ TV. Notices will be sent to each member by the secretary.

Vice Chairman Erwin E. Kapheim, one of NRI's oldest graduates, gave us one of his fine short talks on "Getting Along With Each Other." He is a real inspiration.

Chairman Petrich spoke of the coming elections in December when officers for the following year will be elected. He asked the members to be alert for likely candidates, to select men who are qualified and he admonished those interested in assuming leadership to prepare themselves for the possibility of being selected. Chairman

Petrich made it clear that the Executive Committee would not relax its efforts to not only improve the programs for the chapter but to see that all officers carry out their responsibilities. He assured the new officers of the fullest cooperation of those now in office.

At one meeting, three sound films were shown on "Deflection Circuits," "Localizing TV Troubles," and "Practical TV Alignment." The third mentioned film showed members the use of the cathode ray oscilloscope for various TV sound and picture troubles. It was a very interesting meeting.

Meetings are held on the third Monday of each month at 2249 N. Humboldt Ave., Corner East North Avenue. Students and graduates in Milwaukee and vicinity are invited to communicate with Secretary Robert Krauss, 135 E. Keefe Ave., Milwaukee.

St. Paul-Minneapolis Chapter is coming along in great shape. Secretary John I. Babcock, 3157 32nd Ave., S., Minneapolis 6, wishes all members to know that meetings are now held on the second Thursday of each month at Rm. 201, Midway Branch, St. Paul YMCA. Please make a note of this.

Treasurer Walter Berbee gave a very interesting demonstration of shorted r.f. and i-f tubes in TV receivers and their effect on picture quality.

The next several meetings should not be missed by any member who can possibly attend. For one meeting we have a General Electric representative engaged who will explain vacuum tubes and their uses. At a following meeting we have arranged for a service representative from Philco to give us service tips and information.

John Burka demonstrated his home design CRT holder of metal shell CRT's. Mr. Burka has contributed several very good ideas to our members. R. E. Olson gave a short talk on AM radio. Walt Berbee again came to the front with some more good TV servicing hints. With Berbee on the schematic diagram, Burka on the probes and Babcock on the scope a good demonstration of signal tracing was given. Many of the members are not familiar with the use of a scope and they want more of these demonstrations. They shall have them.

George Reil gave a short report on his visit to NRI while in Washington.

We now have the largest group of Radio and TV men organized either in St. Paul or Minneapolis. The spirit of our membership is very high. We are all thankful that NRI established this chapter so that we can get together for meetings that are educational, offer good fellowship and better understanding of common problems.

A vote of thanks is extended to Chairman Warren Schulze and the Starke Radio Supply Co. for the several very splendid door prizes they contributed.

Remember, meetings are held on the second Thursday of each month at the mid-way branch of the St. Paul YMCA, in Room 201. Our twin city members claim this is probably the nicest meeting place in either city and they are very proud of the fine progress they have made in the short time they have been organized.

Flint Chapter, a new group in our organization has gone through the process of organization and from now on will report regularly. A charter was delivered to our Flint chapter by Vice-President F. Earl Oliver. Since then, the chapter has held a number of meetings and now has a membership of more than 50 full-fledged and associated members. A permanent meeting site has been arranged for. Meetings are held at Buick Local 599, UAW-CIO Hall, 812 Leith St., Flint, Michigan.

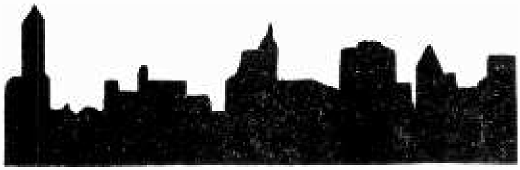
A group of members is planning programs for the fall and winter to include some social and recreation activities. The secretary of the chapter is Mr. David A. Nagel, 3135 E. Mt. Morris Rd., Mt. Morris, Michigan. The members, by the way, prefer to have this chapter known as the Genesee County Chapter which is in conformity with their charter but for the sake of uniformity in making these reports we refer to it as the Flint Chapter.

New Orleans Chapter continues with its program of study sessions on television servicing. A question and answer period was conducted by Mr. Octave Jumonville, Jr. and Mr. V. J. Cornelius.

Meetings are held on the first and third Tuesday of each month at 8:00 P.M. at 2229 Napoleon Avenue. Chairman Louis E. Grossman at the above address or Secretary Anthony H. Buckley, 2817 Burgandy Street will be glad to give information regarding meetings to any students or graduates in the New Orleans area who may be interested in attending. All are cordially invited.

Chicago Chapter, meeting as usual in the American Furniture Mart Bldg., 666 N. Lakeshore Dr., has arranged for a series of talks and demonstrations on the use of the oscilloscope. Charles C. Mead who has an office in Room 228 in the above building and who can be reached by telephone, Superior 7-4100 will be pleased to hear from any NRI men who are interested.

Springfield Chapter sent us an announcement regarding their first annual outing for the benefit of members, their wives and children. Under the



supervision of Frank Seivey the committee arranged for a chicken barbecue.

For information regarding meetings in Springfield. Massachusetts please get in touch with Chairman Howard B. Smith, 53 Bangor St., or Secretary A. L. Brosseau, 56 Gardner St.

Pittsburgh Chapter likewise held a basket picnic for the benefit of their members and families. This was scheduled for August 22 and a report has not been received as this issue goes to press. Knowing the spirit of our Pittsburgh group we look forward to this report with much anticipation.

At one of the recent meetings Mr. Bert Bregenzer, Vice President of the Penna TV Service Federation, gave a talk on the construction and theory of oscilloscope and color TV. Ken Shipley gave a talk on a vacuum tube voltmeter.

Meetings are held on the first Thursday of each month at 134 Market Place. The Secretary of our Pittsburgh chapter is Kenneth Shipley, 1009 St. Martin St. The Chairman is Frank P. Skolnik, 616 Springfield Ave.

New York Chapter, after suspending meetings during the summer season, is back on regular schedule with meetings to be held on the first and third Thursday of each month at St. Mark's Community Center, 12 St. Mark's Place, between Second and Third Avenues in New York City.

Chairman Bert Wappler, assisted by Lou Kunert, Frank Zimmer, Alex Remer, Tommy Hull, and a corps of qualified lecturers, all members of our New York Chapter, look forward to the biggest season of all. Most of those mentioned here have served New York Chapter in some official capacity for the last ten years. If you are a member of New York Chapter you understand why the members attend so regularly. If you live in this area and are not a member of this chapter it would be well for you to attend the next meeting as a guest. You will be cordially received and you will catch the spirit that has made this chapter one of the finest organizations in the country.

Only brief reports can be made here of Chapter activities. The important thing is to make known that these chapters are for the benefit of students as well as graduates and all NRI men are welcome at meetings at any time.

Our Cover Photo

This issue we have stayed within the NRI family by showing a group of Philadelphia-Camden Chapter members on a visit to WCAU studios.

This was a very interesting tour for which we are indebted to WCAU.

We are pleased, too, to show this fine group of men, representative of NRI students and graduates.

Amateur Station Conducts Wildlife Conservation Broadcasts

By GORDON BARRINGTON

Staff Writer, Fish and Wildlife Service, United States Department of Interior

To better acquaint the younger generation with wildlife conservation matters, amateur radio station W8NEJ, located on the Seney National Wildlife Refuge in Schoolcraft County, Michigan, has been delivering shortwave messages to school children.

The messages had their beginning when John H. Nowak, Refuge Clerk, made a 45-minute contact with the biology class at an Escanaba, Mich., high school. Mr. Nowak gave a 20-minute lecture concerning the Seney Refuge and the national wildlife refuge program in general. His talk was followed by 25 minutes of questions by members of the listening class (delivered over a portable transmitter) and answers delivered back by Mr. Nowak.

Mr. Nowak's wife, who also holds an operator's license (W8NEK), has subsequently made contacts with grade-school classes. Lecture-question-answer sessions have been held, with Mrs. Nowak taking over for her husband. Mrs. Nowak's talks deal with the fundamentals of wildlife conservation and with facts on specific birds and mammals being protected at the Seney Refuge. After eleven years as a "refuge wife," Mrs. Nowak is well qualified and does an excellent job.

Contacts now average about five a week, and college classes have been added to the list of participants. Attendance at individual sessions has gone as high as 260 students. The project has become so popular that several of the programs have been tape-recorded by Michigan and Wisconsin school systems, for presentation at the National Teachers Conference.

Here and There Among Alumni Members

Ambrose Maxim, formerly of Lufkin, Texas, and now of Erlanger, Ky., has a new job with American Airlines as a Radio Operator at the Cincinnati, Ohio, airport.

—n r i—

Paul E. Lacourrege, Jr., of New Orleans, La., holds amateur call W5WQO.

—n r i—

Mr. and Mrs. George Reil and daughters were in for a visit. He is a member of the St. Paul-Minneapolis Chapter.

—n r i—

Arthur Berger, of Philadelphia, Penna., says passing the first phone license exam was "child's play" after taking NRI Communications course. Presently employed as Radar Technician by RCA.

—n r i—

Mr. Jan Van Eeklen, a new member of Philadelphia-Camden Chapter, plans to go to Sweden this year to visit relatives who are in the television servicing business in that country. He expects to surprise them with his knowledge of the subject.

—n r i—

John D. Britto, of Rumford, R. I., has assisted in the construction of and is now operating one of the world's largest (one megawatt) transmitters. He is employed overseas by the VOA.

—n r i—

Donald R. Baber, of Port Orchard, Wash., is now shop foreman of a growing Television Sales and Service Company.

—n r i—

Eugene Sims, of Columbus, Ohio, left the U. S. Navy in May and is now employed full time as Radio, TV and Electrical maintenance man for a hospital. Likes his work very much.

—n r i—

Nice letter from Peter Klein, of Youngstown, Ohio. Says he is very busy doing TV work since his lay-off at the steel mill. Has bought his instruments and a late model Station Wagon.

—n r i—

Marc Morin, of Verdun, P.Q., Canada, visited NRI recently. Morin is employed by the C and R Railway, and does spare time servicing.

—n r i—

Fred E. Fowler is employed by the Department of Transport of Canada at its Loran transmitting station, Battle Harbour, Labrador, Nfld., Canada.

—n r i—

Clyde D. Kiebach, of Arlington, Virginia, was recently elected to the Institute of Radio Engineers. Kieback is a qualified telephone technician. High fidelity experiments occupy his spare time.

—n r i—

Robert F. Lent, of Barrington, N. J., is now employed by RCA in Camden as a technician in the coils standard section.

—n r i—

Stanley Rogers, of South Lebanon, Ohio, now has his General Class amateur license, call W8LLM.

—n r i—

Graduate John D. Gibbello, of Napa, Calif., has made over $3500 repairing radios in his spare time during the past few years. Repairs all types, with auto radio as a specialty. A very nice record!

—n r i—

Ray Schramm, of Bismarck, N. D., is attending a special advanced school for his employer, the Bell Telephone Co. He also does part time servicing of TV receivers, mobile equipment, and aircraft equipment.

—n r i—

Alumnus Charles Zanoska, of National City, Calif., is very pleased with his job as an electrical and radio check-out mechanic with Convair Aircraft, of San Diego.

—n r i—

J. T. Reeder is now located in Shreveport, La., working for the Capehart Distributor there.

—n r i—

Alumnus Wallace W. Jones, of Warren, Ark., now has his 2nd 'phone and 2nd telegraph license, plus an amateur ticket. Reports communicating with ten states and Hawaii with the NRI Transmitter, without any modifications.

—n r i—

Sergeant Theodore F. Katt of the Philadelphia Police Force is a member of Philadelphia-Camden Chapter. Another member recently retired as a Police Officer. He is Sergeant James J. Hannon, who completed twenty-five years as a member of the Philadelphia Police Force.

—n r i—

Michael Scholtz, of Atlantic City, travels sixty miles to attend meetings of Philadelphia-Camden Chapter.

—n r i—

Graduate James A. Forsythe, of Crown Point, Ind., was one of ten among 72 men selected for 9 months schooling to learn the new Crossbar Dial System of the Bell System.

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