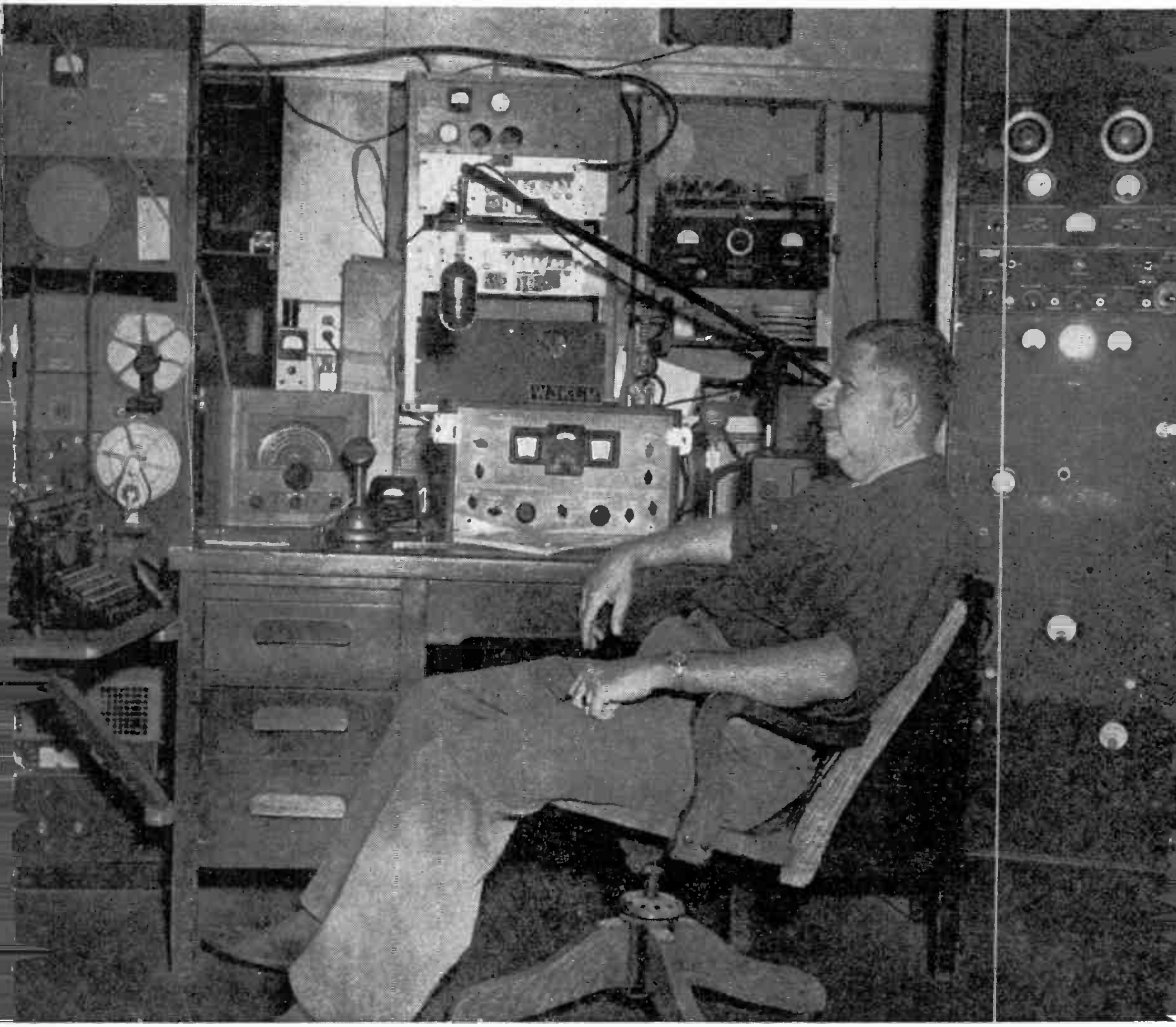
National RADIO-TV NEWS



IN THIS ISSUE

Aug.-Sept. 1952

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Courtesy is a Test of Character

COURTESY is the oil which takes the friction out of your daily life. Friction means wear and tear. Friction creates heat and retards forward motion. You want to get where you are going with the least resistance.

Make full use at every opportunity of the magic oil of courtesy. A quiet word in the right place can accomplish more than a thousand impassioned ones. A simple, thoughful deed of kindness may succeed where weeks of arduous striving could fail.

Practice courtesy in all your contacts, business as well as social. Be courteous to those with whom it may make little difference so that you will establish courtesy as one of your life habits. You will find that it pays even in trivial things. The real man is as courteous to the newsboy as to the bank president. Courtesy will warm hearts, melt opposition, and allow you to transform resistance into forward motion. Courtesy is a sign of strength.

J. E. SMITH, *President.*

B. van Sutphin

THE VACUUM TUBE VOLTMETER AS A SERVICE INSTRUMENT

By
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A vacuum tube voltmeter is an instrument that uses the amplifying properties of a vacuum tube to increase the sensitivity of a meter. In its simplest form, the vacuum tube voltmeter is an amplifier with an indicating meter as the plate load.

Fig. 1 shows the basic circuit for a vacuum tube voltmeter. The voltage to be measured is impressed across resistor R_1, in series with the bias developed by resistor R_2. When the voltage existing between the cathode of a tube and the grid of a tube is changed, the plate current will change. The change in plate current is indicated by the meter connected in that circuit. Resistor R_3 and condenser C serve as an ac filter to prevent any ac voltages from appearing on the grid of the tube.

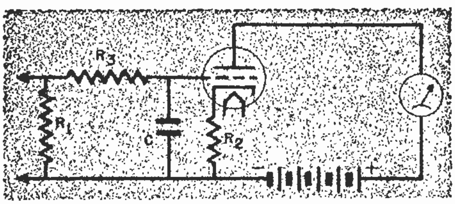


FIG. 1. Basic circuit for a vacuum tube voltmeter.

This basic vacuum tube voltmeter has many shortcomings. Some of the more obvious disadvantages are: (1) the dc input voltage is limited to the value that will cause saturation of the tube, or cut-off of the tube. (2) The full sensitivity of the meter is not used; that is, there will be a certain steady plate current even when no signal is applied to the input of the instrument. (3) No provision is made for covering the multitude of ranges that are necessary in service work. (4) The accuracy of the instrument will vary as the vacuum tube ages, and as the battery deteriorates.

Because of these disadvantages, and others, the basic vacuum tube voltmeter has undergone many changes in the never-ending search for greater accuracy and lower cost. One of the best circuits that has been evolved so far is the one shown in Fig. 2A. You will notice that this circuit resembles the familiar Wheatstone bridge. In fact, this circuit works on the same basic principles as those on which the Wheatstone bridge is dependent.

With no signal applied to the input circuit (between point X and point Y), resistor R_{11} is adjusted so that equal currents flow in the two sections of the bridge. This means that no current will flow through the indicating meter, and the meter will read zero.

Now, if the grid of VT_1 is made more positive by coupling an external source to the circuit, the plate current of this tube will increase. This removes the balanced condition of the bridge circuit, and current flows through the indicating meter. At the same time that the bias of TV_1 is decreased by the external voltage, the extra current flow through resistor R_7 causes the cathode of VT_2 to become more positive, which effectively causes the grid of VT_2 to become more negative. This causes the bridge to become even more unbalanced.

The effect of applying an input signal is to decrease the plate resistance of VT_1 at the same time that the plate resistance of VT_2 is increased. Therefore, the circuit becomes much more unbalanced for a given input voltage than any other type of vacuum tube voltmeter circuit.

The circuit of Fig. 2A also includes a provision for more than one voltage range. By tapping down on the voltage divider (consisting of R_{12}, R_{13}, and R_{14}), we can apply certain selected portions of the voltage between X and Y to the grid of VT_1.

Resistor R_5 and condenser C serve the same purpose as in the circuit of Fig. 1. When an ac voltage is applied to the input, they act as a filter to keep this ac voltage from appearing at the grid of tube VT_1.

This basic circuit has become the most popular one for use in a vacuum tube voltmeter where stability, accuracy, and ease of operation are primary points of consideration. (With slight changes in this basic circuit, the addition of ohmmeter ranges, zero center ranges, ac ranges, and a reversible polarity feature, we arrived at the circuit for the NRI Model 11 Vacuum Tube Voltmeter, Fig. 2B.)

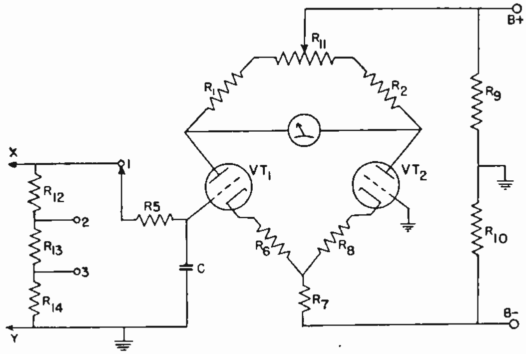
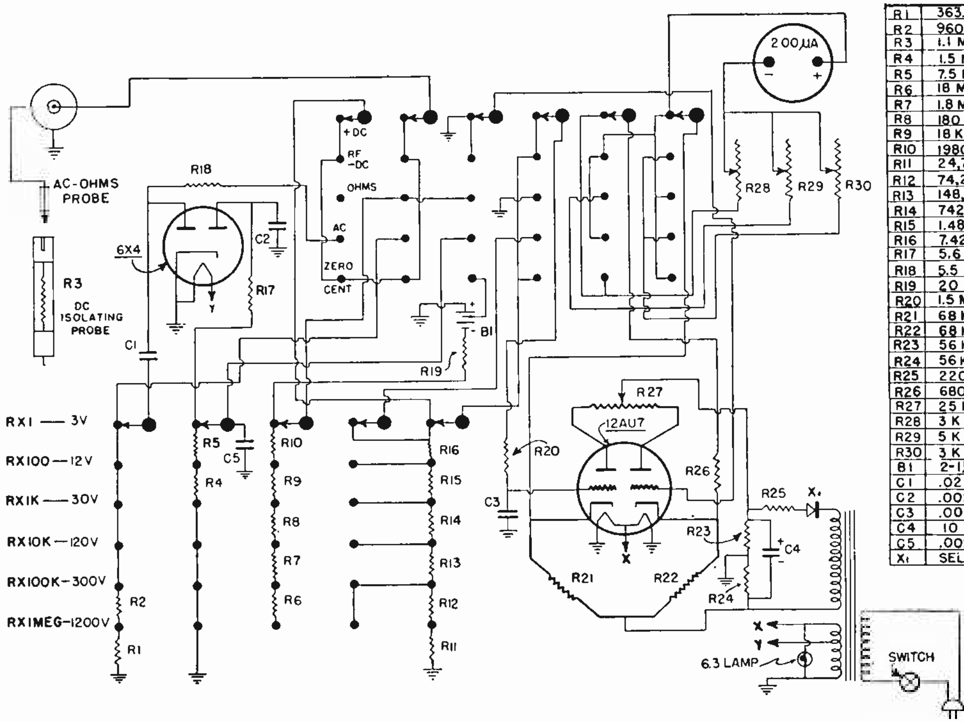


FIG. 2A. Basic, simplified circuit used in most bridge-type vacuum tube voltmeters, such as the NRI Model 11 VTVM.

Advantages of the Vacuum Tube Voltmeter

The most important advantage of a vacuum tube voltmeter is that the input resistance is held constant *at a high level.* The total value of R_{12} plus R_{13} plus R_{14} (Fig. 2A) is the only circuit element which is applied directly across the points to be measured. The total resistance of this voltage divider can be made quite high—as high as 10 megohms. If the instrument is designed to have a basic range of 3 volts when the switch is set at point 1, this means that we have an input sensitivity of 3.3 megohms per volt on this range. Compare this with the input resistance of a standard 1000 ohm-per-volt instrument set for the 3 volt range—input resistance 3000 ohms!



R1	363.5K
R2	960 K
R3	1.1 MEG.
R4	1.5 MEG
R5	7.5 MEG
R6	18 MEG
R7	1.8 MEG
R8	180 K
R9	18 K
R10	1980
R11	24,770
R12	74,230
R13	148,700
R14	742,300
R15	1.487 MEG
R16	7.423 MEG
R17	5.6 MEG
R18	5.5 MEG
R19	20
R20	1.5 MEG
R21	68 K
R22	68 K
R23	56 K
R24	56 K
R25	2200
R26	6800
R27	25 K ZERO ADJ.
R28	3 K SEALED CAL.
R29	5 K OHMS INF. ADJ.
R30	3 K SEALED CAL.
B1	2-1½V. CELLS
C1	.02 MFD
C2	.002 MFD
C3	.002 MFD
C4	10 MFD
C5	.002 MFD
X1	SELENIUM RECT.

Fig. 2B. Actual schematic diagram of Model 11 NRI Professional Vacuum Tube Voltmeter.

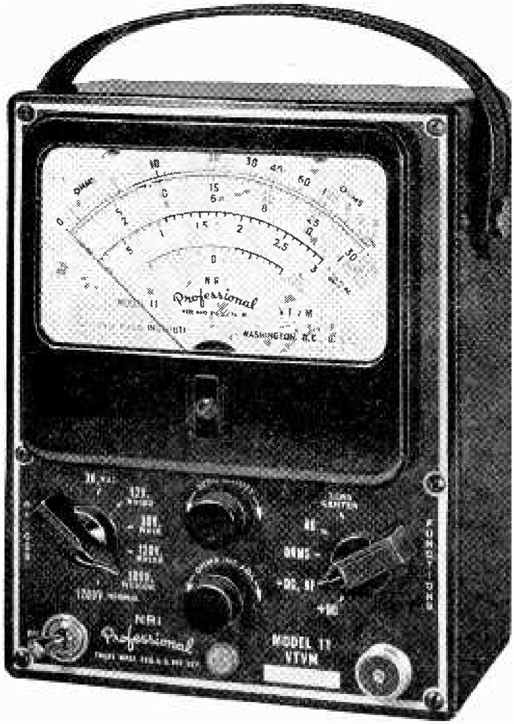


FIG. 3. The Model 11 NRI Professional Vacuum Tube Voltmeter.

Because the voltage to be measured is amplified before being applied to the meter, a meter of less sensitivity can be used in a vacuum tube voltmeter. This decreases the cost of the meter required, and makes the instrument more rugged. Generally, the more sensitive a meter is, in terms of current required for full-scale deflection, the more likely it will be affected by mechanical shock. Therefore, use of a meter of lower sensitivity gives us an instrument that will stand more abuse.

Once a vacuum tube voltmeter like that in Fig. 2A has been calibrated, it will maintain calibration over long periods of time. A dual triode tube is normally used instead of two separate tubes, as shown in Fig. 2A.

As the tube ages and the current flow through it decreases, it decreases equally in both sections. This means that the bridge will maintain its balance even though the current has changed. If two tubes were used, they probably would age differently, the current in the two sections would decrease at different rates, and the bridge would become unbalanced.

Another important advantage of the vacuum tube voltmeter is the ease with which it may be adapted for other measurements. A simple rectifier converts it into a sensitive ac voltmeter. The addition of a few resistors and a battery converts it into a wide range ohmmeter.

These are some of the basic reasons why the vacuum tube voltmeter has become such a popular test instrument for modern circuity. It allows measurements to be made in many circuits where they would be impossible with any other type of instrument. Also, most measurements can be made without affecting circuit operation—this is often quite important in oscillator circuits and high frequency rf amplifier circuits.

The Model 11 NRI Professional Vacuum Tube Voltmeter

Fig. 3 shows an instrument of the type that we have been discussing. This instrument has dc voltage ranges from 3 volts to 1200 volts in ranges designed for maximum usefulness. It has ac ranges from 3 volts to 1200 volts with a frequency range from 25 cycles to 3 megacycles. (An rf probe is available for this instrument that extends the frequency range to 250 megacycles). The instrument has a wide range ohmmeter scale that will measure resistances as high as 2000 megohms. One of the special features is the zero center scale that has been especially designed for use in FM alignment work.

The input impedance of the instrument for all dc measurements is 11 megohms, and there is a provision for reversing the polarity of the scale. That is, by turning a switch you can convert the instrument to read voltages that are negative with respect to the point where the common lead of the instrument is connected.

Before using any vacuum tube voltmeter, it must be properly adjusted to zero. The technique for doing this is virtually the same for all vacuum tube voltmeters, and the following suggestion can be applied to almost any vacuum tube voltmeter.

First, plug the instrument into a wall socket furnishing 110-120 volts, 50-60 cycles. Turn the off-on switch to the "On" position, and wait about one minute for the tubes to reach their operating temperature. Then set the function switch to positive dc, and the range switch to the lowest voltage range. Adjust the "ZERO ADJUST KNOB" until the meter reads zero.

Now, by setting the function switch and the range switch to the proper position, the user will be able to make voltage readings of the operating potentials throughout a receiver or other piece of electronic equipment that is to be tested.

When using the Model 11 NRI Professional

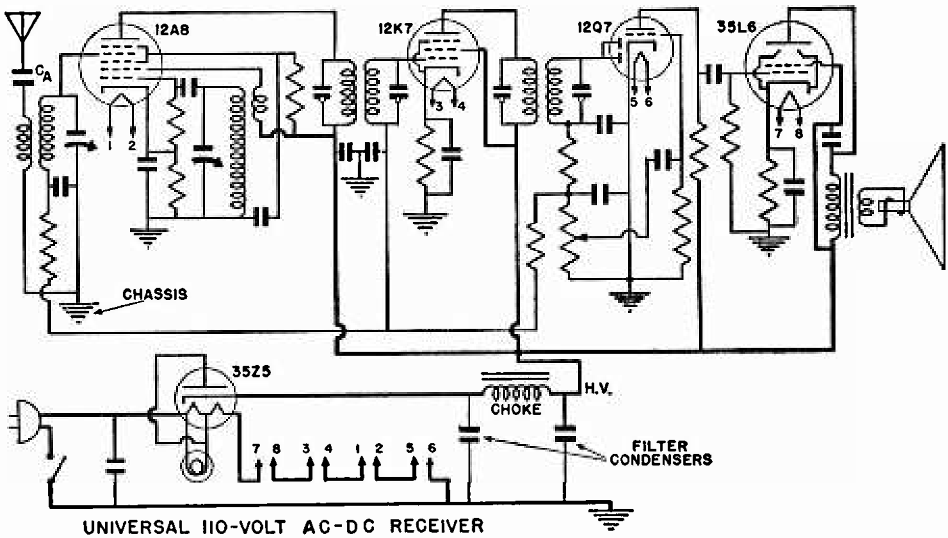


FIG. 4. Schematic of a typical AC-DC receiver.

Vacuum Tube Voltmeter, it is necessary that the dc isolating probe be placed on the standard test probe. When using other makes of instruments, it is usually necessary to use a separate test lead that is designed for use with the dc measuring circuit. Quite often a 1 megohm resistor is included in the dc probe to overcome the effect of test lead capacity. If the proper test lead is not used, considerable capacity will be coupled to the circuit under test and erroneous reading might result, particularly when measuring bias in an oscillator circuit.

Using the Vacuum Tube Voltmeter as a DC Voltmeter In Servicing

For all dc voltage measurements, the common lead of the instrument should be attached to B— of the equipment under test. In ac power transformer-operated equipment, the B— point is usually the chassis. In ac-dc equipment, the B— is the negative lead of the filter condenser, or any point connected to it.

When using a vacuum tube voltmeter, the initial setting of the range switch should be for the highest voltage range. The setting of the range switch can then be progressively reduced until there is sufficient deflection to obtain a convenient reading. When making readings where the highest accuracy is desired, always use a range that will deflect the meter pointer into the right half of the scale. This deflection gives the greatest accuracy.

In explaining the procedures to be used for dc voltage measurements in a receiver, the circuit of Fig. 4 will be used as an example. The reader will probably find it helpful to refer back to this circuit occasionally as information regarding the various types of measurements is given.

Usually, the first step in servicing a set is to check the operating potentials available throughout the receiver.

With the common lead connected to B—, the dc probe may be moved from one place to another in a circuit to make measurements at various points. The normal place to start is at the cathode of the rectifier. If the voltage is low at this point, it signifies that the voltage is low throughout the entire set, and further checks will locate the defective part. For example, if the voltage available at the cathode of the 35Z5 rectifier in Fig. 4 is low, but is considerably greater than the voltage at the screen grid of the 35L6 audio output tube, this means that some component on the "set side" of the filter choke is shorted. Likewise, if the voltage is normal at the screen grid of the 35L6 tube, but is low at the screen grid of the 12A8 oscillator-mixer tube, this signifies that leakage exists directly at the screen grid of the 12A8. (The usual cause for readings of this type is a defective screen by-pass condenser.)

To determine whether the output stage of the receiver is drawing sufficient plate current, touch the voltmeter probe to the cathode of the tube in that stage. At the cathode of the 35L6 tube in Fig. 4, a positive potential of approximately 9 volts should exist. If it does not, insufficient current is flowing through the cathode bias resistor, and the usual cause is a defective tube. However, before installing a new tube it would be well to make certain that the correct potentials are available at the plate of the tube and at the screen of the tube.

The above test will, of course, apply only when the circuit is designed to have cathode bias. In all other cases, set the function switch to —DC, connect the COMMON lead of the vacuum tube voltmeter to the cathode of the tube, and the test probe to the grid of the tube. The meter will then read the bias that is available for that tube. A check with the tube manual will reveal whether or not the bias is correct.

This same procedure of voltage checking can be applied to all of the other tubes in a receiver. Check the operating potential available in each circuit, and if the voltage is low in any one circuit, check that circuit for the cause.

By switching the instrument to DC minus, and connecting the probe to the oscillator grid (the first grid of the 12A8 tube in Fig. 4), you can quickly determine whether or not the local oscillator in the receiver is operating. If the local oscillator is operating, there will be enough voltage so that the grid of the tube will be negative with respect to the cathode. If the oscillator is not operating, this voltage will not exist.

Another useful check that can be made when the instrument is set to the —DC position is measurement of the avc voltage. Touch the test prod to the control grid pin of the i-f amplifier (the 12K7 in Fig. 4), and slowly tune the receiver across the broadcast band. If a change in the dc voltage available at the grid of this tube is noted as the receiver is tuned past the frequencies of local broadcast stations, all sections of the receiver up to the second detector are operating properly. You can be certain of this because the voltage is developed in the second detector circuit of the receiver, and all sections previous to that one must be operating if avc is available.

This same procedure can be used to check agc voltages in television receivers. By checking for a change in agc voltage as the set is tuned from channel to channel, you can quickly determine whether or not the stages up to the second detector are operating properly.

Here is a simple way of checking the various parts used in an avc or agc network. Tune the set to a strong station. Measure the voltage on the "source" side of the avc (agc) filter resistor first, then the voltage of the "set" side of the resistor. If voltage is available on the source side, and not on the set side, this indicates that the resistor is open, or the avc (agc) by-pass condenser is shorted. A simple ohmmeter check will indicate which.

The coupling condenser used in the audio output stage of a receiver can also be checked by means of the vacuum tube voltmeter. To do this, set the instrument for +DC measurements and touch the probe to the grid pin of the audio output tube (the 35L6 in Fig. 4). If a positive voltage is noted at this point in the circuit, disconnect the coupling condenser and check again at the grid of the tube. If the positive voltage has disappeared, the coupling condenser is defective; if the positive voltage remains, the tube is gassy and must be replaced.

There is another important use for the dc voltage scales that will be further explained when we discuss alignment.

AC Voltmeter

One special feature of the NRI Model 11 Vacuum Tube Voltmeter is that no blocking condenser is necessary in series with the test lead when making ac readings. Instead, the blocking condenser is included in the instrument. (This is not true of some voltmeters. If you are uncertain about a particular model, check the manufacturer's instruction sheet furnished with the instrument.)

By setting the function switch to the ac position and the range switch to a position that will accommodate the voltage to be measured, you can measure ac voltages over a wide range. Because of the wide frequency range of the instrument, it can be used as an audio voltmeter for many types of work.

To measure ac voltages, the two test leads must be connected across the voltage to be measured. For example, to measure the filament voltage of a tube in an ac-dc receiver, connect the common lead of the voltmeter to one side of the tube filament, and the test prod to the other side of the tube filament. The voltmeter will then read the potential available across these two points.

Most ac receivers using 6.3-volt tubes have one side of the filament grounded. In such a case, connect the common lead of the voltmeter to chassis, and touch the test prod to those points where measurement is desired.

To measure the ac output of a power transformer, attach the common lead of the voltmeter to one side of the winding and the test prod to the other side. The voltmeter will then read the potential between these two points. (When checking transformers in this manner, always use the highest ac voltage range for the initial measurement. The range switch can be reset, if necessary, to obtain a usable reading.)

When this instrument is set for ac measurements, it will also measure voltages at audio frequencies. This useful feature makes it possible to directly "signal trace" in the audio stages of a receiver.

To do this, feed a signal into the set and check the signal voltage at each audio tube. If an audio voltage is available at the grid of a tube, and not at the plate of that tube, some defect exists in that circuit.

Another useful test that can be performed by the "audio voltmeter" is the checking of the electrical balance of a push-pull audio stage. To do this, check the audio voltage at the plate of first one tube, then the other. These two voltages should be substantially equal. If they are not, check the audio voltages at the grid of each stage. If they are equal, the defect lies in that stage, but if they are unequal, the defect is probably in the preceding stage or the coupling system between the two stages. Balance is necessary in a push-pull audio stage if the advantages of push-pull operation are to be fully realized.

Another use of the audio voltmeter will be given in the section on AM alignment.

Ohmmeter

The ohmmeter section of the instrument used for illustrating this article, the NRI Model 11 VTVM, will measure resistances ranging from ½ ohm to 2000 megohms. This wide range of resistance measurements allows you to make any resistance measurements you are likely to need in the repair of AM, FM, or TV receivers.

To adjust a vacuum tube voltmeter for ohmmeter readings, set the function switch to OHMS, and the range switch to the lowest setting. Then adjust OHMS INF. ADJ. so that the meter pointer is at the full scale point. By setting the range switch to the appropriate position, you can make resistance readings as necessary.

When making ohmmeter measurements, always use the test lead that is designed for use with the ohmmeter section of the meter. In the case of the NRI Model 11, merely remove the dc isolating probe. Changing test leads is not necessary.

To measure a resistor, connect the two test leads to the two ends of the resistor. Adjust the range switch until the meter pointer is on an easily read section of the scale (near the middle). Mentally apply the necessary multiplying factor to the reading observed on the meter. For example, if the needle comes to rest at 10 on the OHMS scale, and the range switch is set to R × 100, multiply 10 by 100 to get the value—1000 ohms. Most vacuum tube voltmeters have the resistance ranges arranged in steps that are multiples of 10. This makes it easy for you to apply the multiplying factor by adding the appropriate number of zeros to the reading observed on the scale.

The high ohmmeter ranges of the vacuum tube voltmeter will often be useful in checking for leakage. For example, to check a condenser for leakage, disconnect one side of the condenser, set the instrument to the highest ohmmeter range, and connect the test leads across the condenser. The reading will be the leakage resistance of the condenser.

This same procedure can be used with coils, i-f transformers, etc., but the unit under test must be completely disconnected. Connect one ohmmeter lead to one winding, and the remaining lead to the other winding. The scale reading will be the leakage resistance between the two windings.

When using the ohmmeter for continuity checks, you should not use the R × 1 scale too often, because use of this scale will cause somewhat more rapid discharge of the ohmmeter batteries. In normal use, the batteries in the ohmmeter circuit will last their "shelf life." Note: The Model 11 NRI VTVM uses two ordinary flashlight batteries. Therefore replacement is a simple problem.

Also, *you should take care not to attempt to measure continuity of battery tube filaments using the R × 1 scale.* When the instrument is set to the R × 1 scale, the 3-volt ohmmeter battery is likely to burn out the filaments of battery tubes. However, there will be no danger if the instrument is set to higher ohmmeter ranges.

Zero Center Scale

The NRI Model 11 Vacuum Tube Voltmeter has a specialized feature that is not found in many service instruments today—a zero center dc voltage scale.

This scale is arranged so that the zero center mark on the scale is at the center, and the meter reads positive voltages by deflecting the pointer to the right, and negative voltages by deflecting the pointer to the left.

To use the zero center dc voltage scale of the instrument, set the function switch to "ZERO CENTER" and set the "ZERO ADJUST" control so that the meter pointer rests over the zero on the black scale that is marked "ZERO CENTER." The dc isolating probe should be used. The instrument is now set up so that you can measure voltages that are either positive or negative, without moving the test leads or resetting the function switch.

This zero center scale is very useful in aligning FM discriminators and ratio detectors. To adjust a discriminator, connect the input of the zero centered vacuum tube voltmeter across the discriminator load resistor. Then feed an unmodulated i-f signal into the receiver. If the meter shifts from zero when connected across the discriminator load resistor, the discriminator is not properly aligned. Adjust the trimmer on the secondary of the discriminator transformer until you get zero voltage reading. This signifies correct alignment of the stage.

Usages in Alignment

In aligning an AM receiver, the vacuum tube voltmeter must be used in conjunction with an AM signal generator which supplies signals at the frequencies required for the alignment of that particular receiver.

One way of using the vacuum tube voltmeter in alignment is by setting the instrument for avc measurements, and connecting the test prod to the proper point of the circuit. Feed an rf (or i-f) signal into the proper section of the receiver, and align the various trimmers for maximum reading on the voltmeter scale. When the instrument is connected, the setting of the range switch should be reduced one step at a time until the 3-volt scale is reached. The output of the signal generator should be adjusted for a reading of approximately 2 volts on the meter. As the trimmers in the receiver are adjusted, the output of the generator will have to be reduced to maintain this value of avc voltage. (See Fig. 5.)

Do *not* set the range switch of the vacuum tube voltmeter to a progressively higher range as the trimmers are aligned—reduce the input signal of the signal generator. This consideration always applies to AM alignment.

As an audio voltmeter, the vacuum tube voltmeter can be used as an output meter for alignment purposes. For use in output measurements the instrument can be connected directly across the voice coil of the speaker, or directly from the plate of the audio output stage to B minus. The connection used in each particular case will depend upon the preference of the user, and the convenience of the connection. Two ways of making this connection are illustrated in Fig. 5.

During alignment, feed a modulated signal into the proper section of the receiver, and align the various trimmers for maximum reading. It will probably be necessary that the output of the signal generator be reduced as the various stages are brought into alignment. Again, always reduce the output of the signal generator, rather than increase the setting of the range switch.

For FM i-f alignment, connect the vacuum tube voltmeter across the limiter grid resistor, and feed into the receiver an unmodulated signal at the i-f frequency (usually 10.7 megacycles). The various trimmers of the i-f circuit of the receiver should be adjusted to give maximum reading on the voltmeter. In aligning FM limiters it is necessary that sufficient signal be available at the limiter, or the desired limiting action will not occur.

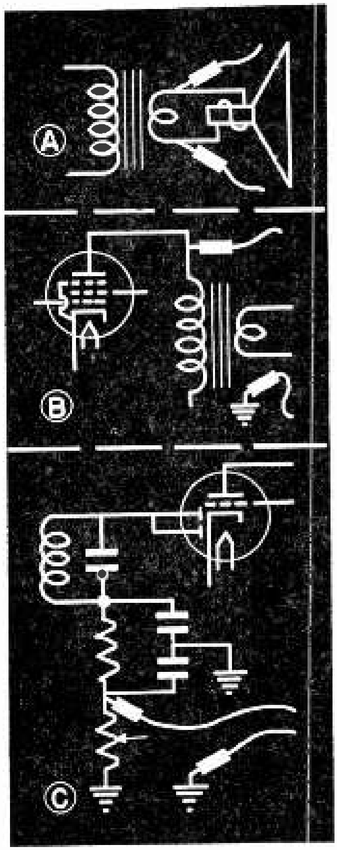


FIG. 5. Three ways of connecting a vacuum tube voltmeter for use as an output indicator in alginment: A, across the speaker voice coil; B, from the plate of the output tube to B—; C, across the diode load. Methods A and B use the instrument as an audio voltmeter. In method C, measure the avc voltage by connecting the instrument as a dc voltmeter, with the function switch set at —DC.

The alignment of discriminators in FM receivers was discussed above, in the section covering the zero center scale.

An FM receiver having a ratio detector can also be aligned with the use of a vacuum tube voltmeter and an AM generator. The oscilloscope and FM *sweep* generator method gives more accurate results, but the vacuum tube voltmeter system of alignment will suffice when an oscilloscope and a sweep generator are not available.

To align the ratio detector feed an amplitude modulated signal into the i-f section of the receiver. Then adjust the various i-f trimmers to give maximum voltage across the ratio detector load resistor. Then connect the vacuum tube voltmeter to the audio stages as an audio voltmeter (as explained previously), and adjust the secondary of the ratio detector transformer to get minimum audio output. This adjustment will give the best FM detection with the least susceptibility to AM signals.

Accessories: R-F Probe

There are rf probes available for some vacuum tube voltmeters (including the NRI Model 11) that extend the frequency range. The rf probe will be useful to a serviceman who wants the ultimate in test equipment.

To use the rf probe, set the function switch as in the manufacturer's instructions, and the range switch to the appropriate division. There is a voltage limit on the crystal contained in the rf probe. It is 120 volts peak (85 volts rms) for the probe for the NRI Model 11. This peak voltage should never be exceeded in testing. For all rf voltage measurements, attach the probe ground lead to the closest B— point.

By feeding a known signal into the input of a receiver and measuring the strength of the signal available at the plate of each successive stage, you can get an idea of the gain of the receiver.

You will need some experience in signal tracing before you can fully evaluate the readings. However, by making a series of signal voltage measurements in a receiver known to be in good operating condition, you become familiar with the rf voltages that you can expect to find at various points in the receiver. A general rule to use in the beginning is that at least 3 volts of i-f energy should be available at the plate of the second detector for proper operation.

You can check the effectiveness of by-pass condensers by touching the rf probe to the point where by-passing is desired. If you get a reading on the voltmeter, it is due to unby-passed energy, and the by-pass condenser at that point in the circuit should be replaced.

To check an rf or i-f stage for suspected parasitic oscillation, stop the local oscillator in the receiver, and check for the presence of an rf voltage at the plate of the suspected stage. If an rf voltage is present, the stage is oscillating.

The output of the local oscillator in a receiver can be checked directly at the grid of the oscillator tube by use of the rf probe. Connect the negative lead of the probe to B—, and touch the tip of the probe to the oscillator grid. You will get a reading of 10 to 25 volts. The exact voltage will vary from set to set, and some experience with this measurement will be necessary before you can fully evaluate the readings.

High Voltage Probe

Another accessory that is available for most vacuum tube voltmeters is the high voltage probe. Most of these probes extend the dc voltage range of the instrument up to 30,000 volts, and the discussion in this section will apply to most instruments, although the instructions regarding the probe were written with the NRI Model 11 VTVM in mind.

To use this accessory, set the function switch to DC positive, and the range switch to 1200 volts. Then remove the dc isolating probe and slip the high voltage probe over the normal probe for the instrument. When the high voltage probe is correctly inserted, a slight "click" will be heard.

Now connect the negative lead from the voltmeter to the chassis of the set on which the high voltage is to be measured. When making measurements in high-voltage circuits, always keep your hand well behind the safety flanges on the multiplier probe.

Touch the tip of the high voltage probe to the point where measurement is to be made. There will be a slight arcing when contact is made. This is normal. The voltage available at that point can now be read on the 0-30 scale of the instrument, by multiplying the measured voltage on the scale by 1000. If the instrument reads 12 volts on the 30 volt scale, the actual value of the voltage available at that point is 12,000 volts.

Special Measurements

There are many special uses for the vacuum tube voltmeter. For example, the approximate capacity of a condenser can be measured, or the percentage of ripple of a power supply can be determined.

Capacitance Measurement. Accurate capacitance measurements are possible only with a bridge circuit that has a power factor balance, thus taking into account both capacitance and resistance. However, rough but useful capacitance measurements are possible with the vacuum tube voltmeter, a source of ac voltage, and a 3-meg-ohm rheostat. This rheostat will serve for capacitance measurements between .001 mfd. and .01 mfd.

Connect an unknown capacitor and a variable resistor in series across a source of 60-cycle ac voltage. The source voltage can be any voltage conveniently available from a filament transformer or directly from the ac line. Adjust the rheostat until the voltage drop across it is equal

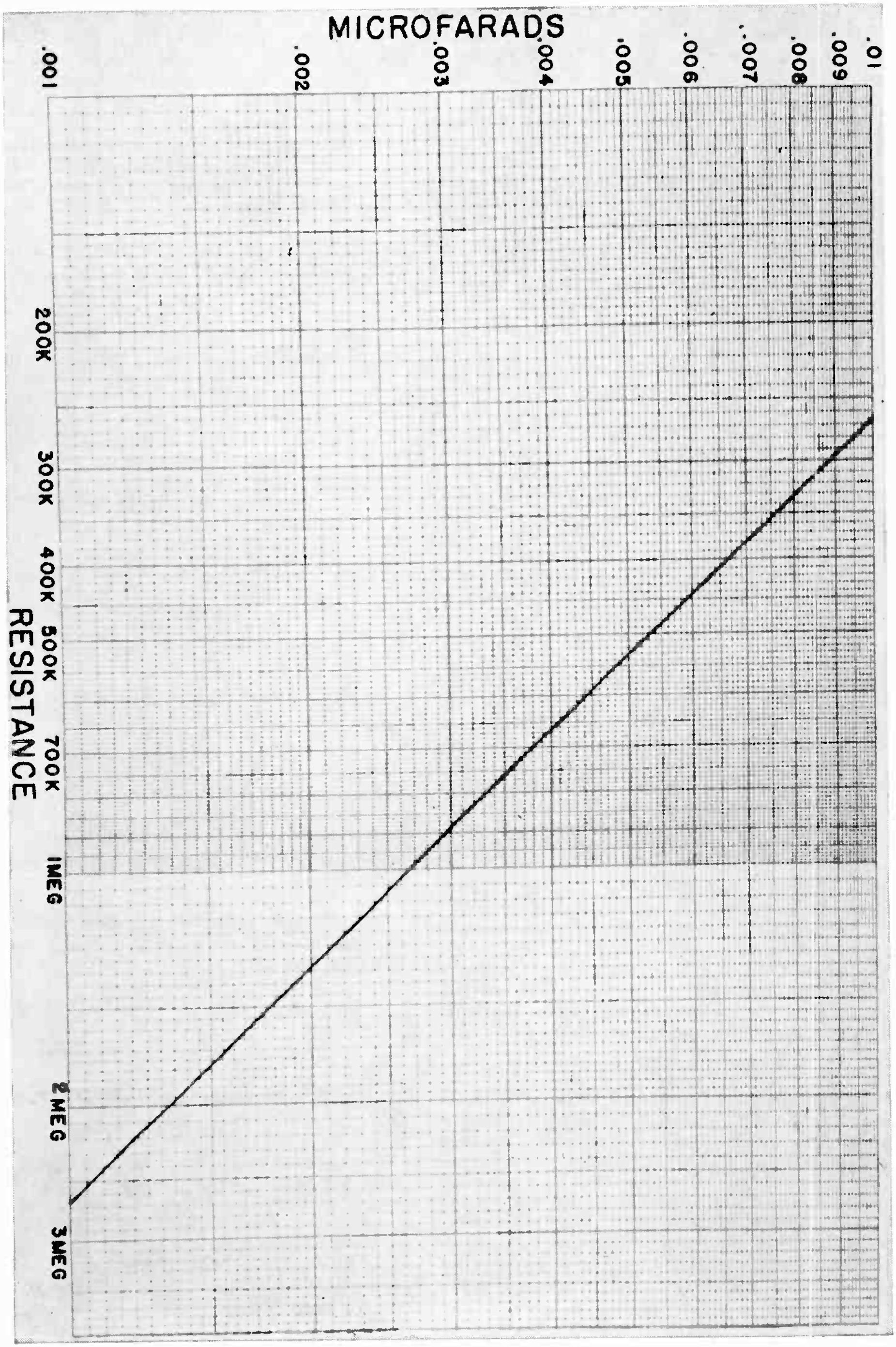


FIG. 6. This graph is used in obtaining approximate capacitance values with a VTVM.

to the voltage drop across the condenser. Then disconnect the rheostat from the circuit and measure its resistance on the ohmmeter section of the vacuum tube voltmeter. Now refer to Figure 6. From the point where the resistance value crosses the slanting line, draw a line to the left side of the graph. This will indicate the value of the unknown condenser.

Measuring Percentage of Ripple. To measure the percentage of ripple of a power supply, first check the dc voltage available at the output of the supply, then the ac voltage available across the same two points. The ac voltage will probably be quite low, so a careful reading will be necessary. Dividing the ac voltage by the dc voltage will give the percentage of ripple.

For example, let us consider a power supply that has a dc output of 380 volts, and an ac component of 7 volts. Divide 7 (ac component) by 380 (dc component), and multiply by 100 to obtain the percentage of ripple—in this case, 1.84%. This method of measuring the percentage of ripple of a power supply can be applied to any supply on which the dc output is not over 1200 volts.

With an instrument such as the NRI Model 11 Vacuum Tube Voltmeter you will be able to measure any supply voltage in a receiver or other piece of equipment, usually without disturbing the operation of the circuit. You can also measure any ac supply voltage in the receiver, any resistor you are likely to encounter in service work, and many of the signal voltages in the receiver. In TV work a vacuum tube voltmeter is especially valuable. It's almost a necessity, because no other instrument can be used to check voltages in many TV circuits without upsetting the operation of the circuit under test.

As you can see just from the examples given in this article, a vacuum tube voltmeter is one of the most useful test instruments a serviceman can own. It will repay its cost many times over. Further information about NRI's new Model 11 Vacuum Tube Voltmeter, may be had by writing to NRI Supply Division, National Radio Institute, 16th & You Sts., N.W., Washington 9, D. C.

n r i

Enough has already happened to show that the human race has little more than begun to realize its possibilities and capabilities. All that we have done is but child's play compared to what we can do and will do. It is said that the advancement made during the first half of the present century has exceeded all that made previously. This is because people are just beginning to realize what a marvelous thing it is to be a human being, and to use the abilities with which a human being is endowed.

—Clarence E. Flynn in **Good Business.**

News or No News!

TO those traveling in high gear, this will be *no* news, but for those students in "second" or in "creeper gear" we want to explain NRI has made a change.

It's fundamental! For many years students have been sent a new lesson *every* time they sent a lesson for grading, but on June 16, 1952 the system was changed—

1. Students enrolled on and after June 16 are sent lessons *in groups*. Lessons are sent in groups of 3's—(after the first shipment).

2. Some students enrolled before June 16 have been *converted to* the group plan and have received a detailed explanation of how it works. The remainder *will be* converted as their progress permits. *Every* student enrolled before June 16 will be converted by the time he has studied three (3) lessons after June 16; when you receive *one* group of 3 lessons, you'll be on the group plan thereafter.

Here are some of the advantages:

1. More lessons will be sent at the start; many students in the past have run out of lessons before any new texts got to them.

2. Fewer lessons will go astray in the mail since there will be only one-third as many *mailings* of new texts.

The general idea of keeping students a number of lessons ahead is continued. If you send 3 or more lessons for grading and don't get any new ones, better write—but allow plenty of time for lessons to reach you under present mail conditions.

The practice of keeping students more than the normal number of lessons ahead where distance or mail conditions justify will be continued. The *plan* is to keep some new texts on hand for you at all times; write if you run out of lessons to study.

n r i

Possible Business Opportunity in Paullina, Iowa

We recently received a letter from a successful business man who operates a clothing chain store in Paullina, Iowa. He points out that this particular town of 1300 population is located in a rich rural section, and has no trained person for Radio and Television Service work. Some enterprising student or graduate living in this particular area may wish to investigate the opportunity further.

Our Cover Photograph

NRI Graduate I. L. Hankey, of Frederick, Maryland, posed with a part of his Radio Amateur equipment for the cover photograph of this issue. Hankey is what might be called an "old-timer" in Radio and of course now he is succeeding also in Television. Graduate Hankey writes:

"I had been servicing Radio receivers for ten years. After building up a nice business, I found it was necessary to get the technical knowledge I lacked, so I enrolled with NRI. I now have my own business and am servicing home Radios, automobile radios, Television sets, and also handle public address installation and servicing.

"It has been over sixteen years since I completed my course with NRI. These past years have seen me grow from a novice in the field of AM Radio up to the largest Radio and Television Service business in Frederick, Maryland. Much credit for this success must go to NRI for starting me on the way with the splendid home schooling I received. Just recently I was compelled to build a large new shop to take care of the increased business brought on by Television.

"In my opinion, the NRI course will benefit any ambitious man who wants a future in Radio."

I. L. Hankey,
Frederick, Maryland.

n r i

DuMont Engineer, and NRI Graduate, Stresses Shortage of Qualified Electronics Technicians

We are very proud to quote from a letter recently received from Robert P. Wakeman, who is head of the Propagation Department, Research Division, Allen B. DuMont Laboratories, Inc. Mr. Wakeman graduated from NRI in 1937, and has an outstanding record of achievement since that time. In regard to the future of Television, Mr. Wakeman has the following to say:

"During the past five years, Television has been the most rapidly expanding industry in the Nation's history. With the recent lifting of the freeze, there's every reason to believe that this growth will continue for some time. As everyone in the industry knows, probably the most severe shortage of qualified personnel in the country today is in the field of Electronics."

In his letter, Mr. Wakeman also outlined some of his accomplishments since graduating from NRI. He has had wide and varied experience and training since his graduation. We do not mean to imply that NRI training directly enabled him to achieve his eminent position as an Engineer. However, when Mr. Wakeman enrolled with NRI he was employed as an assistant shipping clerk, at the age of 20 years. Thus, enrolling with NRI was his first step in the direction of a brilliant electronics career. Mr. Wakeman writes the following about his experiences:

"I enrolled for the NRI course during 1934. Upon graduation, I took a position as Radio Tester with United American Bosch in Springfield, Massachusetts. Subsequently, I obtained a commercial operator's license and operated Station WBRK in Pittsfield, Massachusetts for about six months. I then accepted a position with the Signal Corps in a civilian capacity and spent about a year in the Arctic as a field engineer.

"During the last three years of the war, I was a member of the Modulation Group at the Radiation Laboratory at M.I.T. In 1945, I joined the Research Division of the Allen B. DuMont Laboratories, Inc., and for the past three years have been a Research Engineer in charge of wave propagation."

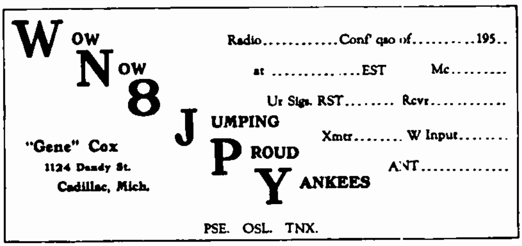
We are very grateful to Mr. Wakeman for giving us permission to publish the above statement. We feel that every young man interested in a career in Television and Electronics can receive encouragement and inspiration from the comments of this successful engineer.

n r i

—CQ—

"I now have my novice amateur license and the call letters are WN8JPY. I would like to make contact with some other NRI students. I have partially built my rig using a command transmitter and am running 70 watts. I have worked and confirmed 15 states."

Eugene A. Cox, WN8JPY
1124 Dandy St.,
Cadillac, Mich.



n r i

G.E. Building New Transformer Plant. A multi-million dollar transformer plant employing 1700 persons is scheduled to be completed in Rome, Georgia, by mid-1953.

The NRI Diagram Service

SOONER or later everyone who enrolls with NRI uses our diagram service. Every student who carries out the Practical Training Plan is sent a diagram of the set he selects for training purposes. As you perhaps know, the Practical Training Plan teaches "servicing by doing." The student introduces defects in a set to learn how to correct these defects in other sets. We send him a diagram of the set he uses, because an essential part of the Plan is learning to read diagrams. Then when students and graduates begin professional servicing, they have at their disposal NRI's collection of diagrams and servicing information to help them in particular service jobs.

Many students and graduates who have been to Washington and have visited NRI have seen at first hand how the diagram service is carried on. For the benefit of those of you who have not, this article is written as a sort of arm-chair tour, to explain not only what the diagram service is, but how you can make the best use of it.

NRI's collection of diagrams and servicing data —like Topsy—"just growed." Years ago we began systematically acquiring information, and the job has gone on ever since. As more and more different manufacturers put more and more different models on the market, our files expanded, until today we have information on over 65,000 different sets, one of the largest, if not *the* largest collection in the world.

Now you might well ask why—what's the reason for all the time and labor involved in collecting and keeping up such a large number of diagrams? Is it worth it? That question can best be answered with another question. When you are driving through strange country, isn't it easier to get where you want to go if you have a road map? Of course it is. A diagram is a map of a receiver. It shows you in a clear and simple way how the set is put together electrically, the relation of one part to another, something that may not be easily seen from the external appearance of the lay-out. Servicemen soon learned that servicing was easier if they had diagrams as guides. But the individual serviceman does not usually have a diagram of every set brought to him for repair. Even the manufacturer or distributor may not have one to send him. That's why NRI has collected thousands of diagrams—to help its students and graduates in their work, to provide them with these short-cuts that make servicing faster, and consequently more profitable.

It's not only the serviceman who has found our collection of value. There has even been the case of a manufacturer writing us for one of his own diagrams which had been out of print for a long time. We were able to supply one! And of course the instructors at NRI use diagrams in answering questions sent in by students.

This information is at your disposal, too. If you want a diagram to help you service a set, it's yours for the cost of reproducing it and mailing it to you.

Ordering Diagrams

A printed diagram order blank is sent to all students with the tenth lesson of the Course. A copy is shown in Fig. 1. Use this form whenever you order a diagram. You will be sent additional blanks each time you order, and extra ones may be had for the asking at any time.

It is important that you fill out the form completely. All of the information we ask for is necessary. Print plainly in ink or type your name, address, and student number in the spaces provided. This blank is used as the mailing label to send back your diagram, so if the address is illegible you won't receive what you ordered. Fill in the spaces that indicate how much money you are sending. If you want the diagram sent airmail, check the proper place and be sure to enclose the extra postage.

Notice that the price for TV is different from that for radio diagrams. As you probably know, TV service information is put out by the manufacturer in booklet form, usually from 20 to 30 pages of data, alignment information, parts lists, diagrams, etc., wheras a radio diagram is seldom more than one or two sheets. The cost of reproduction is what makes the price of the TV service information high.

Naturally we can't maintain a stock of duplicate copies of all of our 65,000 diagrams adequate to meet the needs of thousands of our students and graduates. What we do is reproduce our file copies. We have our own photostat machine and printing and drying facilities, so whenever we receive a request for a radio diagram, we send a photostat of our copy.

Now this is a relatively inexpensive process for a one or two page diagram, and we can afford to do it for 25¢, which covers the cost of materials and postage. But photostating a 30-page book of TV service information is another matter. Quite apart from the time involved, the expense would be more than the average serviceman would want

Please Fill Out Completely. Use A Separate Order Form For Each Diagram You Want.

Television Service Data, $2 per set. Radio Receiver Diagrams, 25c each.

Radio receiver diagrams will be sent Air Mail if 6c postage is enclosed. Check here ☐

TV receiver diagrams will be sent Air Mail if 25c extra is enclosed. Check here ☐

Dear Mr. Smith: Please send me Diagram of the following receiver, for which I enclose $.25

National Radio Institute

16TH & U STREETS, N. W., WASHINGTON 9, D. C.

Name John Student

Address 909 Elm Street

City Washington Zone 9 State D.C.

Student No. E105G158 GI

Name of Receiver: Emerson

Model No. 8X211 (Not Serial Number)

Chassis No. AX

If a Radio receiver, how many tubes? 5

If a Radio, give type number of each tube: 6A8, 6K7, 6Q7, 25L6, and 25Z6

Always give MODEL NUMBER of the receiver which is given some place on either the chassis or cabinet.

Step 1 Fold Here

Place Quarter Here

Step 2 Fold Here

Fig. 1. Use this printed diagram order blank when ordering radio and TV diagrams from NRI.

Louise Lo Jacono (left) and Mary Ann Conley removing file copies of diagrams from the NRI master diagram files.

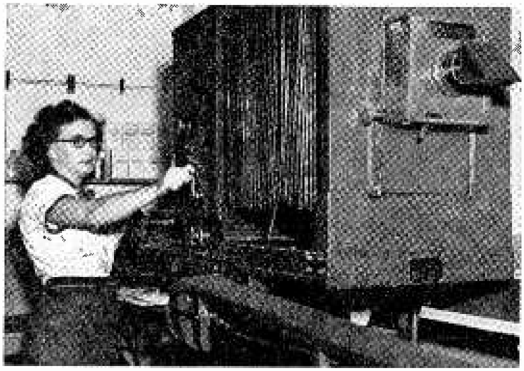
to pay. Yet a diagram is just as important, perhaps more so, in servicing a TV set.

To make the TV service information in our files available at a reasonable cost, we recently acquired another kind of reproducing process, by means of which we are able to reproduce TV service manuals at $2.00 a set. This process is essentially a photographic one. Light passing through the material being duplicated leaves an impression on sensitized paper. The exposed paper passes through ammonia vapor, and is ready for use at once—which eliminates the long developing, fixing, washing, and drying operations necessary in photostating. We make a master reproduction copy of service information on special paper to make better prints. This master copy is kept in our files, and is used whenever we get a request for that particular data. Duplication still has to be done page by page, but it's a lot less expensive than photostating, it's faster, and it does bring the price within the serviceman's reach.

You realize, of course, that the cost of a diagram is a part of the cost of doing the service job, and you are legitimately entitled to charge it to your customer. It's to his advantage after all, because with a diagram you'll be able to do the job faster, and save him the extra labor cost. So do not hesitate to use diagrams in servicing, and recover the cost in your price for the job.

Another word about TV diagrams: Remember, the television industry is still young and it still has growing pains. Many new companies are springing up. Manufacturers are making frequent, almost continuous, changes in their products. Consequently, service data is not always readily available in printed form until some time after a model has been put on the market. Even then it may have had limited distribution and be outdated and out of print in a short time.

NRI makes every effort to get whatever data is available, but we are, to a large extent, dependent on the manufacturers. If they prepare



Elizabeth Mast operating the photostat camera at NRI. Most regular radio diagrams ordered from NRI are reproduced on this machine.

printed service data, we can eventually get it. If they don't, then, of course, we can't supply it.

Now back to our printed order blank. After you have filled in the address label and the amount you are sending in, fill in the description of the set. In order to send you a diagram we must know exactly what set you have. To identify a receiver we need to know what make it is, the manufacturer's name (if different from the make), the model number, the chassis number—if any, and a list of the tubes used (if it's a radio—but not for TV). Let's look at each one of these items.

The Make and Manufacturer's Name

Since our diagrams are indexed under the name of the manufacturer, before we can locate a diagram we must know who made the set. As a general rule, a model or trade name is of no help in identifying it in our files. Therefore, always give us the name of the manufacturer. DuMont, for example, makes a set which it calls the Stratford. We might not be able to identify this set as a DuMont product simply from the name of the model, which is usually a name descriptive of the cabinet style, not the chassis used. The DuMont Stratford uses a RA-105 chassis, but so do several other cabinet styles. Make sure that the name you send us is the name of the manufacturer, not the name of the model. Check the label posted inside the cabinet as well as the name that may be stamped on the outside. In the case of table models, look on the bottom of the cabinet for a label.

Sometimes a manufacturer will license other firms to use some feature of one of his products. In case you want a diagram for such a set, be sure to send us the name of the firm that actually made the set, not the one that licensed it. If, for example, you see a label on a receiver "Licensed by Hazeltine," look further for the name of the manufacturer. It is not a Hazeltine set.

There are also what are called private brands—items made up especially for some retail outlet, such as a department store or drug chain. Many of these are sold under unfamiliar names, names different from those of the manufacturers. For example, one of the department stores here in Washington sells a radio called the Beverly. We do not have a section in our files for Beverly sets, but we might have a diagram for the set filed under the name of the company who makes that particular model for the store. If you want a diagram for a set whose name you don't recognize, look carefully for a label somewhere on the set for the manufacturer's name, or get it from the store that originally sold the set.

There are two private brands which are so widely sold that we file diagrams under their names, rather than under the names of the firms that make them. Both the Silvertone sold by Sears, Roebuck and the Airline sold by Montgomery Ward are made by various manufacturers for those stores. Since they are popular sets, however, we keep our diagrams under the set name. If you want a diagram for one of these sets, it will not be necessary to send the name of the manufacturer.

The Model Number

Just as important as the manufacturer's name in identifying a set is the model number, which will be found pasted inside the cabinet, on the chassis, or perhaps on the bottom of the cabinet. A distinction must be made between the model number, which is the same for all sets of the same design, and the serial number, which is different for each individual receiver. When you order a diagram, be sure that you send in the model number, not the serial number. Serial numbers are of no help in identifying a set except in cases where the serial number includes the chassis number. If you are in doubt as to which is the model number, send in all numbers and identifying marks on the cabinet or the chassis. Then we'll be sure to have enough information to identify the set.

The Chassis Number

Some manufacturers use a chassis number, and when the same chassis is used in several models, or the same model uses different chassis, it can be of help in pinning down the exact set. This number will be stamped into the chassis or on the label with the model number. In some of the new TV sets, the chassis number is absolutely essential in identifying the set, as, for example, in the case of Emerson, Motorola, and Admiral. The Admiral Model 30F16A, for example, uses two dif-

Vernon Messick operating the Revolute Rocket reproducing machine at NRI. This machine is used mainly for the large television diagrams, and produces a finished print in about one minute.

ferent chassis, numbered 20A1 and 20B1. If you ordered a diagram for this set and just gave the model number, we could not tell whether to send you a diagram for a set using chassis 20A1 or for one using 20B1.

Tube Complement

If some of the other identifying information is missing, a list of the tubes may help us identify a radio receiver . . . but it is not of value in identifying a TV set. It's always a good idea to send in a list of the tubes when you order a radio diagram anyway, even if you have the model and chassis numbers. Then if we haven't the diagram for the exact set, we may be able to send you one of a set using similar tubes, which in all likelihood will be close enough to help service the set.

This does not apply to TV sets. After all, there's quite a difference between the average radio receiver with 5 or 6 tubes and the average TV receiver with 20 to 25. We can often look through our diagrams and find one using a similar tube complement if there are only a few to compare, but the job becomes almost impossible when there are 4 or 5 times that many. Besides, since TV diagrams are more expensive, you probably wouldn't want to buy one unless it is *exactly* what you need. Consequently, we do not send substitute information if we do not have a TV diagram, but we do send substitute information for radio diagrams if we can supply a similar diagram.

If we have all of the above information, the name of the set, the name of the manufacturer (if different from the name of the set), the chassis number (if any), the model number, and a list of the tubes (if it's a radio set), we will be able to locate a diagram for you if we have one in our files.

If we do not have the diagram you ordered and have no substitute information to send, we will write the manufacturer, and ask him to send a diagram directly to you. Most manufacturers cooperate with us in getting service information in the hands of servicemen. There are some who do not, because they restrict information to their outlets or have a policy of authorizing only certain dealers to handle their products.

In this connection, we might point out the advantages of making friends with the TV distributors in your area. Get to know them. Frequently they have up-to-date information direct from the manufacturer which they will let you have free or for a small charge. This is particularly true if you service many TV sets. If there are distributors in your locality, it will usually be cheaper in the long run for you to contact them for TV diagrams first. As we said above, we have to reproduce each page of servicing data by an expensive process. The dealer or distributor may have printed material he can let you have for a lower price than we are required to charge you to reproduce it.

Perhaps you can get a better idea of how our diagram service is operated if we trace an order through the Institute, from the time the order blank is received in the mail until the diagram is mailed back. Suppose you want a diagram of an Emerson 8X211. You would fill in the order blank as shown in Fig. 1, giving in addition to the name and model number, the chassis number and a list of the tubes. On the chassis you would find the chassis number—AX. The set uses one each of the following tubes: 6A8, 6K7, 6Q7, 25L6, 25Z6.

Your order is opened in our Mail Room and the remittance recorded. The order blank itself is then sent to the Instruction Department. There a clerk locates the diagram in our file under "Emerson," and then in numerical order under the model number. Our file copy is removed and sent to the Photostat Room where it is duplicated for you. The print is developed, dried, and returned to the clerk in a few hours. Your order blank was given a number and this same number is temporarily attached to our file copy of the diagram, so the photostat you receive will have this order number too. If you ever write us about a diagram you get from NRI, DO NOT give us this order number. It's only a temporary identification during the photostating process. Always describe a set or its diagram by name and model number. When the photostat

Blan Straughn, Supervisor of Training, and Anne Gorman discussing a student's diagram order to be sure that the student will receive the proper diagram.

is ready, the clerk attaches your order blank to the diagram, along with a couple of new order blanks, and sends it to our Out Mail Section, where it is put in an envelope and mailed to you. If your order is received in our morning mail, the diagram usually will be mailed to you the afternoon of the same day.

Remember

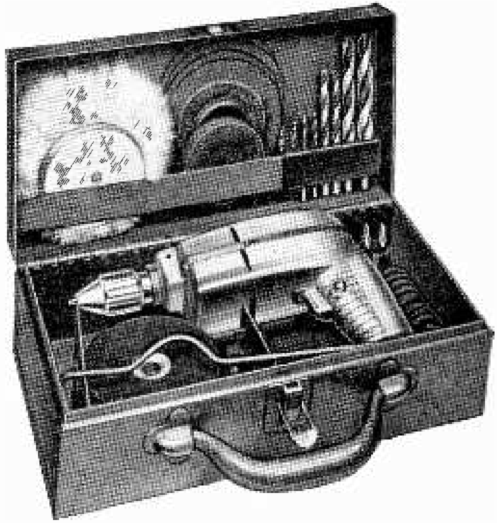
We have built up our collection of servicing information for YOUR use. If you do not already realize the time saved and the extra money earned through servicing with the help of diagrams, put it to the test the next time you have a set that involves a little circuit-tracing to locate the trouble. But remember too that we can't help you unless we know exactly what kind of set and what model it is you have. You have to do your part in *completely* identifying the set for us. Give us all of the information we ask for on the order blank, and you'll have the diagram you need if we have a copy of it in our files.

———— *n r i* ————

You can't tell; maybe the fish goes home and brags about the size of the bait he stole.

Many girls are dyeing to find out if gentlemen really prefer blondes.

Praising yourself to the skies is not going to get you there.



Are You Interested in a Portable Electric Drill Kit?

We still have on hand a limited number of Zephyr Portable Electric Drill Kits. The 23-piece Kit includes, drill, polished chrome finish, with removable auxiliary side handle and precision, hand-operated, 3-jaw drill chuck; adapter; 5" molded-rubber disc; 6" disc polishing bonnet; 2 wood bits, 3/8" and 1/2" dia. with 1/4" shanks; 3 carbon steel twist drills 1/16", 1/8", 1/4" dia.; 3 high speed steel twist drills 1/16", 1/8", 1/4" dia.; 3" buffing wheel; wire wheel brush; grinding wheel; 4 assorted abrasive discs, 5" dia.; paint mixer, horizontal bench stand for electric drill.

The regular price of this DeLuxe Drill Kit is $26.35. You can buy it direct from NRI at the low price of $22.40. If Jacobs Gear Chuck with key is desired add $2.50, total $24.90, postpaid.

National Radio Institute
16th & U Sts., N. W.
Washington 9, D. C.

Drill Kit

I enclose $....... Send me by parcel post, prepaid:

☐ Zephyr Electric Drill Kit (Price $22.40).

☐ Zephyr Electric Drill Kit, including Jacob's Gear Chuck (Price $24.90).

Name ....Student Number........

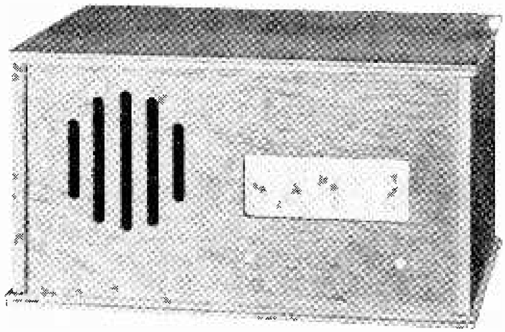
Address ....

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

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

A BEAUTIFUL CABINET FOR YOUR NRI RADIO

ONLY $4.95



OUR boys have been asking, "Where can I get a cabinet to house my NRI Radio? Mail order houses do not have the right size. So the answer was to have one designed especially for the NRI Radio Receiver students build after receiving their seventh kit in the Radio and Television Servicing course.

It took a lot of searching. We wanted one made of wood, because wood cabinets produce a more pleasing tone than metal or plastic. And there was the matter of price—we wanted to keep it down. That's not easy when quality workmanship is specified. Luckily we found a cabinet maker whose shop is out of the high rent district—whose overhead is low. He built several samples. We selected the one pictured above.

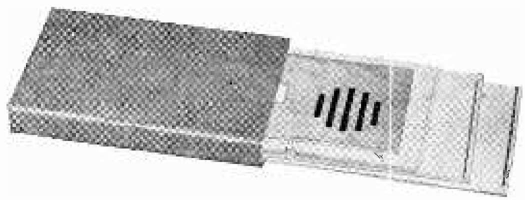
Notice the cabinet will come to you knocked down. That is to avoid possible damage in shipment. The sides, top and bottom, are rabbeted. Everything slips perfectly and securely into place. It's fun to assemble—a five minute job. No dirt, no fuss. No nails or screws. You simply apply a bit of glue into the grooves, use a little hand pressure and your cabinet is complete.

The sides, top, and bottom are made of 3/8 inch 5 ply White Gum sanded to a smooth finish. The front panel is attractive Philippine Mahogany. The grille cloth is rich green, harmonizes with the color of the dial scale. The back is open.

The cabinet is well seasoned natural wood, unpainted. You can, if you wish, give it two or three coats of clear alcohol resistant lacquer, or paint it your favorite color to match the room. Four neat rubber bumpers prevent scratching or marring furniture on which you may set your Radio.

Slipping it into the cabinet is a two minute job. You'll notice a big improvement in your Radio's tone immediately. You'll have an attractive Radio for your den, living room or bedroom.

When we started to shop for a cabinet we insisted upon getting one of this quality and at this low price. Only $4.95 delivers it to you. It's true we had to buy a large quantity to get a price that low because professional cabinet makers are not hammer and saw men—by nature, they're craftsmen, artists. Their specialty is building furniture to order. Their livelihood depends upon satisfying discriminating customers.



Mailed knocked down. Easy to assemble.

Be sure to check whether you have the NRI Radio built from parts supplied with Kit 7RK or from Kit 7E. This is important because there is a slight difference in size in the two cabinets.

To order—use the coupon below. Enclose $4.95 with order. (No C.O.D. orders, please.) We'll send your cabinet by parcel post, prepaid. When you get it, you'll agree that you made a truly grand buy. You'll be proud to show your Radio to your friends.

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

Radio Cabinet

Enclosed is $4.95. Send me, parcel post prepaid, one knocked-down cabinet for my NRI Radio.

☐ I received 7RK Kit.

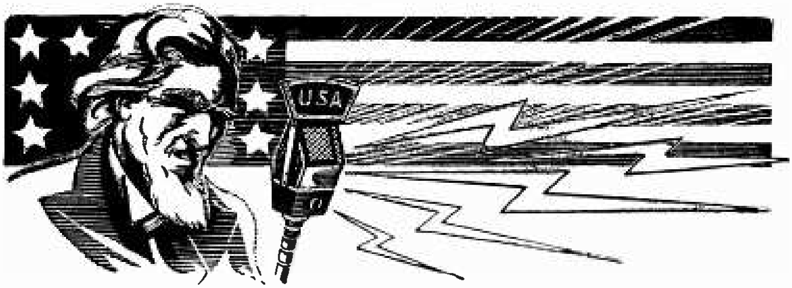
☐ I received 7E Kit.

Name ....**Student Number** ....

Address ....

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

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



THE VETERAN'S PAGE

Devoted to news items and information of special interest to veterans taking NRI courses under the GI Bill of Rights.

S-O-S

IT'S the Same Old Stuff!

For some months past you've recognized the theme of this Veterans' Page; it is "keep going somehow."

Since July 25, 1951 when most veterans lost the privilege of starting new courses, our main message has been for veterans who are *in* training and who stand to lose out if they stop. It seems unbelievable but it's true, that every month a number of GI's give us the unpleasant duty of telling the VA the names of students who have let 120 days—four whole months—slip by without doing any work on their courses. These men, for the most part, forfeit *all remaining entitlement to education* under the original GI Bill.

There's really nothing we can do when a man just doesn't study. We send monthly letters reminding him time is slipping by. We try to persuade, encourage, and cajole. As part of this effort, and at the risk of being monotonous we repeat again that every GI student should try to keep his record open somehow. If he can't do one lesson a week, he should do one every two weeks; if one in two weeks is impossible, then one a month. As a very last resort and only temporary measure, study a lesson in 2 or 3 months—but study some.

The recent announcement of allocation of TV channels making possible as many as 2,000 new television stations only emphasizes the importance of "hanging on to that course" until working conditions or other circumstances improve enough for you to study regularly. The students who finish Communications in the next year or two will be ready at just the time these new stations are looking for technicians; the students who finish Servicing in that time will be ready to make conversions to UHF or to install new sets, and to handle servicing in areas which are now fringe areas or which now receive no satisfactory signals.

This is indeed the time in television when the men in the younger generation are making momentous decisions. A few of the new stations will be in operation this summer; many by mid-1953—and after that the lid will be off, many experts think. This means (so far as the industry is concerned) that every student has probably a year to become a graduate and get in at the time of greatest demand. Even two years from now would not be too late to qualify.

But those men who sleep evenings now, or visit the club, or who take pleasant drives instead of studying will wake up in 1952 or 1953 with the realization that they missed the boat.

A beginner in any field can get ahead faster at times of great expansion than he would in normal times. The requests for *experience* will be fewer. The chances to get started greater—the chance to get a foothold in TV as it develops in your community will be *denied* the man who fails to prepare now.

Three or more years from now some readers of this article will be established for life; others will have "put off" and "delayed" and will not be prepared any more than they are today to take any of the vacancies advertised in every large city Sunday help-wanted section. Those who stop now will know then the meaning of the words of remorse:

> "Of all sad words of tongue or pen,
> The saddest are these—
> 'It might have been!'"

Television Interference On DuMont Telesets

By CARL QUIRK

Reprinted from the DuMont Service News, a monthly publication of Allen B. DuMont Laboratories, Inc.

The Editor of NATIONAL RADIO-TV NEWS *is indebted to Allen B. DuMont Laboratories, Inc., for permission to reprint the following article. It was written to cover DuMont Telesets, but the information can be applied to other television receivers as well.*

DUMONT Telesets are designed to be as free from the effects of interference as it is possible to make them. Despite all of the precautions taken, conditions occasionally arise when interference may become a problem. Such conditions are beyond the control of the designer and it is up to the service technician to find the remedy.

In most cases in which interference occurs a remedy can be found. The purpose of this article is to discuss the various types of television interference and to illustrate the techniques required to remedy them.

Determining the cause of the interference is probably the most difficult part of the job. Familiarity with the various types of interference and a certain amount of patience are required. Once the cause has been determined, the application of the proper remedy becomes a routine matter.

FM Interference

While the term FM interference is generally applied to all types of interference emanating from frequency-modulated sources, it is used here to refer to interference of the following specific types.

a. Interference from standard FM broadcast stations.
b. Interference from more than one source, when one of the sources is an FM station.
c. Harmonics of the sound i-f, which feed back into the front end, to produce beats with the video carrier.

Fig. 1 illustrates the effects on the picture of interference from an FM broadcasting station. This type of interference occurs when an FM signal beats with the video carrier of the TV signal to which the Teleset is tuned. The herringbone pattern which appears in the picture varies with the modulation of the FM station. If the FM station is tuned in on an FM receiver, at the same time that the interference in the picture is being observed, a definite relation between changes in the FM sound and the interference will be noticed.

There are a number of ways in which an FM broadcast station can interfere with television reception. One of the most common forms of FM interference occurs because a portion of the FM broadcast band is at the image frequency of channel 2.

Because of the high image-rejection ratio of all four-circuit DuMont Inputuners, interference of this type is not likely to occur with current Teleset models unless the Teleset is located very close to an FM station. Image interference is more likely to occur in receivers which were manufactured prior to the use of the four-circuit Inputuner. In these earlier sets, the video i-f is 26.4 mc. Since the local oscillator frequency is equal to the frequency of the incoming signal

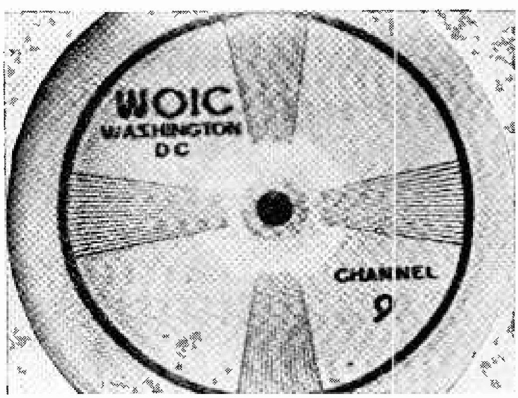


Figure 1. Frequency Modulation Interference.

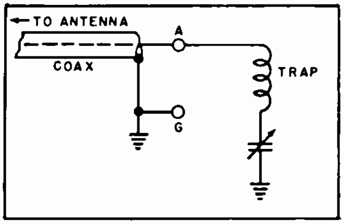


Figure 2. Series Tuned F-M Trap.

(video carrier), plus the video i-f, the oscillator frequency in these receivers, when tuned to channel 2, is 81.65 mc (55.25 + 26.4 mc).

The local oscillator signal beats with all other signals which reach the mixer. The band of frequencies allocated to FM broadcasting stations extends from 88 to 108 mc. If a strong FM broadcast signal reaches the mixer, it will beat with the local oscillator signal to produce a third signal whose frequency will be equal to the frequency of the FM signal, minus the local oscillator frequency. If the frequency of the FM stations is between 103.65 and 108 mc and the television receiver is tuned to channel 2, the beat signal produced will fall within the i-f passband, somewhere between 22 and 26.4 mc. This signal will be passed through the video i-f stages and appear in the picture. The intensity of the interference will depend upon the relative amplitudes of the interfering signal and the television signal. The frequencies involved are shown below:

Channel: 2
Frequency Range: 54-60 mc
Video Carrier: 55.25 mc
Local Osc.: 81.65 mc
Image Frequency: 103.65-108 mc

Other television channels are not affected by FM broadcasting stations in the manner described above, because their image frequencies fall outside of the FM broadcast band.

Harmonic Interference

Another type of FM interference is produced when the rf and mixer stages of the television receiver are overloaded by a strong FM broadcast signal. The overloading occurs at the fundamental frequency of the FM station, and results in the generation of harmonics of the FM signal in the mixer and rf stages of the receiver. Since the FM signal must be quite strong to produce harmonic interference, this condition will usually be encountered in areas close to FM transmitters.

Of the harmonics generated, the second is the one which causes the difficulty, because it usually falls within one of the high television channels. The second harmonics of FM broadcast stations fall between 176 mc and 216 mc. This range includes all of the high channels and consequently, any one of the high channels may be affected.

FM interference can also be caused by two interfering signals which enter the receiver and produce a beat in the rf or mixer stages, which enters the video i-f's along with the video signal of the channel to which the receiver is tuned, and creates an interference pattern similar to that shown in Fig. 1.

A typical case of interference of this type would occur if a strong FM signal at 94.5 mc were present at the input of the receiver. If a strong signal is received on channel 4, its 71.75 mc sound carrier might beat with the FM signal to produce a heterodyne at 22.75 mc. Since the 22.75 mc heterodyne falls within the video i-f passband, interference would result. This condition actually occurred in Dallas, Texas, where channels 4, 5, and 8 are in operation.

In the location at which the interference occurred, the signal on channel 5 was relatively weak, while channel 4 was very strong. An FM station operating at a frequency of 94.5 mc was located not far from the television receiver. The interference was observed on channel 5 only.

Investigation proved that the sound carrier of channel 4 (71.75 mc) and the FM broadcast signal (94.5 mc) were entering the front end of the receiver. These signals were producing a beat at 22.75 mc which was causing an interference pattern in the picture. Since channels 4 and 8 were quite strong there was no interference when tuned to these channels, although the interfering signal was undoubtedly present.

In another case of interference caused by two stations a signal falling within the rf passband was produced. The television receiver was located very close to an FM station operating at 99.5 mc. The signal received on channel 5 was very strong. When the Teleset was tuned to channel 7, an FM interference beat appeared in the picture; in addition the signal from channel 5 was observed swinging back and forth in a manner sometimes referred to as the windshield wiper effect. In this case the interference was produced by the 99.5 mc FM signal and the 77.25 mc video carrier of channel 5. These signals produced a beat equal to their sum or 176.75 mc. This beat falls within channel 7 and it was strong enough to produce interference.

Since the FM station was operating at a frequency of 99.5 mc, the possibility that it was combining with the 77.25 mc carrier of channel 5 to produce a beat at 22.25 was considered. It was possible to determine that the interference was being caused by the 176.75 mc signal by observ-

TABLE 1

Part No.	Description	Used on Teleset Models
21005881	Straight Bracket Type	RA-103C RA-103D RA-104A RA-110A
21005891	"L" Bracket Type	RA-105A RA-105B RA-106 RA-108A

ing the picture. Observation indicated that the beat was located approximately 1.5 mc from the video i-f or rf carrier.

The video carrier frequency of channel 7 is 175.25. When it is combined with a signal at 176.75 mc a 1.5 mc beat is produced. The video i-f carrier of the receiver in question, was 26.4 mc. When the video i-f signal is combined with a signal at 22.25 mc, a 4.15 mc beat is produced. Obviously then, the 176.75 mc signal was causing the interference.

In the above case, an FM interference pattern was also produced on channel 11. This pattern was found to be the result of the generation of the second harmonic of the 99.5 mc FM signal. This harmonic was produced in the front end of the receiver by overloading, as described earlier in this article. The insertion of a 99.5 mc trap in the antenna of the receiver eliminated all of the interference encountered.

FM Broadcast Traps

When interference of any of the types so far described is encountered, it can be eliminated by preventing the FM signal, which is causing the interference, from entering the Teleset. This may be accomplished by inserting a tuned stub or lumped constant trap in the antenna lead of the receiver. Lumped constant traps are compact and effective. Several of them are available through your DuMont distributor. One of the simplest traps consists of an inductance and a capacitance in series as shown in Fig. 2. The trap is connected between the ungrounded antenna lead and ground, and tuned to the frequency of the interfering signal. The part numbers of the series traps available from your DuMont Distributor are shown in Table 1. Also shown are the Teleset models with which each trap should be used. Complete instructions for the installation of the traps are included with the parts.

Another type of trap which may be used to eliminate FM interference consists of a parallel resonant circuit connected in series with the transmission line. It may be used with 72-ohm coax or 300-ohm twin-lead. When used with twin-lead two traps are necessary, one for each side of the line. The methods for connecting parallel resonant traps when using 72-ohm coax and 300-ohm twin-lead are shown in Fig. 3.

Each of the resonant circuits in Fig. 3 is made up of an air core coil, consisting of 10 turns of #14 enameled copper wire, close wound, with an inside diameter of one-half inch and a 1 to 1.5 mmf variable capacitor. After a trap has been installed it should be tuned to minimize the interference.

Band Elimination Filters

The insertion of a trap in the antenna lead of a Teleset will cause some attenuation of the desired television signals. In weak signal areas such attenuation must be minimized. The insertion loss of a properly designed "M" derived filter is less than that of a series or parallel resonant trap and, when possible, such a filter should be used.

The circuit and method of installation of an "M" derived filter is illustrated in Fig. 4. When properly adjusted this filter will give adequate attenuation of the entire FM broadcast band, with minimum attenuation of the desired tele-

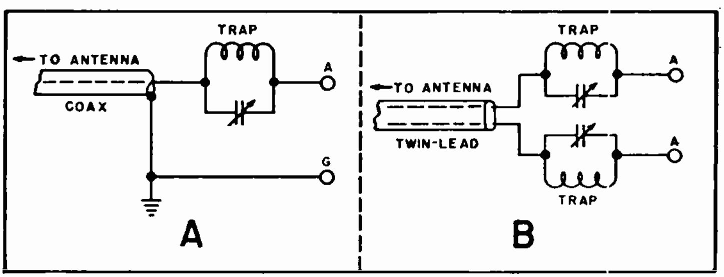


Figure 3. Parallel Tuned F-M Traps. (A) 72 OHM Unbalanced Line. (B) 300 OHM Balanced Line.

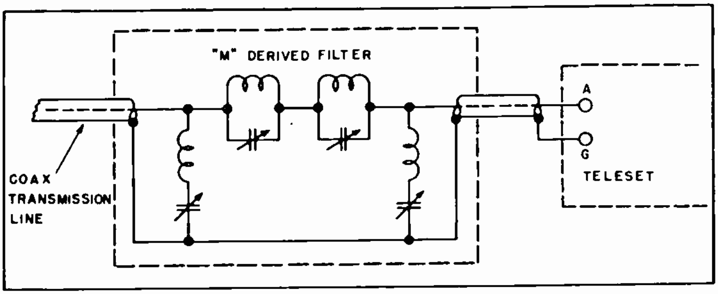


Figure 4. M Derived Band Elimination Filter.

RA-109A — Serial number 09115725
RA-112A — Serial number 12702
RA-113—Serial number 13580

If a beat pattern similar to that shown in Fig. 5 is encountered on channel 7, in a Teleset whose serial number is lower than those shown above, the interference can be eliminated by realigning the sound i-f's to 21.75 mc.

vision signals, usually giving good results.

A band-elimination filter of the type shown in Fig. 4 is available from your DuMont Distributor. The filter comes enclosed in a case for convenient mounting on the back panel of the Teleset. It is equipped with a female input connector and a 72-ohm coax output lead with male connector. The part number of the filter is 88 000 301.

Sound I-F Harmonics

FM interference can also be produced in the television receiver itself. All DuMont Telesets employ a separate sound i-f channel, which incorporates a discriminator for sound detection. The discriminator is a non-linear device; consequently it generates harmonics of the sound i-f signal. If these harmonics are strong enough they can feed back into the front end of the receiver, beat with the video carrier of the channel in which they fall, and produce an interference pattern in the picture. This pattern may be similar to that shown in Fig. 1 or like that shown in Fig. 5. The exact appearance of the pattern is determined by the difference in frequency between the harmonic and the video carrier.

If the ninth harmonic (195.75 mc) of the sound i-f signal of a receiver using a 21.75 mc sound i-f frequency, feeds back into the front end of the receiver when it is tuned to channel 10 (193.25 mc), a 2.5 mc beat will be observed in the picture. The appearance of the pattern will be similar to that shown in Fig. 1.

If the eighth harmonic (175.2) of the sound i-f of a receiver, having a 21.9 mc i-f, feeds back into the front end, and the receiver is tuned to channel 7 (175.25), a 50 kc beat will be produced. Since the frequency of the beat is quite low, a pattern similar to that shown in Fig. 5 will be produced.

Both of the sound intermediate frequencies mentioned above are used in post-war DuMont Telesets. In the earlier sets the sound i-f was 21.9 mc. It was changed to 21.75 mc to eliminate the possibility of interference on channel 7 as previously mentioned. This change took place starting with the following chassis serial numbers:

Table 2 shows the harmonics of the 21.75 and 21.9 mc i-f's, which fall within television channels. Note that only three harmonics of the 21.75 fc i-f fall within television channels, while four of the harmonics of the 21.9 mc fall within television channels. Actually the only sound i-f harmonic interference which has been encountered with the 21.9 mc i-f has been on channel 7. With the 21.75 mc sound i-f, the channel 7 beat is eliminated although a beat is sometimes encountered on channel 10. The other possible beats shown in Table 2 have not been encountered.


Figure 5. F-M Interference, Frequency of Beat Approximately 50 KC.

When beat interference is encountered, one of the sound i-f tubes, or the discriminator tube, should be removed. If removal of a tube eliminates the beat, the interference is probably of the sound i-f harmonic type just described. If the beat is not eliminated by the removal of a tube, the source of the interference is probably external to the receiver.

Unmodulated RF Interference

Fig. 6 illustrates the type of interference pattern which is produced by an unmodulated rf signal. When an unmodulated rf signal, which falls within the television channel to which the receiver

TABLE 2

Channels		21.9 mc Harmonics			
	Freq.	3	4	8	9
3	60- 66 mc	65.7 mc			
6	82- 88 mc		87.6 mc		
7	174-180 mc			175.2 mc	
10	192-198 mc				197.1

Channels		21.75 mc Harmonics		
		3	4	9
3	60- 66 mc	65.25 mc		
6	82- 88 mc		87.00 mc	
10	192-198 mc			195.75 mc

is tuned, enters the receiver, it beats with the video carrier and causes a pattern similar to that shown in Fig. 6. Some of the sources of this type of interference are as follows:

1. Local oscillator radiation from another TV receiver
2. Local oscillator radiation from an FM receiver
3. A harmonic of the video i-f of the Teleset itself
4. An unmodulated signal at the image frequency of the video i-f
5. Any unmodulated rf signal whose frequency lies within the passband of the Inputuner

Of the above causes of interference, local oscillator radiation from another television receiver is the most common. In severe cases it can result in complete loss of reception of one or more channels. Unfortunately the interference cannot always be eliminated. When local oscillator radiation is encountered, the receiver which is affected, its antenna and its transmission line, should be relocated as far as possible from the installation which is causing the interference.

If the interference occurs in a strong signal area, and is originating from just one receiver, some improvement can usually be obtained by inserting an attenuator at the input of the offending receiver. To locate the offending receiver turn on the receiver which is suffering from the interference and tune it to the channel which is affected. Then turn on each of the suspected receivers, one at a time, tuning them to each channel in use and observing the picture on the receiver suffering from the interference. When the offending receiver has been found the technician should proceed to relocate the components of the installation which is affected by the interference. Don't attempt to check a receiver for local oscillator radiation by removing its antenna. In many cases there is sufficient radiation from the chassis itself to cause interference.

The local oscillator frequencies of a receiver having a video i-f of 25.75 mc are shown in Table 3. The local oscillator frequencies which fall within television channels are indicated. A table like that shown may be made up for the channels

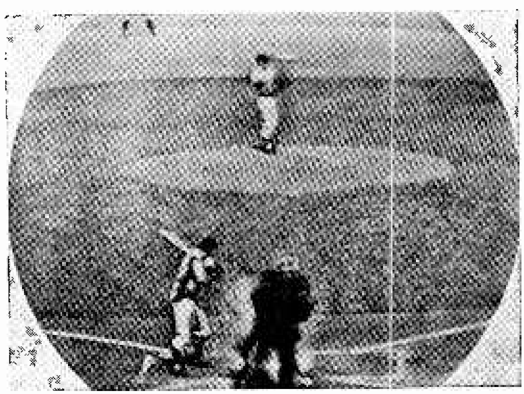


Figure 6.—Interference Produced by Amplitude Modulated or Unmodulated r-f Signal.

TABLE 3

Assuming a Video IF of 25.75 mc

Channel	Video Carrier	Loc. Oscillator	Interferes With		
2	55.25 mc	81 mc	Chan.	5	76- 82 mc
3	61.25 mc	87 mc	"	6	82- 88 mc
7	175.25 mc	201 mc	"	11	198-204 mc
8	181.25 mc	207 mc	"	12	204-210 mc
9	187.25 mc	213 mc	"	13	210-216 mc

in use in a particular area and for each of the popular video i-f's. Such a chart will be helpful in identifying the source of interference. In Table 3 the local oscillator operates above the video carrier, as it does in all DuMont Telesets. In some receivers the oscillator may operate at a frequency below the video carrier. In others the oscillator is operated above the video carrier on the low channels and below the video carrier on the high channels.

Local oscillator radiation from FM receivers often causes interference with television reception. The effect on the picture is similar to that shown in Fig. 6. The i-f of most FM receivers is 10.7 mc. The oscillator frequency is usually below that of the FM signal being received. The local oscillator thus operates at a frequency equal to that of the FM signal minus 10.7 mc.

Since the FM broadcast band extends from 88 mc to 108 mc the local oscillator, in an FM receiver with a 10.7 mc i-f, operates in the range between 77.3 mc and 97.3 mc. These frequencies cover most of channels 5 and 6. When interference is encountered on these channels the possibility of FM receiver local oscillator radiation should be considered.

Remedies for FM receiver local-oscillator radiation are generally the same as those for television receiver local-oscillator radiation. In addition to the remedies previously mentioned in connection with TV receivers, a trap may be inserted in the antenna lead of the offending FM receiver. This procedure is not always effective because the interference may be entering the power line.

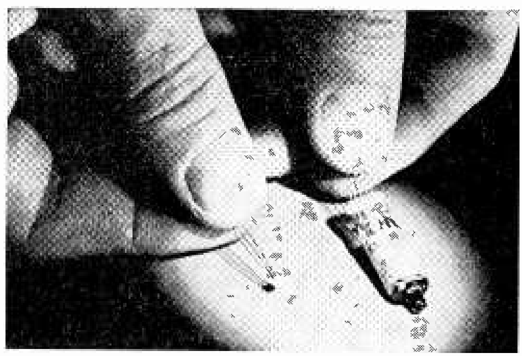
A third source of unmodulated interference is the video detector of the receiver itself. Since the video detector is a non-linear device it generates harmonics of the video i-f carrier. These harmonics can feed back into the front end of the receiver and beat with the video carrier, to produce interference.

This type of interference has occurred in DuMont receivers on channel 5. The third harmonic (79.2 mc) of the video i-f (26.4 mc) produced a 1.95 mc beat with the carrier of channel 5. In receivers using a 26.25 mc video i-f, its third harmonic (78.75 mc) has occasionally produced a 1.5 mc beat on channel 5.

Such a beat has also been encountered on channel 8, as a result of the 7th harmonic (183.75 mc) of the 26.25 mc video i-f. Since the video carrier of channel 8 is 181.25 mc the frequency of the beat is 2.5 mc.

If interference from an unmodulated i-f source is encountered it is possible to determine whether the interfering signal is being generated in the receiver or outside of it, by tuning the Teleset around the correct point and observing the beat pattern. If varying the tuning causes the pattern to change, the interference is probably an i-f harmonic. If little change in the pattern occurs, the source of the interference is probably external.

n r i



Smallest type of electronic tube, a subminiature, right, seems large in comparison to tiny diffused junction transistor. General Electric germanium scientists say that there seems to be no fundamental size limit for transistors. How much smaller they can be made depends largely on assembly techniques.

N.R.I. ALUMNI NEWS

Nominations For 1953

THIS is indeed election time. Not only do we choose a President of the United States, but we have the nice little responsibility of electing a President of our NRI Alumni Association to serve during 1953. Along with our Alumni President, we will also elect four Vice-Presidents.

This is always a pleasant contest. First, we choose our candidates. This is done by nominating the two men who receive the highest total of votes in the primary. It is the primary in which you are now asked to vote. The two candidates, having received the highest total of votes, will thus be declared nominees, and will then run against each other. The one who ultimately receives the most votes will be certified as the new President to take office the first day of 1953. The contest for Vice-Presidents is conducted in the same manner except that the eight members who get the most votes for Vice-Presidents in the primary are declared nominees. We then have a run-off to elect four of the eight.

Our first move then is to hold our primary election to select our candidates. It is earnestly requested that every member of the NRI Alumni Association cast his vote. A convenient ballot will be found on Page 29.

It has been suggested that some members do not vote in our annual elections because they do not wish to disfigure their copy of NATIONAL RADIO-TV NEWS by cutting out the ballot. The ballot is purposely placed on a page where the reading matter is of no permanent value and therefore can be cut out without sacrificing anything of importance. However, if you prefer to send a postcard ballot, it will be acceptable. Simply say "My candidate for President of the NRI Alumni Association is (name one) and my candidates for Vice-Presidents are (name four), and sign the ballot, give your address and student number. Please remember—only graduates who are members of the NRI Alumni Association are eligible to vote in this election.

For the benefit of those who may not be entirely familiar with the Constitution of the NRI Alumni Association, it is always well to give that portion pertaining to the election of officers. The following is taken from Article VI of the NRI AA Constitution and By-Laws:

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

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

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

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

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

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

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

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

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

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

11. The nominee receiving the greater number of votes for the office for which nominted shall be declared by the Executive Secretary to be elected to that office, and notice of such election shall be forwarded in sufficient time, prior to January one, to permit such elected officer to enter upon the duties of said office on that date.

The rules regarding our elections are simple but of course they must be followed. It is important to emphasize that the polls for nominations will close August 25, 1952. That will give us, at Headquarters, five days to count the votes and announce the nominees in the October-November issue of NATIONAL RADIO-TV NEWS which goes to the printer on September 1. Balloting on the nominees will then take place and the successful candidates will be announced in the December-January issue of NATIONAL RADIO-TV NEWS, in time for them to take office on January 1, 1953.

Last year, you may remember, we had a very interesting contest between Alexander M. Remer of New York and Norman Kraft of Perkasie, Pennsylvania. Remer was elected in a very close contest. He has made an excellent President. Norman Kraft probably is the foremost candidate for President during 1953. He is a member of Philadelphia-Camden Chapter, has served that local as Chairman and has also been a Vice-President of our national organization. He hardly ever misses a meeting in Philadelphia although it is necessary for him to drive approximately seventy miles round trip from his home to the meeting place in Philadelphia. Considering that Philadelphia-Camden Chapter meets twice a month and that Norman Kraft makes this trip in all weather, summer and winter, this in itself speaks well for his great interest.

In an effort to be helpful, we have selected the names of a few members from various parts of the country, as an aid to you in choosing your nominees. Please be sure to vote. Remember you are to select one candidate for President and four candidates for Vice-Presidents. Sign your ballot, give your address, and mail it promptly to Mr. L. L. Menne, National Radio Institute Alumni Association, 16th and U Sts., N.W., Washington 9, D. C. Mr. Menne has appointed Mr. Charles Alexander, NRI Bookkeeper, to act as teller. The results of the primary will be announced in the next issue of NATIONAL RADIO-TV NEWS.

Nomination Suggestions

H. E. Nichols, Bisbee, Ariz.
Gorden E. DeRamus, Selma, Ala.
Don Smelley, Cottondale, Ala.
Edgar E. Joiner, El Dorado, Ark.
A. R. Waller, Keo, Ark.
Oliver B. Hill, Burbank, Calif.
Jos. E. Stocker, Los Angeles, Calif.
Herbert Garvin, Los Angeles, Calif.
P. A. Abelt, Denver, Colo.
Chas. Bost, Leadville, Colo.
Albrecht Kroener, Stamford, Conn.
Geo. W. Neely, E. Woodstock, Conn.
Joseph Snyder, Danbury, Conn.
Eric Woodin, Naugatuck, Conn.
Wm. F. Speakman, Wilmington, Del.
Jos. Certesio, So. Wilmington, Del.
Max Yacker, Washington, D. C.
Wm. G. Spathelf, Washington, D. C.
Glen G. Garrett, Bonifay, Fla.
Henry C. Hasse, St. Petersburg, Fla.
Stephen J. Petruff, Miami, Fla.
W. P. Collins, Pensacola, Fla.
Odell Puckett, Rocky Face, Ga.
R. R. Wallace, Ben Hill, Ga.
Joseph Bingham, Twin Falls, Idaho
Arvil H. King, Montpelier, Idaho
Erwin Andrews, Batavia, Ill.
Robert Reid, Evanston, Ill.
Fred J. Haskell, Waukegan, Ill.
Jerry C. Miller, Skokie, Ill.
Herbert Lausar, Chicago, Ill.
John Janesick, Chicago, Ill.
Harold Bailey, Peoria, Ill.
Dick Michael, Hartford City, Ind.
Chase E. Brown, Indianapolis, Ind.
Russell Tomlinson, Marion, Ind.
H. E. McCosh, Charles City, Iowa
E. C. Hirschler, Clarinda, Iowa
C. Hopkins, Hutchinson, Kans.
Wm. B. Martin, Kansas City, Kans.
K. M. King, Wichita, Kans.
Wm. Griese, Bellevue, Ky.
R. B. Robinson, Louisville, Ky.
L. H. Ober, Alexander, La.
Lawrence Merz, New Orleans, La.
Walter Dinsmore, Machias, Maine.
Harold Davis, Auburn, Maine
Ralph E. Locke, Calais, Maine.
Emil M. Stetka, Baltimore, Md.
J. B. Gough, Baltimore, Md.
John Kelley, Riverdale, Md.
G. O. Spicer, Hyattsville, Md.
Manuel Enos, Fall River, Mass.
Louis Crestin, Boston, Mass.
A. Singleton, Chicopee, Mass.
Omer Lapointe, Salem, Mass.
Robert Swanbum, Duluth, Minn.
Arthur J. Haugen, Harmony, Minn.
Ray Williams, Minneapolis, Minn.
F. Earl Oliver, Detroit, Mich.
Chas. H. Mills, Detroit, Mich.
Harry R. Stephens, Detroit, Mich.
Floyd Buehler, Detroit, Mich.

Walter Jenkins, Biloxi, Miss.
Robert Harrison, West Point, Miss.
C. S. Burkhart, Kansas City, Mo.
A. Campbell, St. Louis, Mo.
C. W. Wichmann, Inverness, Mont.
Earl Russell, Great Falls, Mont.
V. S. Capes, Fairmont, Nebr.
Albert C. Christensen, Sidney, Nebr.
C. D. Parker, Lovelock, Nev.
L. R. Carey, Elko, Nev.
Clarence N. George, Dover, N. H.
Geo. Stylianos, Nashau, N. H.
J. A. Stegmaier, Arlington, N. J.
Delbert Delanoy, Weehawken, N. J.
Claude W. Longstreet, Westfield, N. J.
Enrique Baros, Santa Rosa, N. Mex.
Solomon Cruz, Raton, N. Mex.
Denver Stevens, Castle Pt., N. Y.
Alfred R. Guiles, Corinth, N. Y.
Paul W. Mueller, New York, N. Y.
L. J. Kunert, Massapequa, N. Y.
Charles W. Dussing, Syracuse, N. Y.
Henry R. Zeman, Charlotte, N. C.
Irvin Gardner, Saratoga, N. C.
Max J. Silvers, Raleigh, N. C.
Arvid Bye, Spring Brook, N. Dak.
Jacob J. Knaak, Cleveland, Ohio
H. F. Leeper, Canton, Ohio
Chas. H. Shipman, E. Cleveland, Ohio
Byron Kiser, Fremont, Ohio
Robert Bond, Okla. City, Okla.
Emil Domas, Ritter, Oreg.
Folia T. Hall, Portland, Oreg.
Norman Kraft, Perkasie, Pa.
Harvey Morris, Philadelphia, Pa.
Elmer E. Hartzell, Allentown, Pa.
Chas. J. Fehn, Philadelphia, Pa.
Neil F. Ross, Cranston, R. I.
James F. Barton, Greer, S. C.
Joel J. Lawson, Aberdeen, S. Dak.
John Wenzel, Gettysburg, S. Dak.
Newell M. Comer, Tullahoma, Tenn.
Matthew Duckett, Memphis, Tenn.
Oscar C. Hill, Houston, Texas
Dan Droemer, Ft. Ringgold, Texas
N. G. Porter, Cedar City, Utah
Clyde Kiebach, Arlington, Va.
Wm. L. Cline, Daphne, Va.
Floyd Goode, Richmond, Va.
B. C. Bryant, Alburg, Vt.
C. R. Thompson, Vancouver, Wash.
Alfred Stanley, Spokane, Wash.
G. Blomberg, Aberdeen, Wash.
Edgar Maynard, Red Jacket, W. Va.
Wm. Wiesmann, Fort Atkinson, Wisc.
J. C. Duncan, Duncan, Wyo.
Robert Kirkham, Calgary, Alta., Canada
M. Martin, New Westminster, B. C., Canada
E. D. Smith, Winnipeg, Man., Canada
H. V. Baxter, St. John, N. B., Canada
W. F. Arseneualt, Dalhousie, N. B., Canada
Donald Swan, Springhill, N. S., Canada
J. A. Hehir, Smiths Falls, Ont., Canada
G. Favreau, Montreal, P. Q., Canada
Thos. Crooke, Saskatoon, Sask., Canada

Nomination Ballot

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

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1953.

(Polls close August 25, 1952)

MY CHOICE FOR PRESIDENT IS

....

City.......................... State.........

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. ....

City.......................... State.........

2. ....

City.......................... State.........

3. ....

City.......................... State.........

4. ....

City.......................... State.........

Your Signature ....

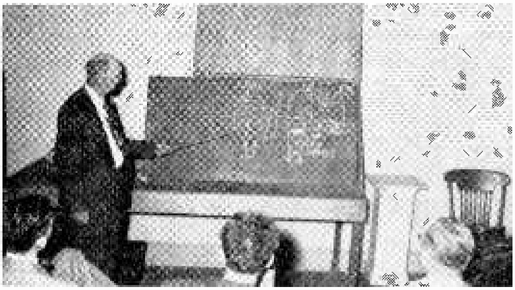
Address ....

City.......................... State.........

Student Number ....

Chapter Chatter

Baltimore Chapter. Our semi-monthly meetings feature a general servicing forum in which all Chapter members participate. Special features recently included a lecture by Elmer Shue on The Use of Schematic Diagrams in Tracing Circuits. H. J. Rathbun conducted a question and answer session using an actual receiver chassis.



H. J. Rathbun is here making a talk at a meeting of Baltimore Chapter.

We welcome our newest member, Mr. E. S. Hazlegrove. NRI students and graduates in our area may obtain information on meetings by writing to our Secretary, Mr. Thomas P. Kelley, 1414 Mt. Royal Avenue, Baltimore 17, Maryland. Meeting nights are the second and fourth Tuesday of the month in Redman's Hall, 745 West Baltimore Street, Baltimore, Maryland.

Philadelphia-Camden Chapter. Our Chapter is drawing new members in like a magnet. We may have a new record, because one of our newest members, Michael Scholtz, travels all the way from Atlantic City, New Jersey, a distance of sixty miles to attend meetings. Other new members from out of town are Kenneth J. Smith, Merchantville, New Jersey; Clyde Wilbur, of Mt. Ephraim, New Jersey; and Denis Blanchon from Pemberton, New Jersey. New local members include Clinton Travis, Robert Walters, and Earl Lovering. We are glad to welcome these members.

Norman Kraft of Phila-Camden Chapter checking a TV receiver with the NRI Scope.

Officers of Phila-Camden Chapter. Standing (left to right) Laverne Kulp, Chairman; Charles Fehn, Treasurer; Ray Stout, Sergeant-at-Arms; Al Lemper, Financial Secretary; Ray Weidner, Librarian; Jules Cohen, Secretary, and Fred Seganti, Vice Chairman.

On Service Meeting nights we have two separate benches set up, one for Television and the other for Radio. This is a new scheme which we hope will enable more of our members to get first hand experience under expert guidance.

We had an outstanding talk from Mr. Carl Hoffner, Electronic Engineer at the Frankford Arsenal. His subject was "Vacuum Tubes and Transistors." Another guest speaker was Mr. Bernie Bycer, Service Manager of the Perfect Television Company of Philadelphia. Mr. Bycer spoke on TV Tuner Trouble Shooting. He also discussed some of the problems connected with UHF and VHF Television, including the use of converters for UHF.

Our meetings have been suspended during the months of July and August. We will resume meetings in September, meeting on the second and fourth Monday of the month, at the K. of C. Hall, Tulip and Tyson Sts., Philadelphia, Penna. Anyone wishing any information about Philadelphia-Camden Chapter can contact the Secretary, Jules Cohen, at 7124 Souder Street, or phone Fidelity 2-8094.

New York Chapter. We gave special recognition at a recent meeting to three of our members who have served our Chapter continuously as officers for the past ten years. These honored members were Bert Wappler, Lou Kunert, and Frank Zimmer. Special guests at this meeting were J. Morrison Smith and L. L. Menne, from our National

Headquarters. Mr. Smith and Mr. Menne both made very inspiring remarks. Alex Remer, President of the NRI Alumni Association, Frank Zimmer, Lou Kunert, and Bert Wappler also spoke at this meeting. A great meeting.

At another meeting, Frank Zimmer presented a pair of wire strippers to each of the three members who attended the most meetings during the past year. Winners of this contest were Frank Catalano—seventeen meetings; Sidney Fried—sixteen meetings; and Harry Gerdts—sixteen meetings. There were fifty-eight members present to congratulate the winners.

Meyer Ferdinand, one of our new members, delivered his first lecture on the NRI Electronic Multitester. He did a fine job. Frank Manz told us of a few of his experiences in Radio and TV servicing. Peter Guzy spoke on Synchronized Vibrators. Thomas Hull, Jr., in his regular feature "Radio Clinic" spoke on the Oscilloscope as a training aid. Cres Gomez discussed Radio servicing experiences. These are just a few of the fine talks which our members have given recently. Two new members are Jerome Galiley and Edward Regan.

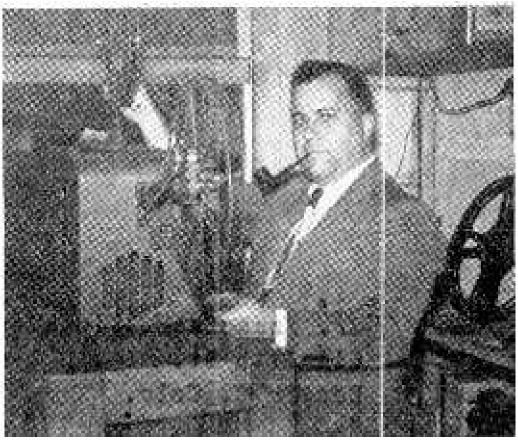
New York Chapter is suspending meetings during the months of July and August. Our next regular meeting will be Thursday, September 18. Meetings will then continue to be held on the first and third Thursday of each month at St. Marks Community Center, 12 St. Marks place, between Second and Third Avenues, New York City.

Detroit Chapter. We held our usual annual social dinner party on June 25. The surroundings of the delightfully cool, air-conditioned Grand Cafe, at 6366 Gratio, were very agreeable as the temperature on this particular day reached 100. Mr. L. L. Menne, Executive Secretary from Washington, D. C., was a guest at this dinner.

The door prize for men was won by Max Ludtke, and who do you suppose won the ladies door prize—none other than Helen Ludtke. Our thanks to Chairman Alex Nikora, Secretary Ken Kacel, and Vice President F. Earl Oliver, for splendid arrangements.

Programs at regular meetings have included Civil Defense films on Radio communications, a discussion of Television service organizations in the Detroit area, and an excellent talk by Bill Jameison on Alignment of Television Receivers. Mr. Jameison is a member of the RCA Mobile Television Service Unit.

Meetings will not be held during the months of July and August, but will be resumed in September. Notices will be sent to regular members. Prospective members may contact our Secretary, Mr. Kenneth L. Kacel, 5700 St. Clair, Detroit 13, Mich. Meetings are held on the Second and



Floyd Buehler preparing to show a film at a Detroit Chapter meeting.

Fourth Friday of the month at Electronics Institute, 21 Henry Street, Detroit.

Detroit Chapter members gather for a movie in the little theater of Electronics Institute.

Chicago Chapter. Under the leadership of our able Chairman, Charles Mead, and other very capable officers, good programs are ahead for Chicago Chapter. We are continuing meetings through the Summer months at the unanimous request of our membership. New members we are pleased to welcome include Louis C. Skipper, Ernest Hamilton, Joseph Smyk, and John Kromka.

All members appreciated a recent lecture by Member John Hartman on the use of the Vacuum Tube Voltmeter and its accessories. Frank Yurek delivered a very well planned demonstration on the practical use of a Signal Generator. Other members have planned talks for future meetings which will benefit all members.

We invite NRI men in our area to meet with us on the second and fourth Wednesday of each month, thirty-third floor, Tower space, American Furniture Mart Building, 666 Lake Shore Drive, Chicago. Use West Entrance.

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

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Mr. Francis H. Fingado 25236 4
611 17th St.
Denver 2, Colo.

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

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