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J. E. Smith

TRY IT!

One of the most extraordinary things about kindness is—the more of it you spend, the richer you become.

An old French proverb that goes, "To speak kindly does not hurt the tongue," is just another way of saying a man can lose nothing by kind words and often gains much. Everyone craves and is constantly on the lookout for words of sincere encouragement and approval from the other fellow. Too often, all they get is flattery.

Stop whatever you're doing occasionally and do a little quiet thinking about the people around you. Make an effort to understand them better. Then, take a few moments to speak words that may lift their spirit—boost their self-respect.

Try it! You'll never guess what a few well chosen words may do for them—and for you!

J. E. Smith
Founder

TEST EQUIPMENT FOR COLOR TV SERVICING

By JOE SCHEK, *NRI Consultant*

When a service technician decides to start servicing color television receivers, he must know what kind of test equipment is necessary, how far he can go with whatever black-and-white test equipment he already has, and whether the test equipment he already has can be modified for servicing color sets. In this article we will begin by discussing the use of black-and-white equipment for servicing color sets, then we will take up special test instruments for servicing color sets, and finally, we will give a brief description of several of the available commercial instruments.

J. Schek

Using Black and White Equipment

To begin with, you should realize that the same test instruments are used for making basic checks on both color and monochrome (black-and-white) receivers.

A vacuum tube voltmeter will be required for voltage and resistance measurements. Since the high-voltage output is more

(*Page Two Please*)

RECOGNIZE YOUR "NEWS"?

Maybe not. For quite awhile, the folks at NRI have felt it was time for a change—a "facelifting"—in the appearance of your News. We all eventually get tired of looking at the same things. Otherwise, there would be little need for women's beauty shops.

This is your first News issue using the new format. Different size, easier to read layout, and from now on it's *NRI News* instead of National Radio-TV News. Even more important, you will continue to get just as much in fact-filled articles, news items, and material of most interest to you—our reader.

We think the new format is a pleasant change and improvement. Hope you will too!

critical in color sets than in monochrome sets, the serviceman should have a reliable high-voltage probe for use in color servicing. The probe should be capable of increasing the useful dc voltage range of his VTVM above 25,000, preferably to 30,000 volts.

A modern tube checker can probably be adapted for testing some of the latest color tubes. Also, a reliable signal generator such as one used for aligning 45.75-mc video i-f stages can be used to check color receiver tuned circuits.

A good oscilloscope such as one used for waveform observation in video and sweep circuits can be used in checking the same circuits in color sets. However, when checking color circuits where it is necessary to view the 3.58-mc subcarrier burst and subcarrier oscillator output, a wide-frequency response in the vertical amplifier system of the oscilloscope will be necessary. An oscilloscope with a vertical amplifier response extending to four megacycles with little attenuation is suitable for checking these circuits.

Resistance and capacitor checkers, crossbar generators to check linearity, and other black-and-white servicing accessories and devices can also be used in similar applications in color receivers.

Some manufacturers have kits available to modify their instruments for use in color servicing. For example, the Hickok Model 650 bar generator can be converted to produce white dots with a kit available for less than $10.

Color television servicing does not make black-and-white test equipment obsolete, but additional equipment of a specialized type must also be acquired to speed up servicing faulty circuits, and also for properly adjusting the various circuits that handle the color signals. Let's take a look at the specialized equipment now.

The White-Dot Generator

An important part of color television servicing is adjusting the color circuits. Such adjustments require equipment not used in black-and-white alignment and trouble shooting. The additional instruments needed are a color-bar generator, and a white-dot generator. We will take up the white-dot generator first.

A critical adjustment that must frequently be made is *convergence*. This is the process of adjusting the three individual beams produced by the color picture tube triple-gun assembly to cross over at the openings of the internal aperture mask so that each beam hits the phosphor dot on the screen that will produce the desired color. If the beam from the blue gun strikes the red phosphor dots or the beam from the green gun hits the blue phosphor dots, then you will get red when you want blue and blue when you want green.

Obtaining proper convergence at the center area of the picture tube screen is not very difficult, but proper convergence at the outer edges is more difficult since the distance that the beam must travel to strike the picture tube screen increases.

When making convergence adjustments,

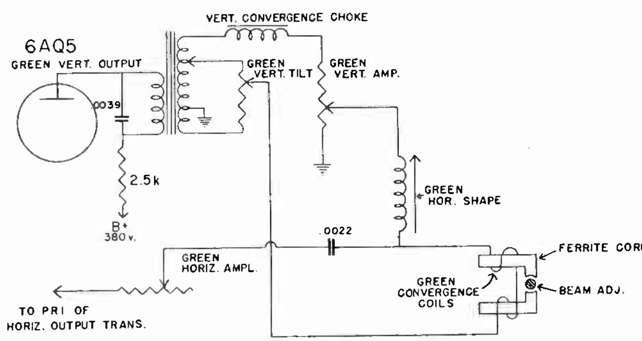

Fig. 1. Vertical and horizontal convergence adjustments for green beam.

the first step is to make certain that convergence at the center of the screen is good. After center convergence is obtained, the magnetic fields of the convergence yoke must be adjusted so that the properly shaped compensated beams will converge vertically and horizontally along the outer edges of the screen. The current for the convergence coils is obtained by combining horizontal and vertical sweep output signals through a suitable network of resistance, capacitance, and inductance.

A typical convergence circuit for a single beam is illustrated in Fig. 1. This circuit is used for the green beam in the 21-inch RCA color chassis Model CTC4. Notice how many controls are used to aid in converging only one beam. Since there are three beams, there are three times this many controls. If a receiver needs only slight retouching for satisfactory convergence, it can be done by closely ob-

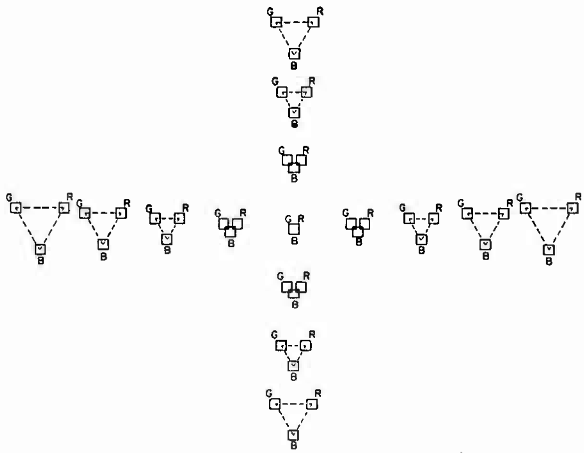

Fig. 2. Segment of screen showing convergence at the center but not at the edges.

serving a televised scene, but when the convergence system is considerably off from its correct operation, complete readjustment of the convergence system can become quite complex.

A specialized test instrument which is necessary for making convergence adjustments is the white dot generator. It produces a predetermined series of white dots against a black background furnished by the picture tube screen when the convergence is correct. When the beams are not correctly converged, each normally single white dot breaks up into three dots of different colors. A section of a picture tube showing proper convergence in the center is shown in Fig. 2. In the center of the screen there is a white square, showing that each beam in the picture tube is striking its proper phosphor dot. In the areas leading away from the center, there is a lack of acceptable convergence, and the normally white square is broken into three individual squares, each with a different color.

Complete convergence at the edges of the screen is accomplished by properly adjusting the tilt, amplitude, and shaping controls shown in Fig. 1. Correct vertical and horizontal convergence is shown in Fig. 3.

A white-dot generator should be capable of producing fairly large dots or squares. It is difficult to determine whether convergence is proper if the generator produces only small-size dots, and the technician may tend to turn the brightness control up too high if the dots are too small. Turning the brightness control up too high will disturb the convergence settings.

The generator circuits should have inherent stability so that the dots can be synchronized and locked in for a stationary test pattern. From ten to twelve dots should be visible horizontally and 8 to 10 dots vertically.

Most white-dot generators can also be used as cross-bar generators and also have a panel switch for selecting either horizontal or vertical bars for linearity adjustments of monochrome or color sets. These patterns are shown in Fig. 4.

The Color-Bar Generator

Another very important specialized service instrument for color television receivers is the color-bar generator which can be used for checking the color automatic frequency control system, the matrix, and other circuits. These circuits are shown in the block diagram of Fig. 5. Although a considerable amount of color TV servicing and adjusting can be done with a white-dot generator, a high-voltage probe, and a wideband sensitive oscilloscope, a color-bar generator should also be acquired as soon as possible.

True color representation is dependent upon the phase of the incoming 3.58-megacycle burst signal with respect to the locally generated 3.58-megacycle signal, and upon the proper adjustment of gain in the color signal amplifier stages and

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mixing circuits. The color-bar generator produces signals that form a number of colored vertical bars on the screen of the picture tube. A typical color-bar pattern produced by a color-bar generator is shown in Fig. 6. The sequence, number, and color of the bars differ for the various commercially available bar generators. Therefore, the service technician must become familiar with the number and color sequence of the particular color-bar generator which he uses. The color bars produced by color-bar generators are not suitable for making horizontal or vertical linearity checks.

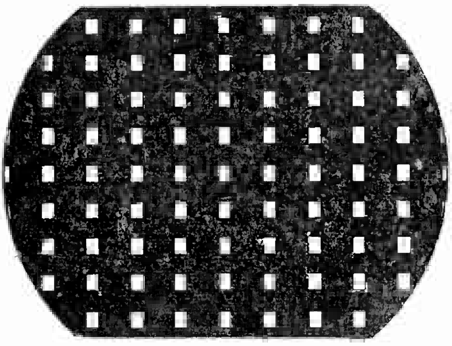


Fig. 3. Proper vertical and horizontal convergence.

The color-bar pattern shown in Fig. 6 is composed of 10 colored vertical bars that extend from the top to the bottom of the screen. Notice that the spaces between the bars contain no color. This half-tone background can be used to compare the color levels and the background brightness. From left to right, the colors of the bars are dull yellowish-orange, orange (I), bright red (R —Y), magenta (Q), reddish blue, blue (B —Y), greenish blue, cyan (—I), bluish-green —(R —Y), and dark green.

During each TV line interval, the circuits in the color-bar generator transmit signals that correspond in phase and amplitude to each of the hues. The signal usually contains 8 cycles of the sub-carrier frequency for each hue to be reproduced.

A crystal-controlled oscillator in the color-bar generator produces a pulse signal with a fundamental frequency twelve times as high as the TV horizontal line rate (or approximately 189 kc). This signal is used to control the operation of another oscillator, the 3.58-mc subcarrier oscillator. Each time a pulse is produced by the crystal-controlled oscillator, 8 cycles of the subcarrier signal are fed to the color receiver.

Since the frequency of the crystal-controlled oscillator is 12 times the line frequency, the pulses will occur every 30° of the line cycle. The chrominance signals used in color TV transmission are spaced approximately 30° apart in phase so feeding in the 3.58-mc signal at each of these points will produce the colored bars on the screen.

Many color-bar generators are able to produce not only the chrominance signals, but also the sub-carrier signal, similar to that sent from the transmitter. Therefore, the instrument can conveniently be connected to the antenna terminals.

Typical Commercial Color Test Equipment

Many commercial test units for checking color circuits are available in prices ranging from less than $100 to well over $200 for individual test units. Generally, the more expensive color test instruments feature crystal-controlled oscillators and a number of output signals to provide the utmost operating flexibility. These instruments in addition to generating color bars or white dots, will also produce rf or video signals for alignment, and cross bars for linearity checking. If the service technician already has up-to-date black-and-white test equipment, he won't need these extra features, and can feel safe in buying lower-priced specialized test equipment for color set servicing. If his existing black-and-white equipment is outmoded and is not usable in aligning late-model receivers that have video i-f stages with

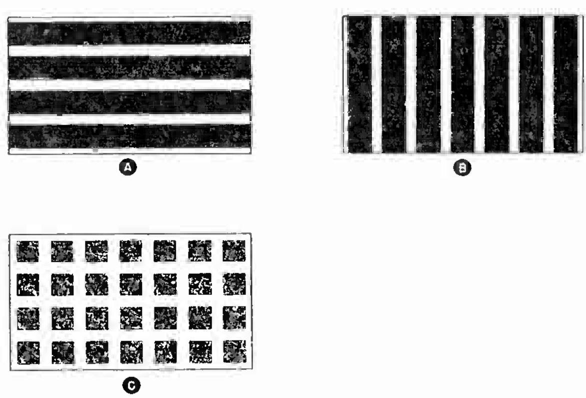


Fig. 4. Most white-dot generators will also produce the bar and crosshatch patterns shown here.

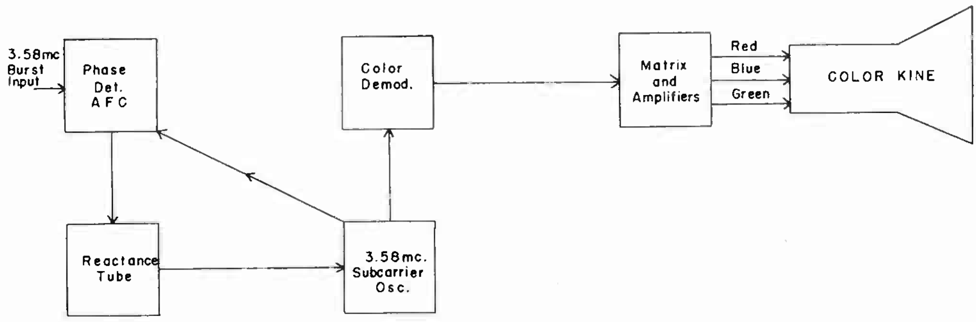
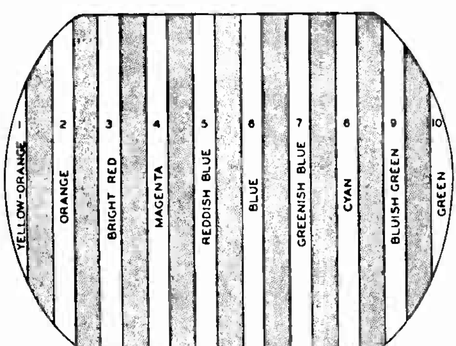


Fig. 5. Circuits that can be adjusted and serviced with a color-bar generator.

a 45.75-megacycle peak, he should get the higher-priced equipment.

Bar Generators

RCA WR-61A. This color-bar generator produces 10 vertical color bars, which correspond to the National Television System Committee (NTSC) Standard R —Y, B —Y, G —Y, I, and Q signals, as shown in Fig. 6. In addition, the instrument also provides a crystal-controlled picture carrier, a 3.58-megacycle color subcarrier, and a sound carrier.



Courtesy RCA

Fig. 6. Color-bar pattern produced by color-bar generator.

The stability of the generator is obtained by crystal control. The rf output signals correspond to channel 3. A separate video output signal is also provided, having either positive or negative polarity.

The radio-frequency output is approximately .01 volt peak-to-peak across a 300-ohm load. The video output from the Hi output terminal is approximately 8 volts peak-to-peak across 4700 ohms. Luminance signals are available which show up at the edges of the color bars for checking the registration of the luminance and chrominance signals. This color bar generator incorporates a special rectifier circuit that can be used in conjunction with an external VTVM for measuring and adjusting sync and subcarrier amplitudes.

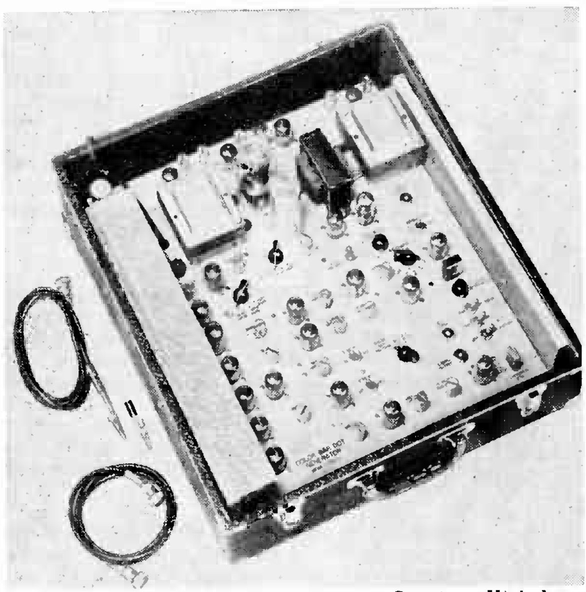
The picture carrier output is modulated by a color subcarrier. A front-panel switch can be used to eliminate the sound carrier from the output signal for rapid identification of any interference in the bar pattern resulting from sound signals. The sound carrier signal permits exact tuning of the receiver and testing its sound-rejection and beat interference characteristics with respect to the color set carrier and the sound carrier.

Hickok Model 656XC. This color test instrument, shown in Fig. 7, produces a series of 8 vertical color bars—green, yellow, red, magenta, white, cyan, blue, and black. The white bar is useful as a reference for adjusting the color circuits. It is only when the receiver has the correct convergence and proper signal amplitudes of red, blue and green that a white bar can be obtained.

A 3.58-mc subcarrier of 1 volt peak-to-peak is provided for aligning and testing the color synchronizing stage. Crystal control for the 3.58-mc signal is used for maximum stability. A video output signal is available at an amplitude of two volts peak-to-peak when measured with a VTVM. This will decrease to 1 volt across a 100-ohm load. This color-bar generator puts out an rf signal which is modulated by the color-bar pattern. The rf signal can be adjusted for channels 4, 5, and 6. A sound carrier output signal is also available.

Precision Model E-440. This test unit, shown in Fig. 8, is capable of producing ten equally spaced color bars across the screen of an operating color-TV receiver. Included are the color bars corresponding to R —Y, G —Y, B —Y, I, and Q signals. In addition, this instrument produces a crystal-controlled 61.25-megacycle picture carrier and a 65.75-mc sound carrier (channel 3). The rf output impedance of 300 ohms permits direct connection of this instrument to the antenna terminals of the color television set. A video signal of 8 volts peak-to-peak into a 4700-ohm load is available in either a positive or negative polarity.

Brightness or luminance signals are provided for the edges of the color bars to help in checking the registration of the color and brightness signals that appear on the screen of the picture tube. The brightness signals appear as a dark, thin vertical line at the left side of each color bar and a white, thin, vertical line at the right side of each color bar. Faulty color and brightness signal registration is shown by the color bars extending beyond these two lines.



Courtesy Hickok

Fig. 7. The Hickok Model 656XC color-bar generator.

Win-Tronix Model 150. This test unit provides from 1 to 8 vertical color bars with the main colors having the sequence: red, magenta, blue, cyan, and green. There are provisions for modulating the rf carrier with a 60-cycle luminance or brightness signal and the 3.58-mc chroma subcarrier.

A 300-ohm output jack at the rear of the test instrument provides the 3.58-mc color signal or the rf signal modulated by the color signal. The modulated rf signal output is approximately .3 volt. Crystal control of the subcarrier oscillator can be had by installing a 3.58-megacycle crystal into the pre-wired socket mounted at the rear of the test unit case.

Dot Generators

RCA WR-36A. This dot generator produces a signal which will be accepted by a color set whose channel selector can be set from channel 2 to 6. The maximum output voltage is .08 volt. Approximately 10 to 12 vertical and 8 to 15 horizontal dot rows can be produced across the screen of a color picture tube. The video signal output is 3.5 volts peak-to-peak on open circuit. It can be made either negative or positive.

Simpson Model 434. This white-dot generator, shown in Fig. 9, produces from 6 to 15 vertical and from 6 to 14 horizontal dot rows. The controls can change dot width and height and horizontal and vertical retraces are blanked out. The rf output can be varied over channels 2 through 6 and a balanced 300-ohm output is used. The rf output is variable up to .05 volts on open circuit; the video output is adjustable to 3.5 volts peak-to-peak on open circuit. The internal sync and blanking provided by the generator circuits eliminates the appearance of white smears between dot segments.

Win-Tronix Model 160. This white-dot generator produces large and small white dots and vertical and horizontal bars for linearity checking and adjustments. In the large-dot position, approximately 10 horizontal and vertical dots are produced. In the small-dot position, approximately 15 horizontal and 11 vertical dots are produced. The rf signal output is adjustable from channels 2 through 6. An input terminal is provided for external modulation of the rf carrier and another jack is available so that the television receiver can provide a source of sync for increasing dot stability.

Other Test Equipment

Chromatic Probe. Test instrument accessories are available which provide specialized functions in the servicing and adjustment of color television sets. One of these is the Simpson Chromatic Probe. It in-

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Food For Thought

A MAN LIVED BY THE SIDE OF THE ROAD . . . and sold hot dogs. He was hard of hearing so he had no radio. He had trouble with his eyes so he did not watch TV or read the newspapers.

But he sold good hot dogs.

He put up a sign on the highway, telling how good they were. He stood by the side of the road and cried. "Buy a hot dog, mister."

And people bought.

He increased his meat and bun orders, and he bought a bigger stove to take care of his trade. He got his son home from college to help him. But then something happened.

His son said, "Father, haven't you been listening to the radio? There's a big recession. The international situation is terrible, and the domestic situation is even worse."

Whereupon the father thought, "Well, my son has been to college. He listens to the radio and reads the papers. He ought to know."

So the father cut down on the bun order, took down his advertising signs, and no longer bothered to stand on the highway to sell hot dogs. His sales fell off almost overnight.

"You were right, son," the father said to the boy. "We are certainly having a great recession."

ACACIA CLARION published by Acacia Mutual Life Insurance Co., Wash., D. C.

How The Model W VTVM Works

By J. KELLY, *NRI Consultant*

The circuits in a VTVM are often a mystery, even to an experienced terchnician. The "mystery" may be primarily due to the schematic diagram of the instrument which at first glance appears complex and confusing. In addition, the circuits do operate somewhat differently from the familiar circuits in Radio-TV receivers. These factors discourage technicians from taking the time to learn exactly what goes on inside the instrument. However, by knowing the VTVM better, the technician will not only be able to repair the VTVM's in his shop if they ever need servicing, but, more important, he'll get more use out of his VTVM. It is only when a technician "knows" an instrument that he can fully utilize it.

Actually, when we break up the VTVM into its various circuits that do different jobs and analyze each circuit separately, we will see that it is a simple instrument.

Fig. 1 shows the schematic diagram of the Model W VTVM built in the NRI Radio-TV Servicing course. It is typical of most good VTVM's in use today. Let's take it apart circuit by circuit and see how it works.

Fig. 2 shows a balanced bridge circuit that is used in many testing and measuring instruments. We call this a bridge circuit because the meter bridges across two sides of a parallel circuit. If all four resistors in this circuit have exactly the same resistance, the voltage between point A and ground will be exactly the same as the voltage between point B and ground. Since there will be no difference of potential between points A and B (the meter terminals) the meter will indicate zero. Suppose, though, we change resistor R1 from 10 ohms to 5 ohms. By applying Ohm's Law, we can see the voltage between point A and ground will be 3.33 volts and the voltage between point B and ground will be 2.50 volts. The difference in potential between point A and point B will be .83 volts and this will make the meter pointer move. Notice that the balanced bridge circuit

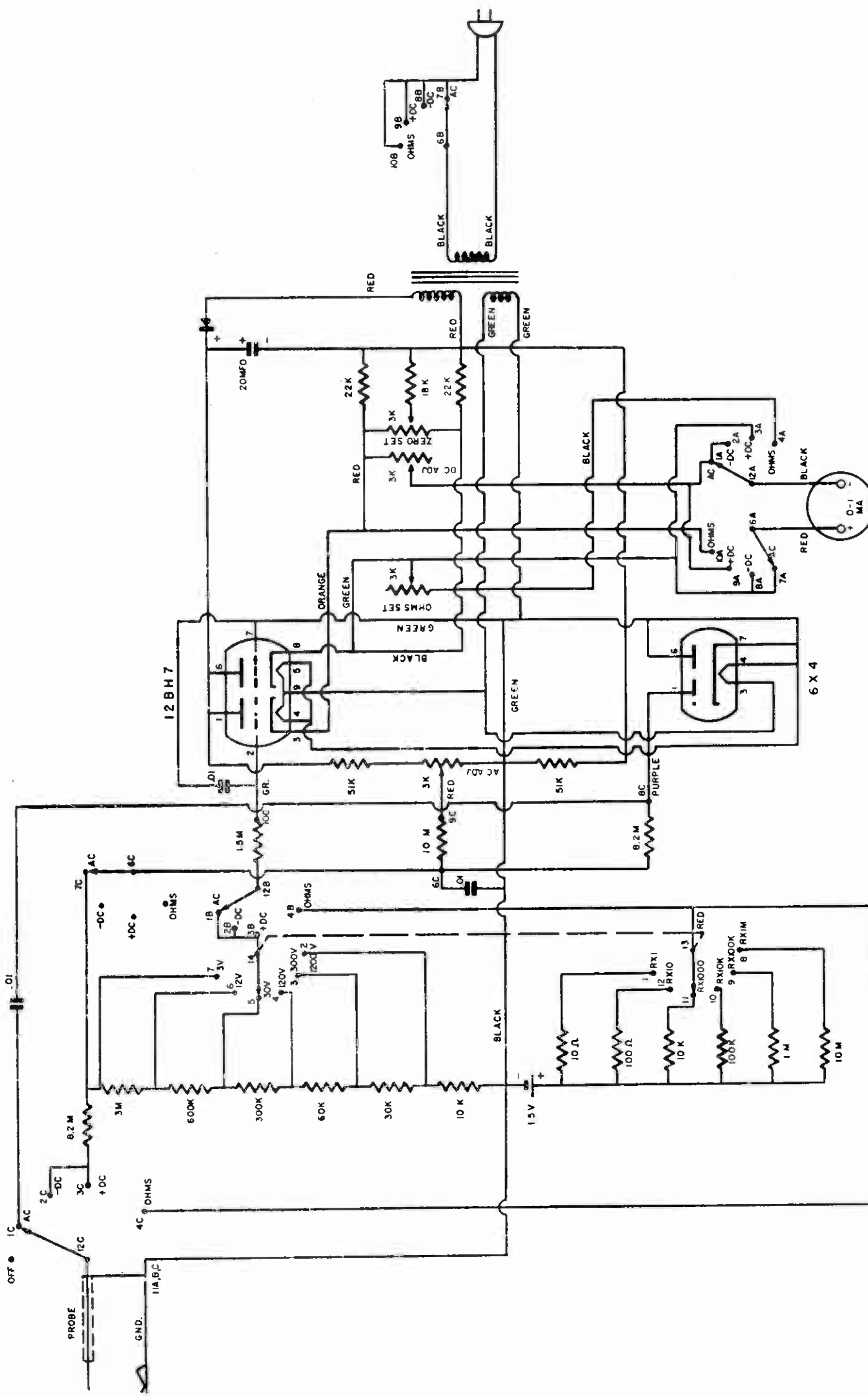


FIG. 1. The NRI Model W VTVM.

will cause a meter indication with a change in resistance of any resistor in the circuit.

The balanced bridge circuit has many advantages. First, it is extremely accurate. What is more important, slight changes in source voltage will not affect the meter reading. If the source voltage becomes greater, the potential at point A will become greater. However, the potential at point B will become greater by an equal amount and therefore the difference in potential between these two points will remain the same. This feature is very desirable in a VTVM since the instrument will not go out of calibration when the operating voltage changes.

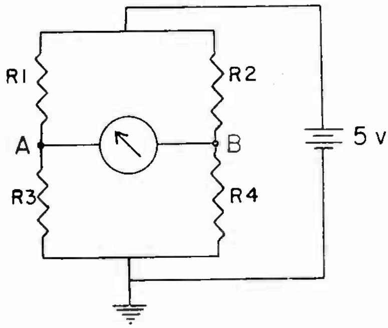


FIG. 2. A balanced bridge circuit.

How can we incorporate this balanced bridge circuit into our vacuum tube voltmeter? Actually, this is quite simple if we consider the tube's plate resistance. When the cathode-plate circuit of a tube is connected into another circuit, the circuit "sees" the tube as a resistance—the plate resistance of the tube. Since this is so, we can substitute the plate-cathode circuit of a tube for any resistor in the balanced bridge circuit of Fig. 2. In Fig. 3, we have replaced resistor R1 with tube VT 1 and resistor R2 with tube VT 2.

When we change the dc voltage between the control grid and cathode of a vacuum tube, it causes the plate resistance of the tube to change. Therefore, any voltage we apply between the control grid and cathode of VT 1 in Fig. 3 will have the same effect as changing the value of resistor R1 in Fig. 2. The meter in Fig. 3 will respond to variations in the voltage applied across the grid and ground of tube VT 1. In other words, this circuit is a voltmeter.

Fig. 3 is the basic circuit of most VTVM's. Since the meter will move as a result of the voltage applied across the terminals, it can be used to indicate the amount of voltage. This circuit also has all the advantages of the balanced bridge circuit in Fig. 2. Incidentally, you will recall from Fig. 2 that we did not change resistor R2 when we changed resistor R1 to get a meter indication. In Fig. 3, we also do not want the plate resistance tube VT 2 to change. To do this, we ground the control grid.

Study Fig. 3 well. It is the basic circuit of the VTVM which at first glance might have seemed complicated. Everything else in the VTVM is just an accessory used with the basic circuit. These accessories include the zero adjust circuit, the voltage divider to allow us to measure a wide range of voltages, the power supply, resistance measuring system, and so on.

The first accessory circuit to consider is the zero adjust circuit. We saw in Fig. 2 that when all four of the resistances are equal, the circuit will be in perfect balance and the meter will rest at zero. In actual practice, it is not possible to get two triode tubes with equal plate resistances. However, by connecting a resistor and potentiometer as shown in Fig. 4 we can change the resistance between points B and C and A and C. When we adjust the zero control (potentiometer) to bring the meter pointer to zero, we are merely changing the resistance of the two cathode circuits to make the voltages equal.

Fig. 5 shows the simple half-wave rectifier-type power supply for the instrument. Notice the voltage divider resistance across the output of this power supply and particularly note the ground connection.

The cathode resistors must be large to make the bridge circuit accurate. However, these large cathode resistors give too much cathode resistor bias. To offset this excess cathode bias, we have connected the power supply to ground in the usual way. The

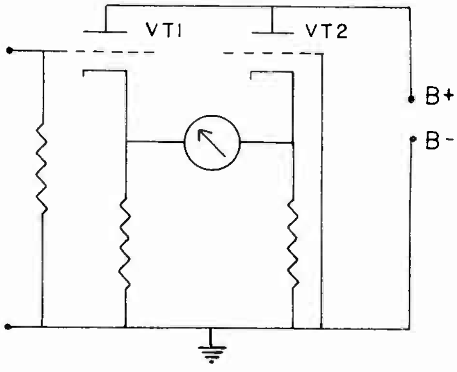


FIG. 3. The basic circuit of the VTVM. The ground connection in this and other diagrams is not a ground to chassis. It is a floating ground.

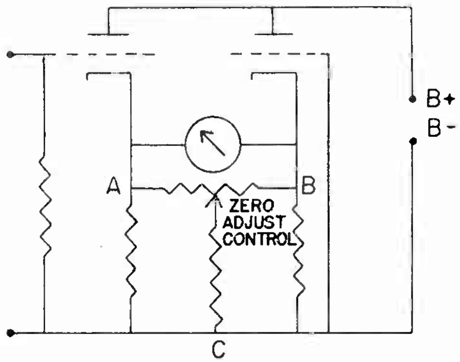


FIG. 4. The zero adjustment circuit.

voltage developed across the resistor R1 (between B— and ground) cancels part of the cathode bias voltage developed across resistors R2 and R3. Notice the polarities of the voltages indicated across these resistors and that the control grid of VT1 is ultimately connected to ground. The bias voltage between the control grid and cathode will be the sum of the voltages across R1 and R2. As we can see by the polarities indicated in the diagram, these voltages will buck each other. Therefore, the use of resistor R1 reduces the high cathode bias that would be present without it. Later we wll see another use for this bleeder resistance across the power supply.

Now let's get down to the business of making measurements with the VTVM.

When we trace through the selector switch of the VTVM, we find that the voltage under test is applied across the voltage divider as shown in Fig. 6. A portion of the voltage under test is picked up by the movable contact on the range switch and applied between the grid and cathode of tube VT1. The meter then indicates the amount of voltage. The bridge circuit is designed so that the meter will deflect to full-scale when approximately 1 volt is applied between the grid and cathode of the tube. When we want to measure a

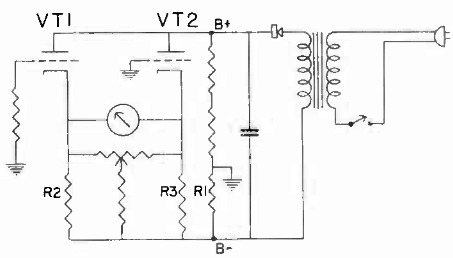


FIG. 5. The power supply circuit in the Model W VTVM.

voltage larger than this, and we usually do, we use a voltage divider and take only a small portion of the total voltage under test and apply it to the grid and cathode of the tube.

For example, if we apply 30 V to the instrument and the switch is in the 30 V position as shown in Fig. 6, 1/30 of the total voltage being measured is applied to the grid of the tube. Since 1/30 of 30 is 1, 1 volt at the grid causes full scale deflection.

What about switching from +dc to —dc? To do this, we just reverse the two connections going to the meter itself; nothing else in the VTVM is changed. This is shown in Fig. 7.

Also in Fig. 7 you will notice a variable resistor in series with the meter. This is the calibrating resistor and it is in series with the meter on all voltage measurements. When calibrating the instrument, we want to be sure that the meter reads

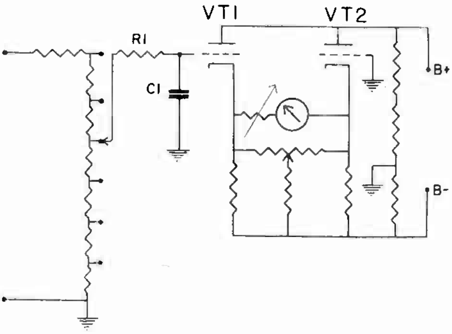


FIG. 6. The voltage divider. This permits measurements on various voltage ranges.

accurately. To do this, we use the flashlight cell in the VTVM as a standard voltage. Touching the test probe to the positive terminal of this cell applies the flashlight cell voltage (1½ volts) across the voltage measuring system. With 1½ volts across the input of the VTVM, the potentiometer in series with the meter is adjusted for a meter indication of 1½ volts. Thus the meter is calibrated by applying a known voltage to the measuring system and adjusting the system so it indicates this voltage.

Next, let's see how the VTVM can be used to measure resistance with the flashlight cell in the VTVM as a source of voltage. Fig. 8 shows the basic circuit used to measure resistance with a VTVM. When there is no resistance between the test probe and ground, the full 1½ volts developed by the battery will be applied across the control grid and cathode of the tube. We have already seen that applying 1 volt to the grid of the tube will make the meter deflect all the way to the right. Therefore, with no resistance between the test leads, the meter pointer will go to the right end of the scale. The ohms set control is adjusted to bring the meter pointer exactly to the right end of the scale. This end of the ohm scale corresponds with infinitely high resistance—in other words, an open circuit.

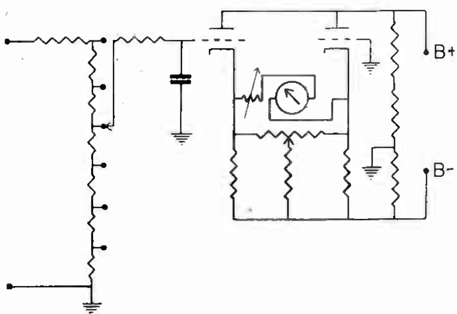


FIG. 7. The circuit change for measuring negative dc voltages.

If we short the test leads, the control grid is shorted to ground and the 1.5-volt battery voltage is removed from the control grid. With no voltage at the grid, the meter pointer will then return to zero. We see on the Ohm scale that, when the meter pointer is at the left end of the scale, it indicates zero ohms. With the test leads shorted, there is zero ohms between the two test leads.

Because of slight variations in the battery voltage, we want to provide a means of adjusting the meter. To do this, we use the ohms set control, which is a variable resistor, in series with the meter as shown in Fig. 8. When the VTVM is switched to the ohms position, the meter pointer will deflect upscale. This variable resistor is then adjusted to bring the meter pointer precisely to the end of the scale. Notice that this adjustable resistor is in the same place and does the same job as the dc voltage calibrating resistor we discussed earlier. However, to eliminate the necessity of constant readjustments, different variable resistors are switched in series with the meter when the function switch is turned to the ohms and dc positions.

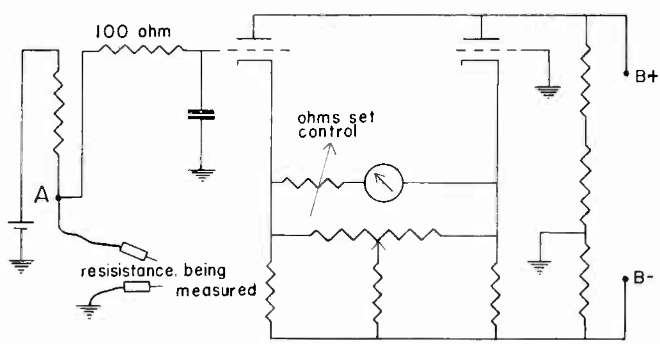


FIG. 8. The resistance measuring system.

Now let's see what happens wnen we measure a resistor. The 100-ohm resistor shown in Fig. 8 is one of the six resistors that can be switched in with the range switch. A 100-ohm resistor will be in the circuit when the range switch is in the Rx10 position. Suppose we connect a 100-ohm resistor to be measured between the two test leads. Now there will be two resistors connected across the positive terminal of the battery and ground—the 100-ohm resistor in the VTVM and the 100-ohm resistor under test. Since both of these resistors are 100 ohms, the voltage between point A and ground will be one-half of the source voltage. If there were one-half of the 1.5 volts across the grid of the tube and ground, the meter pointer would deflect to the midscale position. The ohms scale of the meter is calibrated so that the midscale position reads 10. Since the range switch is in the Rx10 position the meter will indicate a resistance of 100 ohms.

Suppose we were measuring a 200-ohm resistor. Then, there would be two-thirds of the battery voltage present across point A and ground and the meter pointer would deflect two-thirds of the way upscale to the number "20." Multiplying this by 10 gives 200. In a similar manner, we can measure resistance on all six ranges.

Fig. 9 is a circuit that will allow us to measure ac voltage with the VTVM. It is like the circuit for measuring negative dc voltage except for a few additional parts.

We have added capacitor C1 in series with the test probe, and a diode tube in parallel with the voltage divider. The purpose of the capacitor is to keep dc voltage out when we measure ac. If this capacitor were not used and we measured an ac voltage in a circuit in which dc voltage was also present, the dc voltage would get through just as easily as the ac and would cause the meter to deflect.

If we applied a pure ac voltage to the control grid, we would have just as much voltage trying to pull the meter pointer to the right as to the left. As a result, the meter pointer would stay at zero. To eliminate this problem, we add the diode tube and blocking condenser. During the half cycle when point A is positive with respect to point B, the diode tube conducts. This charges the blocking condenser with a dc voltage equal to the ac voltage. The instrument measures this negative dc voltage. However, during the other half cycle of the ac wave when point A is negative with respect to point B, the diode tube will not conduct. Therefore, the polarity of the charge on the condenser will not change. Because of the high input resistance through which the condenser must discharge, the condenser holds an essentially constant dc charge.

One problem is encountered with this rectifier circuit—on the low voltage ranges the meter pointer does not stay on zero. This is because of convection current in the diode tube. Even when voltage is not applied to the diode tube, some of the electrons freed from the cathode by heat accidentally strike the plate of the tube. When these electrons flow back to the cathode, they cause a small negative voltage across the voltage divider. This makes the meter pointer swing upscale causing a false reading. To prevent this we apply a small positive voltage to the circuit to cancel this negative voltage. We get the small positive voltage by connecting a voltage divider of three resistors (one is variable) across the source of B+ voltage. We can pick up a small positive dc voltage here and apply it to point C in the circuit. This voltage divider is a part of the bleeder in the power supply we mentioned earlier.

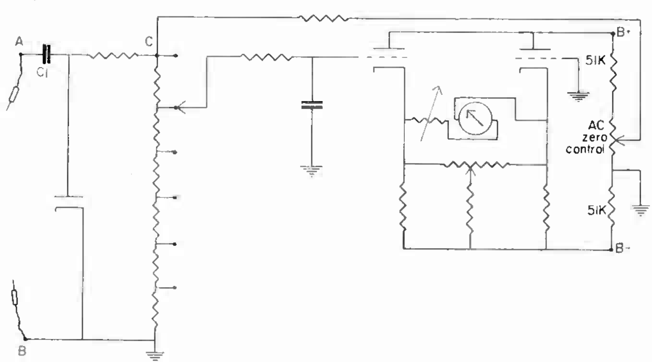


FIG. 9. The ac voltage measuring circuit. The condenser and resistor connected to the control grid of VT 1 in the diagrams are used to keep ac voltages from the grid.

Thus, when the meter pointer goes off zero on the low ac voltage ranges with the probe and ground clip shorted together, we can bring it back to zero by adjusting the ac zero control (the variable resistor in the voltage divider we just discussed). What we are actually doing is applying a positive dc voltage so it cancels the negative voltage caused by convection current in the diode tube. Incidentally, after properly adjusting the ac zero control as described above, it is quite normal for the meter to go up-scale when the probe and ground clips are separated. This is due to stray pickup and the amount of meter pointer deflection will depend on the strength of the stray fields. This deflection can be ignored when the probes are connected to a circuit to make a measurement, because then the stray pick-up will disappear.

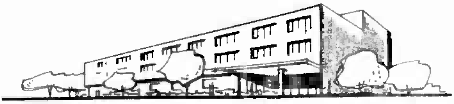
These basic circuits we have discussed make up the seemingly complicated VTVM. We can trace any one of these circuits in the schematic diagram in Fig. 1. By changing the position of the function switch, we can switch from one circuit to another.

A VTVM has several distinct advantages over a conventional voltmeter. The basic voltmeter is simply a milliammeter with a large resistance in series. The current that a voltage can push through that resistor will be proportional to the amount of voltage. Since the current is proportional to the voltage, we can make the meter read in terms of voltage. The basic voltmeter has one big disadvantage. To operate, it must draw considerable current from the circuit in which the voltage measurement is made. Many radio circuits are not capable of delivering the current needed by the voltmeter without upsetting normal operation. Clearly, it is desirable to have a voltmeter that will measure voltage without drawing appreciable current. The vacuum tube voltmeter is just such an instrument.

In the VTVM we apply the voltage we want to measure between the grid and cathode of an amplifier tube. Only an extremely small amount of current is drawn from the circuit under test by the very high resistance voltage divider that is connected into the circuit. As a matter of fact,

(*Page Twenty Please*)

NRI ALUMNI NEWS



Nominations for 1959

It's time once again for the members of the NRI Alumni Association to choose the National Officers to serve the Association for the forthcoming year. There are five National Officers, the President and four Vice-Presidents.

We will first nominate the candidates by ballot. The two men who receive the greatest number of votes for the office of President will become the candidates for that office. The eight men who receive the largest number of votes for the office of Vice-President will become the candidates for a Vice-Presidency.

Nomination of candidates must be completed by August 25, 1958. Make your vote count in this election by mailing your ballot in plenty of time to reach Washington by or before that date.

The votes will be counted at National Headquarters. The names of the nominees will be published in the October-November issue. From among the candidates nominated NRIAA members will cast their ballots for the President and four Vice-Presidents. The necessary ballots will be included in the October-November issue.

This procedure is in accordance with the provisions of our Constitution, Article VI, which reads as follows:

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

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

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

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

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

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

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

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

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

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

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

12. The nominee receiving the greater number of votes for the office for which nominated 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.*

Howard Smith of Springfield, Mass., President of the Association for the current year, will vacate his office on December 31, as provided in Article VI, Section 2. But as we well know here at National Headquarters from past experience, Mr. Smith will continue his loyal and industrious support of the NRI Alumni Association.

A member of the NRIAA who has come to the fore in recent years is John Babcock of Minneapolis, Minn. He was the chief organizer of the Minneapolis-St. Paul (Twin City) Chapter, which was established in 1954; served as its Secretary in 1954, as its Chairman in 1955; was elected as a National Vice-President in 1957. His election as President for 1959 would be a fitting reward for the sincere efforts he has consistently made toward the welfare of the NRI Alumni Association.

According to our Constitution, there is no limitation on Vice-Presidents continuing in office. The present incumbents are therefore candidates for reelection. They are F. Earl Oliver of Detroit, Jules Cohen of Philadelphia, William Fox of New York City, and Joseph Stocker of Los Angeles.

There are many other candidates to be considered: Joseph Dolivka, Chairman, Baltimore Chapter; Edwin Kemp, Former Chairman and now Secretary of the Hagerstown (Cumberland Valley) Chapter; Frank Skolnik, Chairman, Pittsburgh Chapter; Patrick Boudreaux, Chairman, New Orleans Chapter; and Walter Nice, Chairman, Chicago Chapter.

Still other candidates are listed on the following page under "Nomination Suggestions." These names are given in order to allow members the greatest possible choice of candidates. It is each member's privilege to vote for whomever he wishes, except that he must vote for a member of the NRIAA who is qualified to hold office in the Association. The names listed on the following page were selected according to their geographical location in the United States and Canada.

To exercise your privilege of voting in this election, just fill in the Nomination Ballot and mail it to the Executive Secretary. But please note that your vote will count only if it reaches Washington by August 25th.

(Chapter Chatter begins page 19)

Nomination Suggestions

Roy L. Simmons, Phoenix, Ariz.
Gordon E. DeRamus, Selma, Ala.
Don Smelley, Cottondale, Ala.
Curtis Smith, Little Rock, Ark.
A. R. Waller, Keo, Ark.
Sam B. Tenn, Los Angeles, Calif.
Herbert Garvin, Los Angeles, Calif.
A. W. Blake, Denver, Colo.
Chas. Bost, Leadville, Colo.
Albrecht Koerner, Stamford, Conn.
Joseph Medeiros, Hartford, Conn.
Sherwood Peppers, Norwich, Conn.
Eric Woodin, Naugatuck, Conn.
Wm. F. Speakman, Wilmington, Del.
Joseph G. Nice, Claymont, Del.
Stanley S. Scott, Washington, D. C.
Wm. G. Spathelf, Washington, D. C.
Glen G. Garrett, Bonifay, Fla.
E. H. Roberts, Winter Garden, Fla.
Juan A. Garcia, Miami, Fla.
W. P. Collins, Pensacola, Fla.
G. P. Abbott, Sr., Atlanta, Ga.
Paul H. Wills, Macon, Ga.
Joseph Bingham, Twin Falls, Idaho
Virgil D. White, Kellogg, Idaho
Erwin Andrews, Batavia, Ill.
R. A. Haltzhauer, Joliet, Ill.
Fred J. Haskell, Waukegan, Ill.
Jerry C. Miller, Skokie, Ill.
William J. Krepiak, Chicago, Ill.
Claybourne B. Miller, Chicago, Ill.
Harold Bailey, Peoria, Ill.
Dick Michael, Hartford City, Ind.
Chase E. Brown, Indianapolis, Ind.
Paul Knapp, Evansville, Ind.
H. E. McCosh, Charles City, Iowa
E. C. Hirschler, Clarinda, Iowa
Joseph J. Scott, Hutchinson, Kans.
Wm. B. Martin, Kansas City, Kans.
K. M. King, Wichita, Kans.
Joseph Monahan, Lexington, Kans.
R. B. Robinson, Louisville, Ky.
Nick Pisciotta, Alexander, La.
R. J. Crochet, New Orleans, La.
George A. Richards, Machias, Maine
Harold Davis, Auburn, Maine
Ralph E. Locke, Calais, Maine
Elmer E. Shue, Towson, Md.
Joseph P. Yockachonis, Baltimore, Md.
Leonard D. Thomas, Hagerstown, Md.
Andrew F. Gallagher, Hyattsville, Md.
Manuel Enos, Fall River, Mass.
Louis Grestin, Boston, Mass.
Charles L. Rogers, W. Springfield, Mass.
Omer Lapointe, Salem, Mass.
Edward Warmuth, Minneapolis, Minn.
George H. Petersen, St. Paul, Minn.
Arthur J. Haugen, Harmony, Minn.
Elmer Buck, St. Paul, Minn.
Howard Thomas, Detroit 3, Mich.

Chas. H. Mills, Detroit, Mich.
Robert Krieko, Detroit, Mich.
C. A. Diehl, Detroit, Mich.
Pay Hughes, Jr., Gulfport, Miss.
Robert Harrison, West Point, Miss.
Billie E. Lovell, West Alton, Mo.
A. Campbell, St. Louis, Mo.
Irvin F. Stohl, Nashua, Mont.
Earl Russell, Great Falls, Mont.
Aivars V. Matiss, Lincoln, Nebr.
Edward J. Petraska, Omaha, Nebr.
Ralph J. Jepsen, Minden, Nev.
L. R. Carey, Elko, Nev.
Arthur Cornellier, Dover, N. H.
Geo. Stylianos, Nashua, N. H.
J. A. Stegmaier, Arlington, N. J.
George P. Karabin, Weehawken, N. J.
Claude W. Longstreet, Westfield, N. J.
C. Evan Yager, Albuquerque, N. Mex.
Johnnie E. Gallegos, Los Alamos, N. Mex.
William Overton, New York, N. Y.
Myron J. Ferguson, Syracuse, N. Y.
Thomas Hull, New York, N. Y.
Phil Spampinato, New York, N. Y.
Joseph E. Lisinski, Poughkeepsie, N. Y.
James Outlaw, Greensboro, N. C.
Raeford H. Jones, Salisbury, N. C.
Max J. Silvers, Raleigh, N. C.
Clinton N. Anderson, Fargo, N. Dak.
Wilbur Carnes, Columbus, Ohio
James P. Matthews, Canton, Ohio
Bernard Weill, Cleveland, Ohio
Ray L. Opp, Fostoria, Ohio
Francis C. Fisk, Tulsa, Okla.
Ray D. Young, Eugene, Oreg.
Fred O. Henderson, Portland, Oreg.
Mack J. Corley, Philadelphia, Penna.
Robert Meeder, Pittsburgh, Penna.
Frederick Heck, Allentown, Penna.
William Eckhoff, Philadelphia, Penna.
Walter P. Iacobbo, Providence, R. I.
James F. Barton, Greer, S. C.
Fred Huber, Lemmon, S. Dak.
John Wenzel, Gettysburg, S. Dak.
Newell M. Comer, Tullahoma, Tenn.
A. V. Craig, Memphis, Tenn.
Randolph D. Howard, Houston, Texas.
William A. Nichols, San Antonio, Texas
N. G. Porter, Cedar City, Utah
M. S. Galloway, Portsmouth, Va.
Cameron D. Bonebrake, Norfolk, Va.
John Hatcher, Richmond, Va.
Everett L. Sartelle, Barre, Vt.
C. R. Thompson, Vancouver, Wash.
Emerson A. Breda, Tacoma, Wash.
Chester A. Hill, Seattle, Wash.
J. C. Weidman, Jr., Martinsburg, W. Va.
Carl F. Weber, Milwaukee, Wis.
Lyle Speyer, Lander, Wyo.
Charles A. Smith, Cheyenne, Wyo.
M. Martin, New Westminster, B. C., Canada
E. D. Smith, Winnipeg, Man. Canada
John B. Holden, St. Johns, Nlfd., Canada
W. F. Arseneualt, Dalhousie, N. B., Canada
Donald Swan, Springhill, N. S., Canada
Peter Cameron, Alliston, Ont., Canada
Adrien Cagne, Montreal, P. Q., Canada
Edw. D. Schmidt, Saskatoon, Sask., Canada

Nomination Ballot

T. E. Rose, *Executive Secretary*
NRI Alumni Association,
3939 Wisconsin Ave.,
Washington 16, 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 1959.

(Polls close August 25, 1958)

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 ....

We're proud to announce the . . .

New NRI Professional Tube Tester

Model 71

The NRI Supply Division is proud to announce the brand new, improved, NRI Professional Model 71 Tube Tester.

Professional in appearance as well as performance, the Model 71 was designed to meet rigid specifications set down by our own engineers and is built by one of the better-known test equipment manufacturers. In designing the Model 71, we were primarily concerned with (1) Completeness of the test; (2) Ease of operation; (3) Long life; (4) Appearance; and last but far from least—Cost.

The modern highly-flexible test circuit in the Model 71 makes use of ten four-position lever-type element switches. These fast-acting switches provide individual control for each tube under test. Seventeen filament voltages are available for tubes now in use or to be developed in the foreseeable future. Many flexible features make the Model 71 almost obsolesence proof.

Uses Approved EIA Emission Test Circuit

Years of experience have convinced us that a tube tester designed around the Electronic Industries Association's emission circuit is best suited for rapid service work. NRI recommends this type circuit —used in the Model 71—as best suited for Radio-TV servicing.

Outstanding Appearance

Appearance is important in a tube tester. Customers will frequently watch you at work. They will be impressed by the smooth action, the beauty and streamlined proportions of this instrument. The panel is handsome brushed aluminum with black enameled deep etched lettering. Lettering cannot rub off! The beautifully finished leatherette covered case equals the quality used in the finest engineering instruments. The Model 71 is recognized immediately as a professional test unit.

Top Performance—Low Cost

In offering the Model 71 at the low price of **$59.50**, we feel we are giving NRI men the opportunity to purchase an instrument which will serve them faithfully and give them an excellent value for their investment.

70°-90° Picture Tube Adapter And Companion 110° Adapter Available

Enables you to test a Television picture tube in a receiver, or in the original factory carton. This test includes a cathode emission check, and a check for shorts between the various elements of the tube. Price of 70°-90° Adapter—only $4.98.

Using the 110° Adapter *with* the 70°-90° Adapter, you can also test the latest type 110° picture tubes. Both Adapters for $9.75. (Note: You must have the 70°-90° Adapter in order to use the 110° Adapter.)

SPECIFICATIONS

1. Employ Standardized EIA Emission Test Circuit—Ten separate four-position tube element switches make tube prong connections flexible—take care of future electrode connections.
2. Eight Tube Test Sockets—Test 4, 5, 6, 7, and 7L prong tubes; plus octal, loctal, 7-prong miniature; and 9-prong miniature tubes.
3. Test Electric Eyes and Gaseous Rectifiers.
4. Seventeen filament Voltages—0.69, 1.5, 2, 2.5, 3.3, 4.2, 6.0, 6.3, 7.5, 10, 12.6, 18.5, 25, 30, 50, 70, and 110 volts; filament voltages for all receiver tubes.
5. Double Jeweled D'Arsonval Meter Movement—Giant type 4½ inch ±2% accuracy.
6. Short and Leakage Test—Between all elements while the tube is "hot".
7. Value Test—Reads directly Replace ?, or GOOD. Meter is calibrated for comparison tests.
8. Manual Line Voltage Adjustment—uses test meter as a voltmeter.
9. Separate Tests for Multi-function tubes—individual tests for each diode in full-wave rectifiers. Separate checks on each section of multiple tubes.
10. Filament Continuity Test and Open Element Test.
11. Handsome streamlined black leatherite covered wooden case. Size: 15¼" x 10½" x 6". 14 gauge brushed aluminum panel, deep etched black filed lettering.
12. Actual Weight—11 pounds. Shipping weight 15 pounds.
13. Power Requirements—50-60 cycle, 110-120 volts A.C. required. (Cannot be operated on D.C. or 25 cycle A.C.)
14. High Speed, Triple Window Roll Chart.
15. Standard 90 day EIA Warranty—covers entire tube tester.
16. Detailed Instruction Manual—included with each tube tester.

ORDER BLANK

National Radio Institute, Supply Division
3939 Wisconsin Ave.
Washington 16, D. C.

11TE

I enclose $.................. (check, money order, or bank draft) for which send me, express collect, the items I have checked.

- ☐ One Model 71 NRI Professional Tube Tester $59.50
- ☐ Model 71 Tube Tester with 70°-90° Adapter 64.48
- ☐ Model 71 Tube Tester with 70°-90° & 110° Adapters 69.25

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

- ☐ Tell me how I can buy this equipment on monthly terms. ______

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Name .... Student Number ....

Address ....

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

Express Office ....

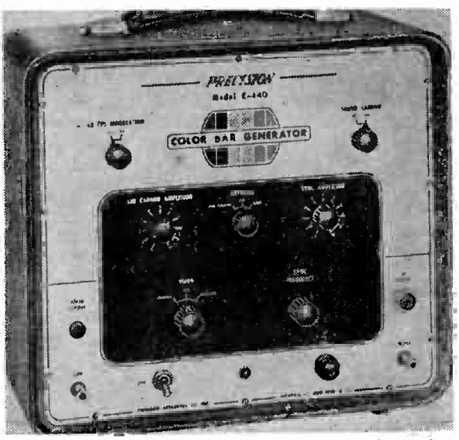
Equipment for Color TV Servicing

(Continued from Page Six)

cludes a crystal rectifier and several resistors that make up a non-linear network for heterodyning. When the outputs from an AM and an FM generator are fed to this device, the frequency difference can be applied to the bandpass amplifier of a color television receiver in order to check the response curve of this stage.

By using the Chromatic probe the necessity for applying the test generator signal through a preceding detector stage is eliminated.

Chromatic Amplifier. Another specialized test instrument accessory for color set servicing is the chromatic amplifier Model 406 which is manufactured by the Simpson Company. This unit can be used to raise video signal levels on an insensitive scope to provide full-screen oscilloscope deflection for checking color receivers. The



Courtesy Precision

Fig. 8. The Precision Model E-440 color-bar generator.

chromatic amplifier needs no circuit tuning or adjustment, and the front panel contains only the off-on switch and the input and output terminals. The amplifier has a gain of 30 over a 4-megacycle band. The output of the amplifier is flat within ± .5 db from 80 kc to 4 megacycles. The input has a high impedance and the output impedance is about 2200 ohms.

Degaussing Coil. If when setting up a color television receiver, you find you cannot obtain a raster that is pure in color, the metal bell of the picture tube may have become magnetized, causing some discoloration along the outside edges of the raster. To remove this defect, the metal

Courtesy Simpson

Fig. 9. The Simpson Model 434 white-dot generator.

bell of the picture tube can be demagnetized or "degaussed". The usual method used for the demagnetizing or degaussing process is to place the magnetized object in an ac field of sufficient strength to overcome the permanent magnetism and then gradually remove the ac field.

Although degaussing coils are commercially available instruments, you may find it convenient to wind your own.

The material required is about four and one-half pounds of No. 20 enameled wire, a 10-12 foot ac line cord with plug, a roll of friction tape, and a roll of plastic electrical tape. The degaussing coil is made by winding about 425 turns of the No. 20 magnet wire on a round form about 12 inches in diameter. If the correct size form is not available, a pail or waste paper basket reasonably close to this size can be used. Connect and solder both ends of the coil to the ac line cord; then completely cover the wire and connections first with friction tape and then with plastic tape. Because of the heavy current flow, degaussing coils are designed for operation over only very short periods of time and will normally overheat in a very few minutes. A degaussing operation should take only about one minute or less. A degaussing coil which was wound on a waste

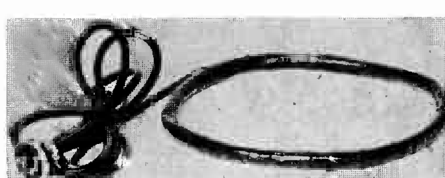


Fig. 10. Appearance of shop-built degaussing coil.

paper basket and constructed as described above is shown in Fig. 10.

Use Of Equipment

The comprehensive operating manual that is furnished with each test instrument should be carefully studied by the operator so that he is thoroughly familiar with the manner in which it is to be used.

If a color-bar generator, for example, does not produce the proper sequence of colors, it is not necessarily an indication that the receiver is at fault but rather that the various controls of the instrument or receiver require proper adjustment. All sorts of weird effects can be produced by the improper use of the bar generator or faulty settings of the fine tuning, phase, hue, and other controls on the color set.

Of equal importance, the brilliancy and contrast controls of the receiver must be properly set when using a dot-bar generator for convergence checking and adjustment. When the service technician appreciates the greater care that is necessary when making the adjustments for proper operation of color test equipment, he will have removed one of the main obstacles in getting the maximum benefit from his color TV test equipment.

———*n r i*———

Someone asked Mr. Einstein one day what kind of weapons would be used in the third world war. "Well," he said, "I don't know. I don't know what they are developing, because things are progressing so rapidly, but I can tell you what they'll use in the fourth world war,"—"They'll use rocks."

Senator J. Wm. Fulbright

———*n r i*———

NYC Chapter Secretary Visits NRI

NRI and National Headquarters recently enjoyed a pleasant visit with Dave Spitzer, Secretary of the New York Chapter, who stopped by while on his vacation trip. Dave was accompanied by Mrs. Spitzer and since they were unable to attend NRI's Open House last year, a "grand tour" was the order of the day. In the absence of Executive Secretary Ted Rose who was away on vacation, his assistant Jack Thompson acted as guide and later as host for luncheon at Washington's Shoreham hotel. We hope you got some good photos Dave, and that you'll pass our standing invitation on to other Chapter Members to visit with us whenever they are in or around Washington.

NRI ALUMNI NEWS

Chapter Chatter

LOS ANGELES CHAPTER, at the time of its formation last Fall, was led by Joseph Stocker, who was chiefly responsibile for organizing the Chapter. In recognition of his successful efforts, the members elected him the first Chairman of the Chapter.

However, the Chapter reports that Joe Stocker has resigned as Chairman, although he will continue as a valued and industrious member. Former (and the first) Secretary of the Chapter, Mr. Thomas McMullen, was voted in as Chairman by an overwhelming majority. Mr. Allen Bernard, Jr., was elected as the new Secretary. Our congratulations to both these new officers!

The Chapter has several important programs for the future in helping its members with their Radio-TV service problems. Any NRI students and graduates in the vicinity who are not members are missing out on an excellent opportunity to get practical help with their problems. You will be more than welcome at the meetings either as a guest or as a prospective member. Contact either Chairman Thomas McMullen, 1002 W. 187th Place, Gardena, or Secretary Allen Bernard, Jr., 11523 S. Broadway, Los Angeles.

Regular meetings are held at 8 P.M. on the second Friday of each month at St. Joseph's Catholic School Hall, 1220 S. Los Angeles St., Los Angeles.

SOUTHEASTERN MASSACHUSETTS CHAPTER'S newest member of which we have a report is Mr. Edward Cacilhas. A cordial welcome to you, Mr. Cacilhas.

The Chapter is trying something new: meeting at members' homes instead of the usual meeting place, the idea being to hold such meetings from time to time so that test instruments would be readily available for trouble-shooting the dog that is to be examined. The attendance at and results of such trial meetings have been very good indeed, proving that NRI students

(Page Twenty-one Please)

How the Model W VTVM Works

(*Continued from Page Twelve*)

the current that actuates the meter itself does not come from the circuit in which the measurement is made but from the power supply in the VTVM. Since the VTVM does not draw appreciable current from the circuit in which a measurement is made, it does not upset the circuit operation and therefore gives a more accurate reading. This is not only desirable, but in many modern high impedence or RF circuits it is essential.

How does the Model W VTVM compare to other VTVM's? I have talked to students who wanted to know about purchasing a professional VTVM after they finished their course. We believe the Model W the VTVM built in the Servicing course is better than most professional instruments on the market today.

As a matter of fact, the model W VTVM has a number of outstanding features not found in other VTVM's. Many VTVM's have three test leads instead of two. It would seem that the difference between two and three test leads is a minor point. However, if you have ever had to take time to untangle three test leads and choose the two correct ones before using an instrument, you know that it is a big convenience to have only two test leads. Some VTVM's use two test leads and have a switch or an auxiliary probe for one of them. This also can be troublesome. The model W VTVM does not have these inconveniences.

The model W VTVM has additional features that make it easy to use. There are fewer calibrating controls. The test probes cannot pull out and get lost. The input circuit allows you to measure rf voltages without using a special detector probe.

Another important feature is that the metal cabinet and chassis of the Model W VTVM are not an electrical part of its circuit. In many instruments the cabinet is used as a circuit ground and there is direct electrical contact between one test lead and the cabinet. When voltage measurements are made in an AC-DC receiver, the "ground" or negative test lead will normally be connected to one side of the power line. Thus there will be direct electrical contact between the metal cabinet of the VTVM and one side of the power line. It is annoying and dangerous to be shocked when you touch the metal cabinet of a test instrument that is set up in this manner. Such a shock is impossible with a properly wired model W.

Now that you have seen what goes on inside of the VTVM, you will be better able to use the instrument and to repair it if it becomes defective.

——— *n r i* ———

New RCA Electronic "Eye" May Disclose Unseen Details of Planets

An extremely sensitive new electronic "eye" which may disclose previously unseen details of the planets and distant nebulae, permit visual reconnaissance in almost complete darkness, and provide a powerful tool for scientific research, has been developed by scientists of RCA.

The new device is a developmental, advanced type of camera tube, based on television principles and known as the Intensifier Orthicon. According to RCA, the new tube is probably 100 times more sensitive than the fastest known photo film for the same exposure time at extremely low levels of light. Operating on principles used in present television pickup functions, it can "see" in surroundings which appear completely dark to the human eye.

When it is used in a camera similar to those employed in television, the Intensifier Orthicon permits the viewing on a television-type picture tube of scenes at light levels far below those needed for pickup by standard Image Orthicon tubes.

Discussing the various possible applications, RCA has emphasized its value in astronomy as a viewing system coupled with a telescope to overcome the effects of atmospheric disturbances viewing planets. So far, it has been impossible for astronomers to clearly view the surface features of Mars and other planets because of such disturbances. In this respect, the new Intensifier Orthicon will be able to gather and display a clear image in a fraction of the time now required for the fastest photographic exposure providing astronomers with detailed information never before available.

> *"The name we leave behind us in the accumulaiton of all the big and little things we have done during our lifetime. . . . Each of us have something to contribute and no matter how small or insignificant it may seem, it can benefit all."*
> *Lauritz Melchior*

Chapter Chatter

(Continued from Page Nineteen)

and graduates in the Southeastern Massachusetts area really want to get together and help each other out.

The first such trial meeting was held at the home of Walter Adamiec, who took over at his service bench and broke out a 12-volt auto Radio with printed circuit board, and began trouble-shooting with an NRI Signal Tracer. This meeting was so successful that another one has since been held and it, too, was just as productive a meeting.

The Chapter wishes its members—as well as other NRI students and graduates in the area who may be interested—to know that it is *not* going to suspend meetings during the summer months. Regular meetings will continue to be held throughout the summer at 8 P.M. on the last Wednesday of each month at the DAV Hall, 120 Third St., Fall River, Mass. All NRI students and graduates in the vicinity will be welcome as guests or prospective members. Those interested should contact Chairman Michael Lesiak, 20 Cooper St., Taunton, or Secretary Ernest McKay, 16 Austin Court, New Bedford, Mass.

FLINT (SAGINAW VALLEY) CHAPTER, in accordance with its usual practice, has suspended its meetings for the summer months.

The final meeting of the season was a banquet held at Zender's Hotel in Frankenmuth, for which reservations were made in advance. Promptly at 7:30 P.M. the twenty members who attended sat down to a delicious dinner. After they had eaten all the chicken they could hold, a short business meeting was held and it was agreed to reconvene the second Saturday in September, when all members would be back from their vacations.

Beginning in September, then, regular meetings will again be held at 7:30 P.M. on the second Saturday of each month at Vice-Chairman's Aaron Triplett's Repair Shop, 2538 Walcott Street, Flint. All NRI students and graduates in the area are invited to attend the meetings. Contact either Vice-Chairman Aaron Triplett or Secretary George L. Hinman, 603½ State Street, Bay City.

MILWAUKEE CHAPTER has announced that it has suspended meetings for the

L to r: Chapter Member August Piechowski, Chairman Philip Rinke, visitor Ted Rose, Secretary Erwin Kapheim, and Treasurer Louis Sponer at a meeting of the Milwaukee Chapter.

months of June, July, and August.

At the last meeting of the season the chapter's latest project, construction of a TV Dynamic Board, was discussed. This took up the entire evening, and well it might, for this is a large project and one that requires the best efforts of the Chapter.

Beginning in September the Chapter will resume its regular meetings on the third Monday of each month at the Radio-TV Store and Shop of S. J. Petrich, 5901 W. Vliet St., Milwaukee. The Chapter extends a cordial welcome to all NRI students and graduates in the area to attend its meetings as guests or prospective members. Those interested should communicate with Secretary Erwin Kapheim, 3525 N. Fourth St., Milwaukee.

Milton Nunemacher, Technician for Pierce Phelps Corp., distributors for the Zenith Corp., speaking on Zenith portables at a meeting of the Philadelphia-Camden Chapter.

A few of the Philadelphia-Camden members who attended WCAU's Surprise Party and Guide Herb Walmer (kneeling) with two of three prizes won by the members.

PHILADELPHIA-CAMDEN CHAPTER is still swelling its ranks with new members. The latest of which we have a report are Charles Salzman, Nicholas Zandelback, John Naccarato, George Rudolph, Daniel Williams, Bert Lough, all of Philadelphia; Raymond Ricci, Newtown Square, and Leonard Sasso, Camden. Congratulations to each of these new members.

A group of new members attended a show and made a tour of the WCAU Radio and TV Studios. The show was called a "Surprise Party." After this show prizes were given to the guests and the Philadelphia-Camden group walked away with three of them. Even Secretary Jules Cohen, who never had won a prize before, finally won one this time, a beautiful ice bucket and cigarette lighter. The group was then taken on a tour through the studios. It was extremely interesting and was enjoyed by all who attended.

The June meeting featured a Philco Corporation 16mm sound movie film on Transistors, which the members remarked was one of the best films they had seen on transistors yet. The Philco Corporation goes all out on these things and the members feel they get quite a bit from them. The Bell Telephone Company also makes available such technical films that can be borrowed for the asking. Other chapters may be interested in this. Following the film the members held their annual mid-year party, which was also thoroughly enjoyed by all the members.

Mr. Milton Nunemacher, Technician for Pierce Phelps Corp., Distributors for Zenith TV, gave a very interesting talk on the Zenith portables. With portables being as popular as they are, the members feel they just can't get enough to satisfy them.

Arrangements have already been made for Mr. Russ Mauger, Service Manager for Sylvania TV, to attend the September meeting as a guest speaker.

The membership voted to hold only one meeting instead of the usual two in July and August. But beginning in September the Chapter will resume its regular meetings on the second and fourth Monday of each month at the Knights of Columbus Hall, Tulip and Tyson Streets, Philadelphia. While the membership of the Chapter is already large, it will nevertheless welcome any NRI student or graduate in the area who wishes to join. Get in touch with Secretary Jules Cohen, 7124 Souder St., Philadelphia.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER has devoted considerable discussion to undertaking a very worth-while project for the summer months, that of converting old television sets to sound only and donating the converted sets to blind people so they can listen to the programs we see on TV but without the picture. Leading the discussion, Chairman Berka explained to the members the problems involved, which components could be removed and which had to be retained and why. The members hope to convert several of these sets in the next few months.

A similar project was adopted by the Philadelphia-Camden Chapter, as reported in the last issue of the NRI News. It is good to see another Local Chapter of the NRI Alumni Association take up such a worthy program.

The Chapter has another innovation—awarding a cash door-prize of $20. The funds for this purpose are accumulated by each member putting in twenty-five cents and his name at each meeting he attends. When the sum thus accumulated reaches $20, the door-prize is then awarded the lucky member, on this condition: the money can be used only toward the purchase of test equipment of the lucky member's choice. Thus members have a double-barrelled reason for attending the meetings. They not only learn a great deal about practical radio-TV servicing but they might even be paid for it!

Any NRI student or graduate in the area will be heartily welcomed at the meetings, either as a guest or as a prospective member. For more information contact Chairman John Berka, 2833 42d Ave. S., Minneapolis. The Chapter meets at 8 P.M. on the second Thursday of each month at Walt Berbee's Radio-TV Shop, 915 St. Clair, St. Paul.

SPRINGFIELD (MASS.) CHAPTER is justly proud that the GE All-American Citation has been awarded to its popular and hard-working Technical Advisor, Lyman Brown. The award was presented by Robert K. Lyman, Manager of Soundco Electronic Supply Company and Honorary Member of the Chapter, on behalf of the General Electric Company. This citation was awarded Lyman Brown for his highly successful efforts in originating and directing the Chapter members in the annual Christmas Cheer Clinic, and for his work with the small fry in the sports field.

Robert K. Lyman presenting the GE All American Citation to Lyman Brown. L to r: Robert K. Lyman, Chairman Rupert McLellan, Secretary Howard Smith and Lyman Brown.

The Chapter held its final meeting of the season on June 20—having voted to discontinue meetings for the summer months—but not before arranging for its annual picnic in August. This annual picnic is always a big affair and we can expect to hear more about it later.

Regular meetings will be resumed in September. They are held at 7 PM on the first and third Friday of each month at the U. S. Army Headquarters Building, 50 East St., Springfield. The Chapter extends a warm welcome to all NRI students in the area to come to the meetings either as guests or prospective members. For more information about the meetings get in touch with either Chairman Rupert McLellan, 233 Grove St., Chicopee Falls, or Secretary Howard Smith, 53 Bangor St., Springfield.

NEW YORK CITY CHAPTER is trying out a new idea—a Reference List to enable its members to "trade" service calls. When Member "A" gets a service call which he feels is too far away, he refers it to the member on the Reference List who is nearest the call. This member in return refers to member "A" any too-far-away calls in "A's" neighborhood. Sounds like a good plan and promises to help both the public and the Chapter members.

The Chapter has suspended meetings during July and August. At the final meeting of the season Chairman Edward McAdams brought up the subject of Honorary Members on the Chapter's list, and asked the members to decide what they wanted to do in reference to this. Tom Hull gave his views on this subject then took over the floor as the principal speaker of the evening.

Tom spoke about a defect in the vertical circuit of a TV set where the vertical oscillator transformer was open. Next he discussed the Chapter's Radio set, explained how the antenna loop picks up the transmitted signal. He then showed on the Chapter's VTVM how the meter changed when a station was tuned in and out, and how the AVC kept the set from blasting each time a different station was tuned in. Following this, he explained how an automobile Radio has different features from a regular Radio and how these different features affect the operation of the set.

Switching to electric house circuits for a brief period, Tom discussed lighting and refrigeration connections, with the help of Dave Spitzer, then continued on the Chapter's RCA set, explaining the operation of each i-f transformer and the oscillator, showing how a signal from a generator can make a set play when the oscillator in the set is defective.

Also at this meeting, the membership voted to make Lou Kunert and Bert Wappler lifetime members of the Chapter. Willie Fox made one of his always-interesting talks on the experiences he has had in TV service work.

Students and graduates in the New York City area are always welcome at meetings. The Chapter will resume its regular meetings on September 4. They are held on the first and third Thursday of each month, 8 PM, at St. Marks Community Center, 12 St. Marks Place, New York City. The Chairman is Edward McAdams, 3430 Irwin Ave., New York City; the Secretary is David Spitzer, 2052 81st St., Brooklyn.

DETROIT CHAPTER enjoyed a variation from its regular meetings in the form of a tour of a picture tube rebuilding factory of the Midwest Electronics, Inc., Detroit. Their host was Mr. Frank Paternel of Frader Associates, Inc., Division of Midwest Electronics, TV Tubes Sales Division.

During the tour Mr. Paternel demonstrated the process of rebuilding picture tubes—how the neck (which contains the guns) is disconnected, the conductive coatings and screen are removed and washed clean. They then look like an empty milk bottle. Then a new screen is put in the face of the tube. Mr. Paternel explained that even the water had to be filtered because just a minute particle of dirt would otherwise roll on the fresh new screen and cause a scratch on it. Then the conductive coating, new guns and neck are installed. It is something to see the glass melt and weld together again on the neck of the tube, under the gas heat, without breaking the tube. In the next step the tubes are tempered in ovens and the air is pumped out and evacuated. Lastly, the tube is tested. Thus, everything is new except the bottle in a reprocessed picture tube. The members were profuse in their thanks to Mr. Paternel for a demonstration that few TV servicemen have seen.

Members of Detroit Chapter watching one of the processes in rebuilding TV picture tubes at Midwest Electronics, Inc., Detroit, Mich.

At a later meeting Earl Oliver and Ellsworth Umbreit again held a TV troubleshooting forum and demonstration on the horizontal multi-vibrator circuit on the panel board built previously by Ellsworth Umbreit. A preview of the sync separator and phase detector circuits was also held.

The chapter enjoyed the unexpected pleasure of a visit by Mr. Thomas McMullen, Chairman of the Los Angeles Chapter. A short discussion was held with Mr. McMullen on the programs and activities of the two chapters.

The Detroit Chapter cordially invites all NRI students and graduates in its area to attend its meetings. They are held at 8 PM on the second and fourth Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. The Chairman is John Nagy, 1406 Euclid, Lincoln Park; the Secretary is Ellsworth Umbreit, 12523 Racine Ave., Detroit.

NEW ORLEANS CHAPTER, as reported in the August-September, 1956, issue of the NRI NEWS, participated in opposing a proposed law for the licensing of Radio-TV technicians in Louisiana. The proposed law was killed in the legislature, partly as the result of the Chapter's efforts.

A similar law has been proposed in the state legislature again this year. And again the Chapter has lined up its forces to fight the bill. As of the time we go to press with this issue of the NRI NEWS, no report had been received as to the outcome of the proposed law.

Here is an excellent example of one of the important ways in which a Local Chapter of the NRI Alumni Association can serve the interests of its members. All NRI students and graduates in the New Orleans area who are not now members of the Chapter should give serious consideration to joining. You will be most welcome at the meetings, either as a guest or as a potential member. Write or telephone Secretary Louis Grossman, 2229 Napoleon Ave., or Secretary Patrick Boudreaux, 1015 Race St., New Orleans. The Chapter meets at 8 PM on the second Tuesday of each month, at the home of the Secretary.

PITTSBURGH CHAPTER Secretary Kenneth Shipley discussed low cost Hi-Fi and the changes necessary to install two speakers (instead of one) without using a crossover network. For the basis of this talk he used the article by NRI Consutant J. G. Dodgson which appeared in the April-May, 1958, issue of NRI News.

Tom Schnader and Tom Ward are getting ahead with wiring the Chapter's dynamic radio demonstrator and the Chapter hopes to begin using it in the near future.

Considerable discussion was devoted to self-service tube testers. Some members praised these; others lambasted them.

The latest member admitted to membership in the Chapter is Mr. Lawrence J. Stapf. A hearty welcome to you, Mr. Stapf.

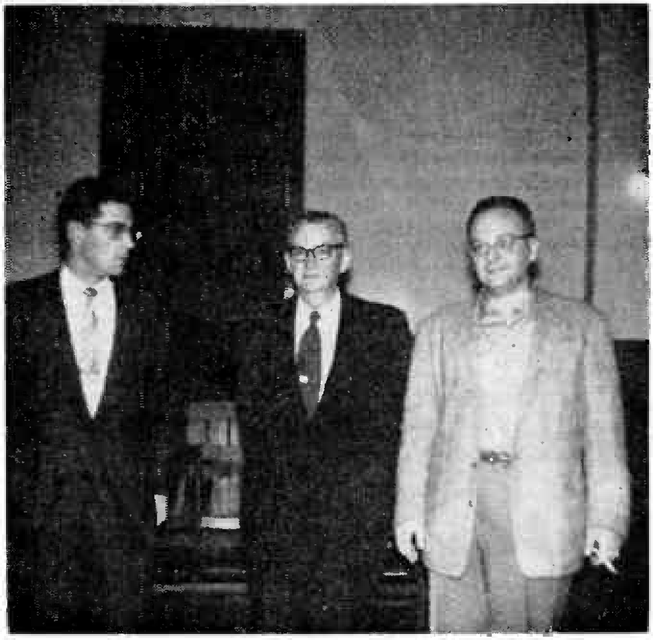
Chapter members are looking forward to a conducted tour of TV Station WIIC (Channel 11) to be made shortly after Labor Day. This is a tour that no member should miss if he can help it. Final plans for the tour will soon be made.

Any NRI student or graduate in the Pittsburgh area is welcome to participate in this tour and to attend chapter meetings as a guest. Meetings are held at 8 PM on the first Thursday of each month at 134 Market Place, Pittsburgh. For further information get in touch with Chairman Frank Skolnik, 932 Spring Garden St., or Secretary Kenneth Shipley, 1009 St. Martin, Pittsburgh.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER was delighted with an address by John C. Maycock, Electronics Engineer with Quality Control, Fairchild Aircraft, Hagerstown, Md., on electronics as used in aviation and in ICBM's. This talk was extremely interesting, covering as it did the various types of instruments, including radar, used in aircraft today—their development, also the evolution of the ICBM, types and the use of radionics employed to guide and operate these missiles. (No classified information was given, just the theory back of the different principles).

Chapter members decided to suspend meetings during July and August and to hold a banquet in September, the same place as in previous years, the VFW Club. The banquet will be free to all paid-up members; others will be required to pay for their dinner. Thereafter regular meetings will again be held on the second Wednesday of each month at the Northend Hagerstown Senior High School, Hagerstown. For more information about the banquet or the meetings, students and graduates in the area should get in touch with Secretary Edwin M. Kemp, 518 Sunset Ave., Hagerstown.

BALTIMORE CHAPTER was honored to note in its midst three graduates who are employees of the National Radio Institute. The Chapter was further honored to receive and speedily approve their request for membership. They are Dale Stafford, John E. Miller, and Nick Pittas.



Jack Thompson, assistant to Ted Rose and Associate Editor of NRI News; Ted Rose, Executive Secretary of the NRIAA, on a visit to the Baltimore Chapter. Right, Chapter Chairman Joseph Dolivka.

As customary at every meeting, Chairman Dolivka asked this routine question of visitors and new members in attendance, "are there any electronic problems which are bothering you"? Imagine his red face when he learned that one of the visitors to whom this question was posed was none other than Mr. Dale Stafford, NRI Consultant, author of the article "How Ohm's Law Is Used in Service Work" appearing in the June-July issue of the NRI NEWS!

As predicted in the minutes of an earlier meeting, Elmer Shue did get his electronic Banjo back from his grandchildren and stated "but it doesn't sound the same."

Bowing to persistent and frequent requests of Chapter members, Elmer has agreed to bring his color organ and electronic Twenty-One game to a meeting. Since these two items are calculated to command a great deal of interest and attention, the program for that meeting was modified accordingly.

All NRI students and graduates in the Baltimore area are cordially invited to attend the meetings, which are held at 8 PM on the second Tuesday of each month at 100 N. Paca St., Baltimore. The Chairman is Joseph Dolivka, 717 N. Montford Ave.; the Secretary is John Woolschleger, 1106 S. Lakewood Ave., Baltimore.

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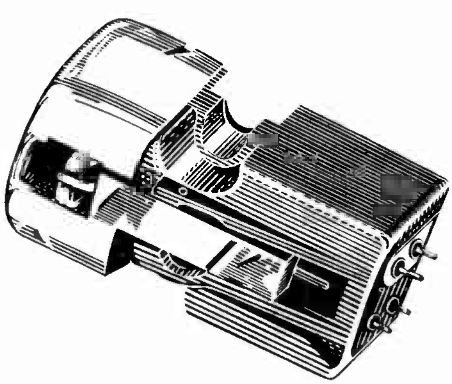
Hi-Fi Corner

By JOHN G. DODGSON
NRI Consultant

Stereophonic Discs. The Westrex 45/45 stereophonic disc system is a new method of recording stereophonic (two-channel) sound in a single groove on otherwise standard long-playing 33-1/3 rpm records. The term "45/45" comes from the method of cutting the groove on the record, which is a unique combination of the early "vertical" and modern "lateral" methods of cutting.

In the early days, modulation of the record groove was accomplished by a vertical movement of the cutter stylus. The stylus moved up and down according to the frequency and loudness of the program material. Later, much more satisfactory results were obtained by lateral cutting. That is, the cutter stylus was made to move back and forth according to frequency and loudness. Two sound channels can be placed in one record groove by modulating the groove vertically for one channel and horizontally for the other. This method was used by the London Record Co. and proved successful.



Artists Conception of the New General Electric Variable Reluctance Stereophonic cartridge.

To eliminate the inherent distortion of vertical cutting, Westrex modulated the record groove at a 45° angle to the record surface in one direction for one channel and at a 45° angle in the opposite direction for the other channel. Thus the term "45/45."

The stereo cartridge needed to reproduce the two channels uses one stylus coupled to two crystals or to two magnetic assemblies, depending upon the type of cartridge, each one designed to respond only to its angle of modulation.

The initial recording of the program material for the discs is the same as for stereophonic tape. For example, when recording an orchestra, two microphones are set up in front of the orchestra several feet apart and the output of each microphone is fed to a separate amplifier and recording head of a dual-track tape recorder. Each channel will record the instruments predominately on its side of the orchestra, and both channels will record the instruments in the middle. The amount specifically recorded on each channel or mixed between channels depends on the directivity and placement of the microphones, which is controlled by the recording engineers. Of course, to produce a monaural recording the engineer merely combines both outputs of the recorded stereophonic tape.

Unlike the electrostatic speakers of a few years ago, stereo-discs appear to be more than a fad, since the major manufacturing companies are investing a good deal of money in this latest innovation. Five record companies have already released over fifty different stereophonic discs, and the major companies are announcing the availability of discs in the very near future. In addition, a number of amplifier manufacturers already have stereo-amplifiers on the market. Among others are Bogen, Bell, Pilot and several kit manufacturers. All of the discs are cut with the Westrex 45/45 system and the Record Industry Association of American (RIAA) has already set up stereophonic disc recording standards.

I recently visited several sound rooms and heard impressive demonstrations of the stereo-discs. In one particular demonstration, inexpensive 8-inch speakers mounted in base reflex enclosures gave very satisfactory sound. This was directly compared to a single but much more expensive speaker system using the same cartridge, disc, and the two amplifiers in parallel. The less expensive stereo system sounded much better than the more expensive monaural system. No doubt two of the expensive speakers in a stereo set-up would have sounded much better than the inexpensive speakers, but the point is that it is possible, with stereo-discs, to obtain much more realism for the dollar.

GE Stereo: The General Electric Company has just released information on five brand-new products specifically designed for stereo-discs. First of all, their new stereo cartridge will be available in August and appears to be quite good. The specifications are excellent, and, as you might suspect, it is a variable reluctance type. The suggested price will be $23.95 with a .7-mil diamond stylus. From the artist's sketch of the new cartridge it appears to be physically similar to the VR2 cartridge GE brought out just last year.

To match the stereo cartridge, GE has also developed a special tone arm called the 'Stereo-Classic." Although the arm was designed primarily for stereo use, it is completely compatible with monaural records. It is designed to accommodate only GE cartridges, either stereo or monaural. The suggested price is $29.95. It appears to be a well-built arm, as was the earlier GE tone arm.

In addition to the new cartridge and arm, GGE has also come out with a new bookshelf-type speaker system and for the first time is offering the speaker system factory built or in kit form. The system includes a specially designed 6-inch woofer speaker and a new 2¾-inch tweeter speaker with a cross-over network. Finally, a new high-fidelity-equipment cabinet will be offered for a little over $100. It features modern furniture styling and maximum flexibility of component mounting.

Scott Stereo-Daptor. This unit is especially designed for using two conventional amplifiers in a stereo system. Although the ideal solution, when going to stereo is to replace the standard amplifier with a special stereo amplifier, this is quite expensive and many of us will be reluctant to do it, since it will probably be less expensive to purchase or build only one additional amplifier. To accommodate this, the Scott Stereo-Daptor provides complete control for such a setup. The unit contains a power switch and special outlets on the back for both amplifiers. Thus, they can both be turned on and off from the Stereo-Daptor. In addition to the power switch, a volume-loudness control permits complete control of both channels together. In addition to these functions, the unit provides input and output jacks for a tape recorder as well as a switching system to reverse the channels when necessary. There will certainly be a great need for a unit such as this and the Scott Stereo-Daptor appears to fill the bill quite well.

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Electricity From Heat

A working model of a thermionic converter —a device that produces electricity directly from heat—has been announced by scientists of the General Electric Research Laboratory, Schenectady, N. Y.

The new device, a combination of metal and ceramic disks surrounding a high vacuum, is the size of a quarter and produces electricity when the flame of a blowtorch is played upon it. The new converter, with its high vacuum, is in contrast to the original, which was filled with gas.

According to Dr. Virgil L. Stout, manager of the Physical Electronics Section, possible appplications could be found wherever a high temperature source of heat is available and a supply of electricity is needed. Any source of heat, nuclear or conventional, could be used. The converter, as a result, should prove valuable in a wide variety of applications, including aircraft, missiles, and satellites. It is estimated that converters the size of this will be capable of operating in the one to ten watt range.

Tube Popularity Contest

By D. B. LOONEY, *Chief Technical Clerk*

We have heard of beauty contests, Miss America contests and popularity contests, but have you heard of a Tube Popularity Contest? A large tube manufacturer, Sylvania Electric Products Co., recently decided to find out which of the many "Miss Vacuum Tubes" were the most popular. Over 10,000 "interviews" were made. Miss 6SN7 received high rating. Relative ratings of other tubes are shown in the accompanying table. The third most popular tube is 6CB6 with a rating of 50. This indicates that out of a total of 1000 tubes sold 50 of the tubes were 6CB6.

This table can be helpful in determining the number of tubes to stock. If you live in a locality that has both radio and TV receivers and want to stock 1000 tubes you would carry the number of tubes of each type as listed under the heading Popularity Rating. If you want to carry only 500 tubes divide the number by two. If you want to have a stock of 250 tubes divide the number by four, etc. Disregard the decimal fractions that you may obtain when making this division.

In many cases you will find the number arrived at will figure out to be less than 1. In such cases write down 1 as the number to stock. If you are stocking only 500 or 250 as mentioned above this may give you a number slightly over the desired 500 or 250. If you want to stock one each of the 25 most popular types, stock the first twenty-five types listed in the first column. If you are in a locality that has few TV receivers do not include the tubes that are listed only as TV tubes in making the above computations.

This popularity rating does not list the tubes as actually used in Radio-TV sets, but it is based on the sale of over 10,000 tubes sold on a nation-wide basis. It does not represent any particular locality or section of the country. Good judgment should be used in selecting a stock of tubes. Be careful and do not get your money tied up in slow moving tubes. If a certain make of receiver is present in large numbers in your community it may change the popularity rating of certain tubes. Watch your sale of tubes carefully and reorder accordingly. After all it is the popularity of tubes in your community that is of interest to you.

TUBE	POPULARITY RATING	CHASSIS
6SN7, A, B	60	R & TV
5U4G, A, B	57	R & TV
6CB6, A	50	R & TV
12AU7, A	40	R & TV
6BQ7A	40	TV
6AU6, A	38	R & TV
1B3GT	32	TV
6U8, A	27	R & TV
6BZ7	23	TV
6AX4GT	20	TV
6AL5	16	R & TV
6J6, A	16	R & TV
12AT7	16	R & TV
6BQ6GT, A, B	16	TV
12BH7, A	15	TV
0Z4	15	R
35W4	14	R
5OC5	13	R
1X2A, B, A/B	13	TV
6CD6G, A	12	TV
12BA6	12	R
6X8, A	12	R & TV
6W4GT	11	TV
6AF4, A	11	TV
35Z5GT	11	R
12BE6	10	R
6AQ5, A	10	R & TV
6S4, A	9	TV
6AV6	9	R & TV
12AX7	9	R & TV
6BK7A, B	9	TV
6V6GT, A	8	R & TV
6BA6	8	R & TV
6W6GT	8	R & TV
6BG6G, A	8	TV
6K6GT	8	R & TV
12BY7, A	8	TV
5Y3GT	7	R & TV
6BL7GT, A	7	TV
12AX4GT	7	TV
6T8, A	6	R & TV
5OL6GT	6	R
6BE6	6	R & TV
6CG7	6	TV
6AG5	6	R & TV
6AW8, A	5	TV
6AU4GT, A	5	TV
5U8	5	TV
1R5	5	R
6BC5	5	R & TV
35L6GT	5	R
25L6GT	5	R & TV
12SQ7	5	R
6C4	5	R & TV
12SA7	5	R
12SN7GT, A	4	R & TV
12B4, A	4	R & TV
12SK7	4	R
6J5	4	R
6BC8	4	TV

TUBE	POPULARITY RATING	CHASSIS
6DQ6	4	TV
12AV6	4	R
3V4	3	R
6AC7	3	R & TV
3CB6	3	TV
6AN8	3	TV
6AS5	3	R & TV
1U5	3	R
6AM8, A	3	TV
6SK7	3	R & TV
25BQ6GT, B	3	TV
12AV7	3	R & TV
6SQ7	3	R & TV
6X4	3	R & TV
4BQ7A	3	TV
12AU6	3	R
6CU6	3	TV
6SL7GT	3	R & TV
6AB4	3	R
6BN6	2	R & TV
6BZ6	2	TV
1U4	2	R
6BS8	2	TV
6BH6	2	R
6AU5GT	2	TV
7AU7	2	TV
12AT6	2	R
6AH6	2	R & TV
6X5GT	2	R & TV
6AK5	2	R & TV
6AH4GT	2	TV
6DE6	2	TV
6L6G, A, B	2	R & TV
6SA7	2	R & TV
6AU8, A	2	TV
6CM7	2	TV
35C5	2	R
6AT6	1	R & TV
6CL6	1	TV
12AZ7	1	TV
6AV5GA	1	TV
6BX7GT	1	TV
12DQ6, A	1	TV
5T8	1	TV
50B5	1	R
6V3A	1	TV
5AT8	1	TV
6CS7	1	TV
6SJ7	1	R & TV
5V4G, A	1	R
3BZ6	1	TV
6BK5	1	R & TV
6BJ6	1	R
6BF5	1	R & TV
6CE5	1	TV
12L6GT	1	TV
2AF4, A	1	TV
6BZ8	1	TV
6AT8, A	1	TV
5AQ5	1	TV
5AN8	1	TV
6AG7	1	R & TV
6AX5GT	1	R
12BR7	1	TV
12BQ6GTA, B	1	TV

TUBE	POPULARITY RATING	CHASSIS
19AU4, GTA	1	TV
6CS6	1	TV
*10DE7	1	TV
7N7	1	R
12X4	1	R
1T4	1	R
5X8	1	TV
6AQ7GT	1	TV
6BA8, A	1	TV
6BY5G, A	1	R
6CF6	1	TV
12W6GT	1	TV
25CD6GA, B	1	TV
25W4GT	1	TV
35Y4	1	R
3BC5	1	TV
*1G3GT	1	TV
6AS8	1	TV
6Y6G, A	1	R & TV
12V6GT	1	R
3BN6	1	TV
4BC8	1	TV
5AM8	1	TV
5BK7A	1	TV
6BN4	1	TV
6SC7	1	R
7C5	1	R
12BF6	1	R
12CA5	1	TV
12K5	1	R
50A5	1	R
3AU6	1	TV
*2CY5	1	TV
1S5	1	R
4BZ7	1	TV
5CL8	1	TV
5CG8	1	TV
6AK6	1	R
6BH8	1	TV
6BY6	1	TV
6CG8	1	TV
6CN7	1	TV
*6CQ8	1	TV
6CU5	1	TV
6J7	1	R
12AF6	1	R
12BL6	1	R
3AL5	1	TV
2D21	1	TV
33DT6	1	TV
5BR8	1	TV
6DT6	1	TV
6BU8	1	TV
5J6	1	TV
19T8	1	R & TV
25DN6	1	TV
2BN4	1	TV
8BY8	1	TV
6T4	1	TV
12AD6	1	R
12BZ7	1	TV
*6CZ5	1	TV

*Newly announced types, movement should increase rapidly as more tubes are put into initial equipment.

More Remarkable Than Ever: RADIO

By NELSON SYKES, William Esty Co., Inc.

In the midst of this television age, millions of people are rediscovering radio. Millions more have been enjoying radio all along, for it is still a miracle to most people that by merely turning a dial you can hear the President of the United States . . . a Beethoven symphony . . . a baseball game . . . the Academy Award presentations and truly amazing things are happening in radio today:

In Massachusetts, not far from Harvard University, stands a gigantic radio that can tune in sounds created before the first man walked on earth! The "programs" it receives were originally made when celestial bodies—millions of light years away—collided in space. Because of the enormous distance they have had to travel, their sound waves are just now reaching earth.

A new science, radio astronomy, was born in 1948 when the first radio "star"—a heavenly body that radiates sound on radio frequencies—was discovered. Now almost 500 such stars are known to exist.

Major tool of this new science is the radio telescope, whose half-ton antenna can pick up invisible radiations from the sun, stars, galaxies and other celestial bodies in the same way that household radios pick up programs.

Because of the similarity of radio waves and light waves, a radio astronomer can do far more than merely listen to this stellar static. He can view heavenly objects and plot their position in space by radio "light."

Result: we're getting a "map" of our universe. The importance of such knowledge for future flights through space is obvious. Yet none of this would have been possible if, back in 1865, Scottish scientist James Clark Maxwell hadn't discovered that light waves were both electric and magnetic. In 1888, Heinrich Hertz, a German, succeeded in generating electro-magnetic waves or radio impulses. Later, Sir Oliver Lodge and other scientists experimented with the Hertzian waves as a medium of communication.

These investigations led to the experiments of Italian Guglielmo Marconi, who in 1894, made a set of instruments that could actually send and receive messages. Two years later, he sent a radio message from ship to shore. The first international radio communication was accomplished in 1899, when a message was sent across the English Channel. In 1901, a message was transmitted from England to Newfoundland.

Improvements came so rapidly, that by 1921 it was possible to hear the New York Giants beat the New York Yankees in the World Series without leaving home.

The 20's were also the heyday of the crystal set, a crude but ingenious radio with a weak operating radius (25-50 miles).

It wasn't long before Americans rebelled at the idea of having to sit huddled about the radio to get their long-distance entertainment, so a "portable" radio was introduced. It weighed 90 pounds (41 pounds for batteries alone) and measured 3 feet x 1½ feet x 1 foot. It looked like a suitcase but was far more fragile. Technically, the "portable" was portable—*if* you had a weight-lifter in the family.

Few people did. Consequently, the portable radio slipped into temporary obscurity. But in 1937 the makers of Eveready batteries perfected something that started the portable radio boom. Using an entirely new principal of design, they made a radio battery smaller than anybody had been able to make before. Using the same principle, they've been turning them out progressively smaller until today some of their batteries are no longer than a cigarette, others no bigger than a shirt button! It's estimated that over 20 million portables now bring music, drama and news to Americans outdoors and in.

Radio really came into its own as entertainment in the 1920's, with the great popularity of the early Amos and Andy show. Those comedians paved the way for future laughs brought on by Ed Wynn, Jack Benny, Fred Allen, Bob Hope, and Red Skelton.

It wasn't long before the major networks, realizing their responsibilities to the public, scheduled news programs, variety shows, special events, political coverage, drama, symphonies and opera as well as popular music and comedy—to suit every conceivable taste.

Even today, despite the inroads of television, 150 million people listen to radio at least 20 hours a week. Most loyal fans are those between 20 and 34 years of age. Favorite listening time is from noon to

6 p.m. Peak listening hour is between 4 and 5 p.m.

Whose is the most listened-to voice in America? That honor stil belongs to Bing Crosby at least one of whose songs is being played somewhere in the country, every minute of every hour of every day. He is most heard in the summer months, as millions head for beach and mountains, their trusty portables tucked under arms and in picnic baskets.

While radio has transformed even the most isolated home into an entertainment center; it has altered civilization in other ways too.

Radio telephones aboard boats enable seamen to talk with other boats, the Coast Guard or parties on shore. Communication by radio makes the aviation industry possible. Arctic explorers keep in touch with civilization by radio. And right now, hundreds of miles above earth, a radio is hurtling through space at a dizzying 18,000 miles per hour, sending valuable information back to earth on cosmic rays, ionospheric temperatures and assorted weather determinants. Future satellites, armed with radios, will tell us even more. Someday, thanks in large measure to radios, man may be able to control his weather.

Meanwhile from the tiniest portable delivering a symphony to a Nevada gold minor, to the giants that scan our heavens, raido continues to broaden horizons.

—— *n r i* ——

The ABC's of Economics

The laws of economics are as important to everyone of us who earns a living as are the laws of nature.

It's true that in the Nation's present-day complex economy these fundamentals become involved and entangled. Literally millions of words are being written and spoken about economics and the part economics plays in our everyday life. It all seems to get pretty high sounding and complicated at times.

But occasionally someone comes along with a simplified statement that can, and should be understood by everyone. Such a statement was made recently. We'd like to pass it along:

"A. When wages outstrip, or outdistance, productivity, the cost of producing an item goes up.

"B. But what increases productivity? Two things. Better, more skilled workers, and better—probably more expensive—machines for them to use.

"C. But here's the rub. To the extent that increases in productivity per man-hour are the result of more and better machines, to that extent must a portion of the increased productivity go to pay for these new and better machines.

"D. Therefore, when, as in the past ten years in a substantial part of industry, wages and salaries rise more rapidly than productivity, there are bound to be the following results which we all are now experiencing.

"Prices continue to rise.

"And . . . this persistent rise in prices leads to an equally persistent decline in the value of savings accounts, insurance, pensions, and the like.

"And . . . we all say there has been an increase in the cost of living.

"Result: Inflation.

"Cure: Increases in wages and salaries must follow or accompany but not precede improved productivity. Wage and salary earners must not receive more than their equitable share of the gain from such improved productivity if business is to continue to attract the necessary capital to buy more and new machines which are so necessary for much of the productivity improvement."

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