National
ADIO-TV NEWS

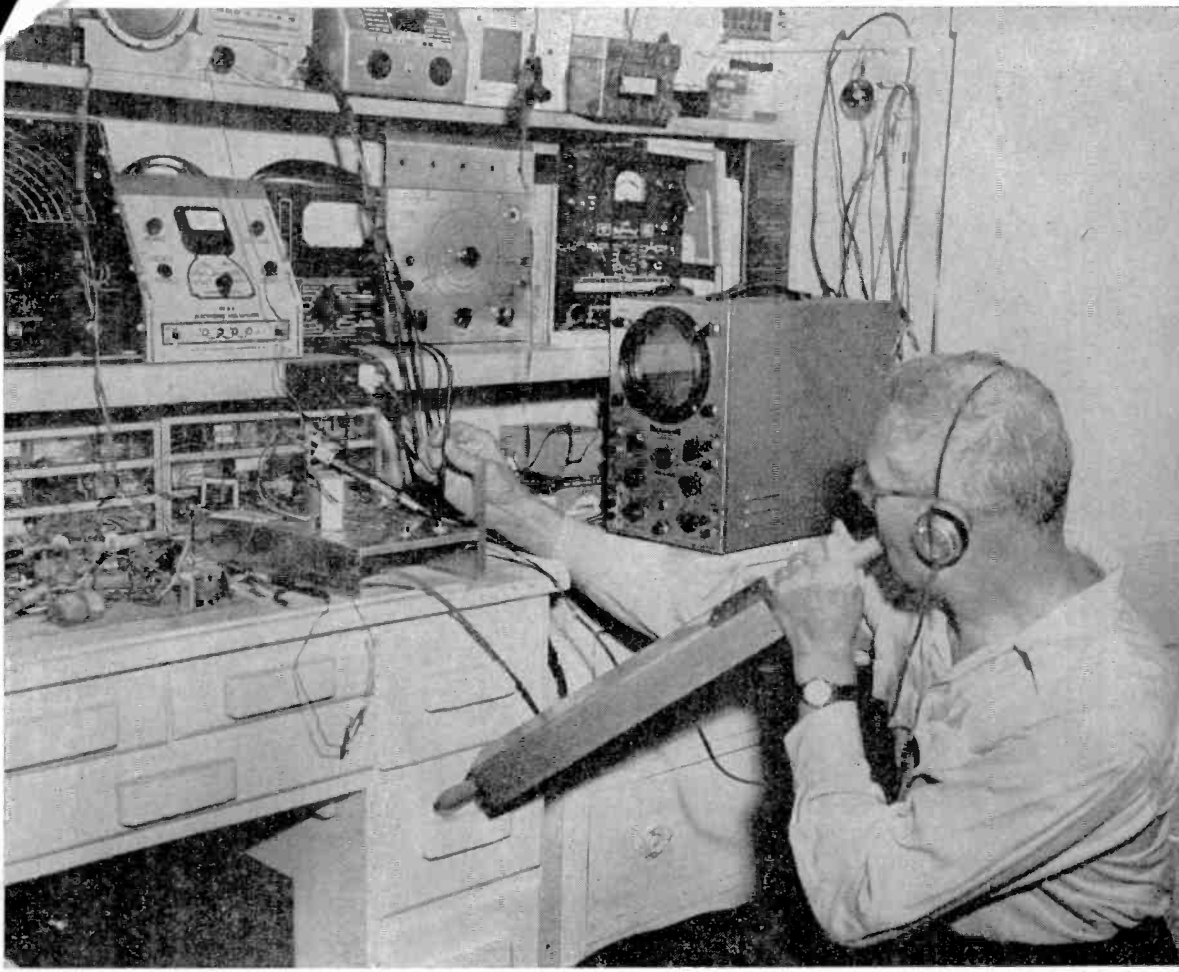

Photo By Lakeland Ledger

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Hi-Fi Corner

June-July
1958

VOL. 18
No. 3

Ah — Summer!

Summer always brings with it a strong temptation to relax our efforts—take a break—turn more toward outdoor activities. This temptation is always accompanied by its own excuses. The fellow next door is planning a fishing trip—man across the street is catching forty winks in a comfortable lawn chair—kids are out of school on vacation. If everyone else is taking it easy, why shouldn't we too? After all, it's just following the crowd.

But let's stop and think for a moment. True, some play and relaxation are necessary but it's easy to overdo it—at the expense of things that count more.

Keep a clear picture in mind of what is most important to you. Keep your goal in sight. Then when you feel the urge of a fishing rod or swimming pool, turn the situation to your best advantage. Roll up your sleeves; continue to work, study, *get ahead of the crowd.* It will mean so much more in the end.

J. E. SMITH
Founder

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Published every other month by the National Radio Institute, 3939 Wisconsin Ave., N.W., Washington 16, D. C.
Subscription, $1.00 a year. Printed in U. S. A. Second-class mail privileges authorized at Washington, D. C.

How Ohms Law is Used in Service Work

By DALE STAFFORD
NRI Consultant

Ohm's Law defines the relationship between voltage, current, and resistance (in a dc circuit) or impedance (in an ac circuit). Since resistance and impedance both refer to the opposition offered to the flow of current, no effort will be made to differentiate between them in this article. The term resistance will be used to refer to any opposition to current flow.

The current flowing in a circuit or through any part in a circuit depends on two things: (1) the voltage applied across the circuit or part and (2) the resistance of the circuit or part.

The current is directly proportional to the applied voltage. It will vary in direct proportion to any changes in the voltage. If the voltage is increased without changing the resistance, the current will increase. If the voltage is reduced without changing the resistance, the current will decrease. If the voltage is doubled, the current will double. If the voltage is cut in half, the current will be cut in half, also.

The current is inversely proportional to the resistance and will vary inversely with any change in the resistance. If the resistance is increased without changing the applied voltage, the current will decrease. If the resistance is reduced without changing the applied voltage, the current will increase. If the resistance is doubled, the current will be cut in half. If the resistance is cut in half, the current will be doubled.

These relationships make it easy for us to find one of these values if the other two are known. Three formulas are used for these computations. They are:

$$I = E \div R$$

$$R = E \div I$$

$$E = I \times R$$

In these formulas E stands for the applied voltage, R stands for resistance, and I stands for current. In calculations involving ac circuits, Z, which stands for impedance, is substituted for R in the formulas. Otherwise the formulas are the same.

Just why is Ohm's Law so important to the serviceman? Only on rare occasions is it necessary for him to use it in finding the value of a part needed as a replacement. Ordinarily, diagrams are available giving the value of the parts used in a radio or TV receiver. He needs only to glance at the diagram to obtain the information he needs.

The answer is that he uses Ohm's Law (perhaps unconsciously) every time he attempts to locate a defect in a receiver by measuring the operating voltages or taking resistance measurements. For example, suppose he finds that the voltage across a cathode bias resistor is too high. Because E equals I × R, he immediately knows that the resistor has increased in value or that

Dale Stafford

the tube is drawing too much current.

Or suppose he finds the voltage too high on a screen grid that has a dropping resistor between the grid and B plus. At once, he suspects that the resistor has decreased in value or that, for some reason, the tube is not drawing normal screen current.

The complaint may be a severe case of distortion. When our technician connects his VTVM across the grid resistor in the output stage, he finds a positive dc voltage on the grid. Normally, the grid does not draw current, and with no current through the grid resistor, there should be no voltage drop across it. Pulling the output tube (if it is an ac set) or disconnecting the coupling capacitor (if it is an ac-dc set) will enable the serviceman to determine if a gassy output tube or a leaky coupling capacitor is responsible for the trouble.

Another condition often encountered is that of an excessive voltage drop across a decoupling resistor in the plate circuit of a tube. This might be caused by a change in the value of the resistor. It could also be caused by some defect that caused the current through the resistor to increase, such as a leaky bypass capacitor on the plate side of the resistor, a shorted cathode bias resistor or bypass capacitor, or a defective tube.

It does not take a very large change in resistance or current to cause a considerable increase in the voltage drop across the resistor with a corresponding decrease in the voltage available at the plate of the tube.

Even if the serviceman does not know what the plate voltage or the voltage drop across the decoupling resistor should be, a tube manual will usually give him this information. These manuals list operating voltages and currents for typical operating conditions and a comparison of these voltages with those available in the receiver will usually make it possible to determine the approximate correct value.

These and many, many others are all practical applications of Ohm's Law. Automatically, almost unconsciously, the serviceman uses Ohm's Law to analyze circuit conditions even though he doesn't sit down with paper and pencil to calculate exact values.

However, there are certain occasions when he may find it necessary to make such computations. One such occasion might be in computing the value of a series voltage-dropping resistor in the filament circuit of a radio receiver. In ac-dc receivers, the tube filaments are connected in series and connected across the power line. If the voltage required for the tubes is less than the line voltage, it is necessary to insert a voltage-dropping resistor in the filament circuit to use up the excess voltage. This resistor may burn out, leaving no clue to the proper value.

To find the value of this resistor, it is first necessary to find out how much voltage must be dropped across it. Adding the voltage drops across all the tubes, and subtracting this figure from the line voltage gives us this value. Of course, tubes in these sets are designed to operate with the same value of filament current, and this current must also flow through the resistor. Dividing the voltage drop across the resistor by the filament current gives us the value of the resistor.

If the resistor is a chassis-mounted resistor, it is necessary to compute the required wattage rating of the replacement to be sure that the necessary amount of heat can be safely dissipated. This can be found by multiplying the voltage drop across the resistor by the resistor current. To allow a margin of safety, a higher value should be used (at least 1½ times the computed value).

If a line-cord resistor is used, there is no need to figure the wattage as these resistors can dissipate more heat than they will ever be required to.

A serviceman may find it necessary to figure the value of a cathode bias resistor to be used in a circuit he is wiring or to replace a burned-out resistor whose value is unknown. A cathode bias resistor carries the plate and screen-grid currents of the tube. The current through the resistor can be found by adding the plate and screen-grid currents which will flow at the value of plate voltage used. Again a tube manual can be used to determine the approximate value.

The bias voltage developed across the resistor will be equal to the current through the resistor multiplied by the value of the resistor (E equals IXR). The proper resistor value can be found by dividing the bias voltage needed by the current through the resistor (sum of plate and screen grid currents).

Pilot lamps in many receivers are connected in series with the tube filaments. When this is done, it is necessary to protect the lamp against excessive current flow. This can be done either by shunting the lamp across a portion of the rectifier tube filament or by connecting a small resistor in series with the filament circuit and connecting the lamp across the resistor.

The resistor is chosen so that the voltage drop across the resistor and lamp will be 4.25 volts when the normal filament current is flowing. The resistor must carry a current equal to the

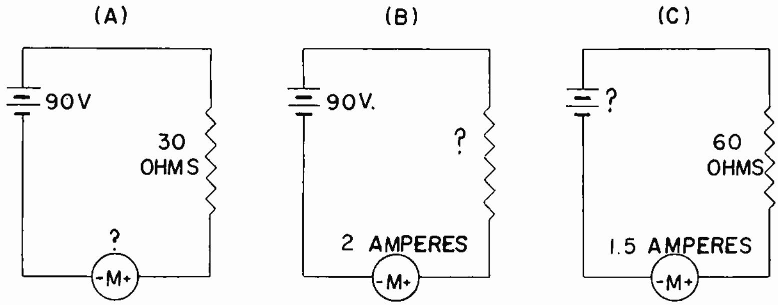

Fig. 1. Ohm's Law in use.

difference between the current rating of the lamp and the current rating of the tubes.

The proper resistance value can be found by subtracting the current rating of the lamp from the current rating of the tubes and then dividing 4.25 by this figure.

Many other applications of Ohm's Law will be encountered in practical servicing work. The busy technician uses his knowledge of this subject every hour of every day. Whether he uses it to figure the exact value of a new or replacement part or merely to interpret the meaning of measurements he has taken, he finds it one of the most valuable "tools of the trade."

There are other reasons why the student of electronics should know the subject thoroughly. Not every student starts his own shop when he completes his training. Many go to work for others. Before a company hires a technician, he will be required to take a written or oral examination to prove that his training is adequate. Quite likely several of the questions will be on practical applications of Ohm's Law.

Those who go to work for someone else may find themselves helping to design and construct circuits of many kinds. Perhaps one may be helping an engineer with design work while another is doing maintenance work on old circuits that must be modified or rewired.

If one of these men is asked by his superior to compile certain information, he must know how to obtain that information as quickly and accurately as possible. For example, if he is asked for the current flow through a resistor, he should know that measuring the voltage drop across it and dividing this figure by the value of the resistor is a quicker and easier method of finding the current than actually measuring the current with a meter. To measure the current, the circuit must be broken so the meter can be inserted in series with the current, the measurement must be taken, the meter removed, and the circuit reconnected. Unless the meter is connected as a permanent part of the circuit, the first method is, naturally, preferable.

The following are some examples of Ohm's Law in use:

In Fig. 1(A), we have a simple dc circuit consisting of a resistor in series with a battery.

If we know the battery voltage and the resistance, we can find the current. Suppose the battery voltage is 90 volts and the resistance is 30 ohms. Since $I = E \div R$, the current through the resistor is 90 divided by 30, which equals 3 amperes.

If the battery voltage and the current are known, as shown in Fig. 1(B), the resistance can be found. Here the battery voltage is 90 volts and the current is 2 amperes. $R = E \div I$, so the resistance equals 90 divided by 2, or 45 ohms.

If both the resistance and current are known, the battery voltage can be found. (Fig. 1(C). Here the resistance is 60 ohms and the current is 1.5 amperes. $E = R \times I$, so the battery voltage equals 60×1.5, or 90 volts.

The same procedure can be used in simple dc series circuits containing several resistance values in series, as shown in Fig. 2.

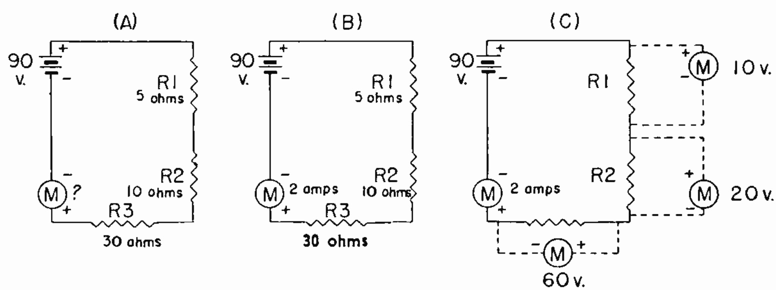

Fig. 2. Ohm's Law in dc series circuits.

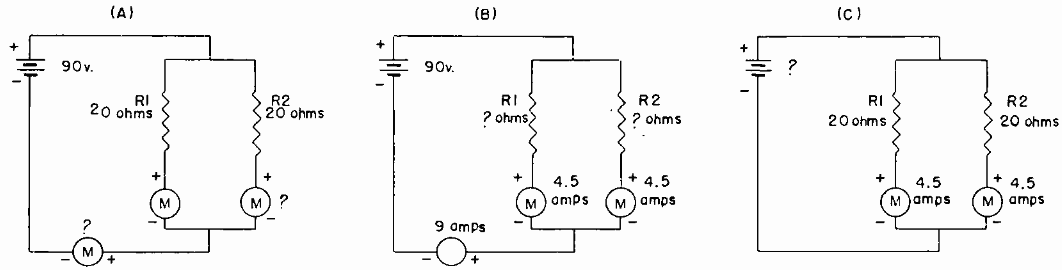

Fig. 3. Ohm's Law in dc parallel circuits.

In Fig. 2(A), we have three resistors of known value in series with a 90-volt battery. The first step in finding the current is to add the value of all the resistors to find the total circuit resistance. (Rt=R1+R2+R3, 5 + 10 + 30). We find the total resistance to be 45 ohms. Then, using the formula E÷R=I; we have 90 divided by 45, which equals 2 amperes, the circuit current.

In Fig. 2(B), we have three resistors of known value in series with a battery. If the circuit current is known, we can use the formula E=I×R to find the voltage across each resistor, since in a series dc circuit the same current flows through each part in the circuit. In this case, 5 × 2 equals 10 volts (the voltage across R1), 10 × 2 equals 20 volts (across R2), and 30 × 2 equals 60 volts (across R3).

In Fig. 2(C), we have the same circuit except that we do not know the value of the resistors. Since R=E÷I, it is easy to find the total resistance of the circuit by dividing the battery voltage by the circuit current. However, we need to know the voltage drop across each resistor to find the value of each. Measuring these voltages, suppose we find 10 volts across R1, 20 volts across R2, and 60 volts across R3 as shown by the dotted lines in the figure. Then 10 divided by 2 equals 5 ohms (value of R1), 20 divided by 2 equals 10 ohms (value of R2), and 60 divided by 2 equals 30 ohms (value of R3).

We can find unknown values in parallel dc circuits in the same manner. In Fig. 3(A), a 90-volt battery is connected in series with two parallel-connected 20-ohm resistors. Since I=E÷R, the circuit current will be equal to 90 volts divided by the equivalent resistance of the parallel-connected resistors. Let's see how to find the equivalent resistance.

If resistors of equal value are connected in parallel, the equivalent resistance of the combination is equal to the value of one of the resistors divided by the number of resistors used. In this case, 20 divided by 2 equals 10 ohms. Had the resistors been of unequal value, the formula $\frac{R1 \times R2}{R1 + R2}$ could have been used to find the equivalent resistance.

The circuit current will be 90 divided by 10, or 9 amperes. In a parallel circuit, the total current divides among the various branches in proportion to the resistance of each branch. Since the resistors are equal in value, each branch will draw half the total current, or 4.5 amperes.

In Fig. 3(B), we know the battery voltage and the circuit current, but, to find the value of

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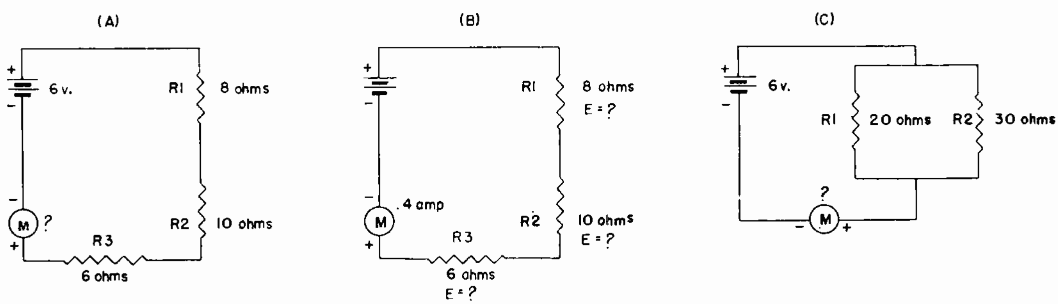

Fig. 4. Problems.

Answers: Fig. 4(A), .25 amp.; Fig. 4(B), R1—3.2 volts, R2—4 volts, R3—2.4 volts; Fig. 4(C), .5 amp.

Our Cover Photo

Cover photo for this issue shows Graduate Arthur Stopes of Auburndale, Florida, at work in his home laboratory. Mr. Stopes, a representative of the Wicks Organ Company, honorary charter member of the American Academy of Organ and member of our own Alumni Association makes his living and hobby servicing, installing, and selling electronic as well as pipe organs.

He is now working experimentally toward creation of a new electronic organ and is shown blowing into an organ pipe and checking the wave pattern on his scope. Mr. Stopes uses this precise method to reproduce "carbon copies" of an original tone.

The following article written by Marion Foster, Staff Writer for the Lakeland Ledger appeared in a recent issue of that newspaper. We felt it would be of interest to our readers. It is therefore reprinted in its entirety for the benefit of our readers with permission of the Lakeland Ledger.

———*n r i*———

"Lakeland's Own Organ-Builder Gets American Academy Certificate"

By MARION FOSTER

Ledger Staff Writer

"Lakeland's only organ builder, Arthur Stopes—who worked three-and-a-half years installing the world's largest organ in the Atlantic City convention hall, and who once made a pipe organ out of 270 beer cans as a novelty gag—is now the recipient of two certificates from the American Academy of Organ.

One of these documents bestows upon him honorary charter membership in the academy, and the other is the organization's certificate of merit.

In his 36 years of organ work, Stopes has tinkered with every kind of those in merry-go-rounds and skating-rinks to palatial instruments in homes of millionaires, but most of his work has been in churches, as it is today.

Though an expert in the mechanics of a musical instrument, Stopes can't read one note of music. Like Irving Berlin, he plays entirely by ear. He attributes this situation partly to the fact that his mother, a French Canadian concert pianist who performed under the stage name of Eva Plouffe, tried too hard to get him to play the piano, producing an emotional block.

(*Continued on page* 22)

A Quick Look at the Washington Hi-Fi Show

By JOHN G. DODGSON

NRI Consultant

Recently the Washington High-Fidelity Music Show had a 3 day stand at the Shoreham Hotel. This was the fourth show of its type in Washington and appeared to be more successful than the other three. At least the number of visitors and amount of noise seems to increase with each show. Audio shows are all alike in one respect—every exhibitor attempts to drown out the others and many, unfortunately, do a good job.

Because of the tremendous amount of noise, large numbers of people, and acoustically poor rooms, it was difficult to judge any equipment properly. The shows, however, do serve a useful purpose in acquainting us with the new developments, because even though there are a great number of audio showrooms in this area, it is practically impossible to visit all of them frequently. Any interesting items exhibited at the show can be examined more closely under better conditions at the individual showrooms.

At every audio show, certain developments are in vogue and the show is saturated with them. In 1956 (the last show) electrostatic speakers held the limelight. The current show had an obvious lack of electrostatics—in fact, I saw only one.

This year, the emphasis was on stereophonic sound—both stereophonic tape and the new stereophonic discs. Although this was very interesting, it had one undesirable effect. Because most of the amplifier and speaker systems were being run stereo-wise, it was difficult to judge the equipment, particularly the speaker systems.

Most of the exhibitors used standard tape stereo, however, there were several demonstrations of the new Westrex system of disc stereo. Both Electro-Voice and Fairchild stereo cartridges were exhibited using Audio Fidelity and RCA stereo discs.

The stereo disc demonstration was very impressive. It seemed to be outstanding in all ways although because of the conditions under which it was heard, it was difficult to compare the stereo disc to standard stereo tape. It was also not possible to compare the relatively inexpensive ($20) Electro-Voice cartridge to the more expensive ($70) Fairchild cartridge.

The only records available for the stereo disc demonstration were one Audio Fidelity record and one RCA record. The RCA disc was a com-

(*Continued on page* 21)

Trouble-Shooting A Color Receiver

By JOSEPH SCHEK
NRI Consultant

Joseph Schek

Here is an article that graduates and advanced students who are ready to start servicing color TV receivers will find interesting. It deals with trouble-shooting procedures in a color TV set.

The procedure for trouble-shooting a color receiver is quite similar to the procedure for trouble-shooting a monochrome receiver. First, the picture on the screen should be closely observed so that a diagnosis of the picture fault can be made. Then, an effect-to-cause analysis is made to check those sections of the receiver which would be most likely to cause the trouble. Once a decision has been made as to the stages probably causing the trouble, the defect can be found more rapidly. It is important to observe the effect of the defect on the operation of the receiver very carefully before starting the servicing procedure. Because of the large number of stages in a color receiver, a great deal of time can be wasted if the fault as it appears on the screen is not analyzed properly.

After deciding the order in which stages should be checked, the first service step is to check for a bad tube. A reliable method is to substitute a tube known to be good for the one being checked. You can get at the tubes by taking off the back cover. Many sets also have removable tops. If no bad tube is found, the second step is to trace the signal through the set until the stage that contains the trouble is located.

In our discussion, we will assume that a color-bar generator and a wide-band scope are available. When looking for trouble in a color receiver, it is necessary to have color signal—either a signal from the station or one from a test instrument, such as a color-bar generator. Since color broadcasts are transmitted rather infrequently, it is almost essential to have a color-bar generator to check all sections of the color receiver.

Troubles in a color receiver fall into two main divisions, monochrome and color. Monochrome troubles are those that cause faulty reproduction of a black-and-white picture. They will also cause unsatisfactory reproduction of a color picture. Color troubles can also be divided into different types. We will take up those that cover the symptoms of no color, weak color, and loss of color synchronization. No color covers all troubles which cause the complete loss of color in the reproduced picture. Weak color covers all troubles in which the receiver is producing colors, but they are too light. Lack of color synchronization is indicated by diagonal or horizontal stripes of different colors, which move about on the screen.

Checking Monochrome Operation

In a color TV set, the signal that carries the brightness information is called the luminance signal. Other signals carry the color information. When a monochrome (black-and-white) picture is being reproduced, only the luminance signal is used.

The first step to follow when starting to trouble-shoot a color receiver, is to tune in a black-and-white signal and check the appearance of the picture. If the results are good for monochrome reception, you know that all the circuits which have to do with the reproduction of a monochrome picture are functioning properly. This means that the luminance signal is reaching the picture tube correctly. If the monochrome pic-

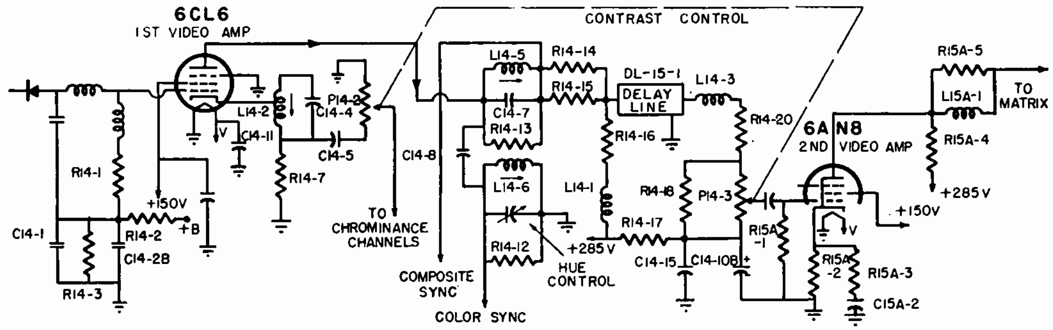

FIG. 1. Luminance section of a color TV set.

ture is not normal, the color picture will also be unsatisfactory since to form a color picture, the luminance signal is combined with the color signals; therefore, any monochrome troubles must be cleared up before considering the operation of the receiver on a color signal.

Trouble-shooting the black-and-white section of the color receiver is the same as for a standard monochrome set. The stages to be checked are those through which the luminance signal passes. These are the rf, i-f, and video detector stages, and the luminance channel. The luminance channel in most color receivers consists of two stages of video amplification, and it should be noted that both the luminance and chrominance signals pass through the first video stage. At the output of the luminance channel, which is the plate circuit of the second video amplifier, the luminance signal is coupled either to a matrix section or directly to the picture tube. Let's take up the defects that may affect a monochrome picture.

Loss of Monochrome Picture. If the symptom is a loss of the monochrome picture, the cause of the trouble is somewhere between the input of the receiver and the output of the luminance channel. The same procedure used for trouble-shooting for loss of the picture in a monochrome receiver is also followed in this case. However, since we are working with a color receiver, we can use the color-bar generator in isolating the stage or stages in which the cause of the trouble exists.

The procedure is to connect the rf output of the color-bar generator to the antenna terminals of the receiver, and see if color is observed. (The colors will not be of the proper brightness levels because of the lack of a luminance signal.) If color is observed on the screen, we can assume that the stages up to the point where the chrominance signal is separated from the composite input or video signal are operating properly. This indicates that the probable cause of the trouble lies somewhere between the stage in which the chrominance take-off point is located and the output of the luminance channel.

Fig. 1 shows the luminance section of a typical color set. In this set it would be necessary to test only one tube, the second video amplifier. If substitution of the tube does not clear up the trouble, the circuit between the output of the first video amplifier and the plate circuit or output of the luminance channel should be checked. An oscilloscope can be used to check the signal at the input and output of the second video amplifier. Then, voltage and resistance checks should be made to pin-point the faulty component.

If color is not seen when the rf output of the color-bar generator is connected to the antenna terminals of the set, the circuit defect is probably located between the input of the receiver and the point where the chrominance signal is separated from the composite video signal. With the usual methods of trouble shooting, the defective tube or part can be located. As you can see, the color-bar generator is very helpful even when checking sets for loss of the black-and-white picture.

Improper Gray Scale. Some circuit troubles will prevent the color receiver from reproducing the proper values of gray. For example, a monochrome picture may have an overcast of a particular color instead of values of gray.

When a color set cannot reproduce values of gray, the circuits that control the voltages applied to the various elements of the picture tube should be checked. There may be a defective tube or circuit part, or one of the picture tube guns may be defective. Fig. 2 shows the matrix section and the color picture tube circuits in the CBS Model 205. The black-and-white or luminance signal in this receiver must pass through separate matrix channels to reach each gun of the picture tube. A faulty tube or component in one of these channels will affect the ability of the receiver to reproduce satisfactory tones of gray.

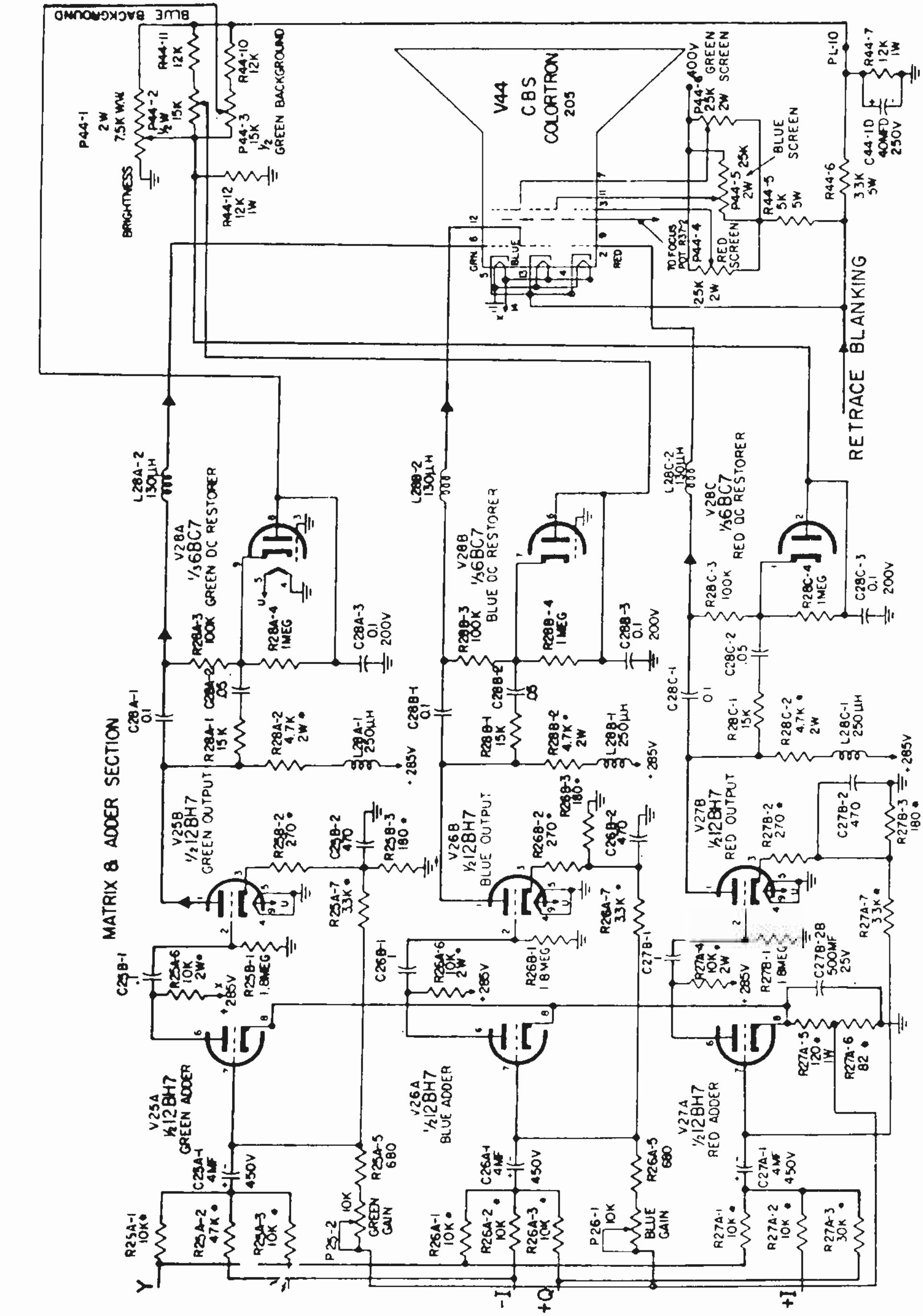

FIG. 2. Matrix section and color picture tube circuit of a color TV set.

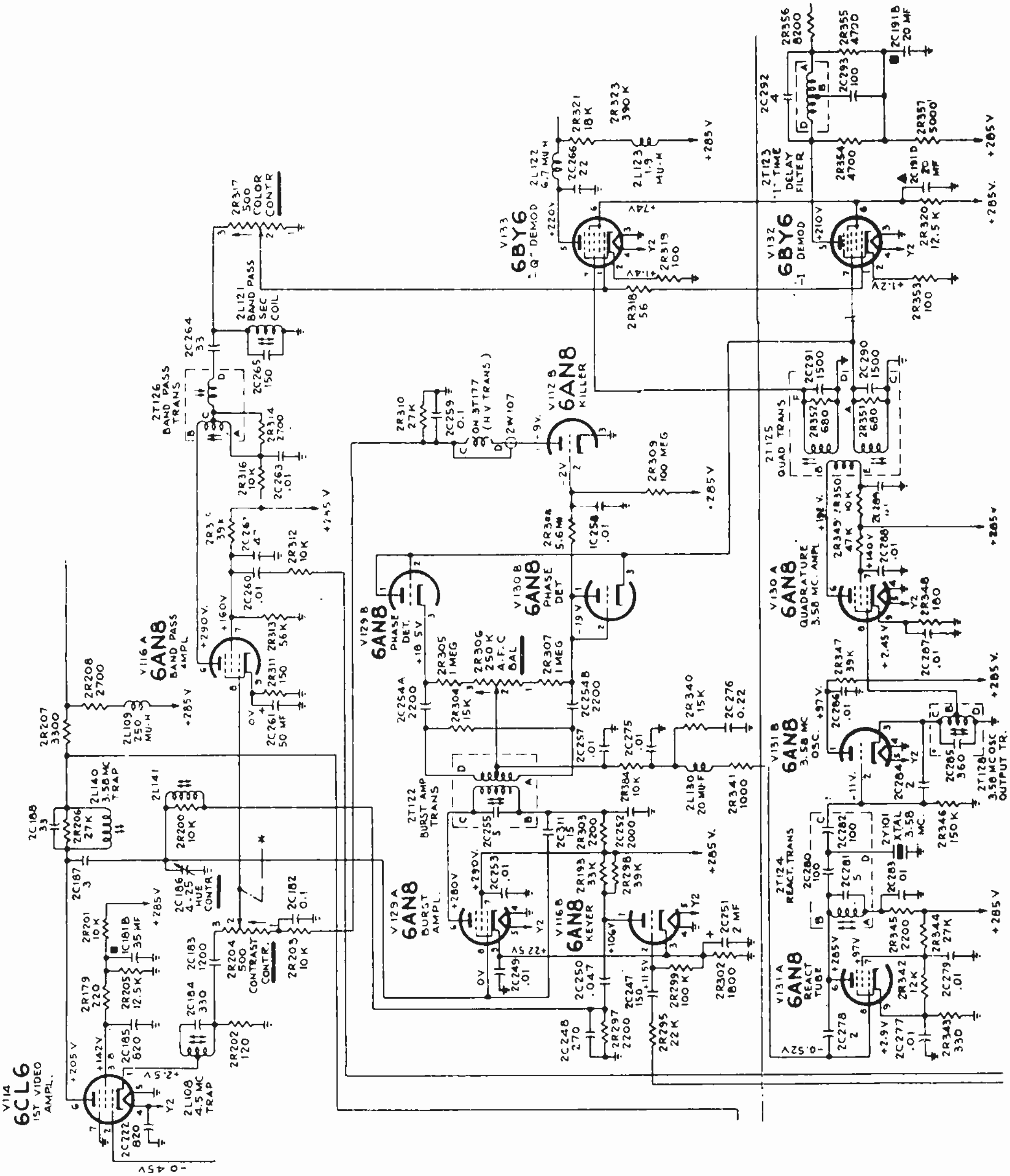

FIG. 3. Color circuits used for RCA Model CT-100.

One way of checking to see whether or not the trouble is in the matrix section is to reduce the setting of the contrast control so that no video signals are seen on the picture tube screen. If the raster is gray, then the cause of the trouble is in the matrix section. If the raster is not gray, but is colored, the screen voltage to one of the guns is not correct or one of the guns in the picture tube is defective. The screen voltages can be checked at the picture tube socket; and if the voltages are found to be incorrect, conventional servicing procedures can be used to locate the cause.

If the defect is in the matrix section, the tubes associated with monochrome reproduction should be checked. These include the tubes used in the adder and output stages and the tubes used as dc restorers. If replacing tubes does not remedy the trouble, the chassis should be removed and the faulty stage located by using an oscilloscope to trace the signal through the suspected channel. When the defective stage is located, standard voltage and resistance checks should be made to pin-point the faulty part.

Hum on Monochrome Pictures. Certain troubles in the color circuits of a receiver can affect monochrome reproduction. For example, leakage between the filament and cathode of a tube can cause hum to modulate the luminance signal. Hum that develops in one of the color circuit stages is not difficult to isolate, because the color of the hum bars produced on the screen will indicate which section is at fault.

It is also possible for hum to develop in the matrix section and to reach the control grid of only one of the guns in the picture tube. In such a case, the colors of the hum bars produced on the screen will show which gun is receiving the hum modulation. Hum that modulates the red gun will cause red and cyan bars to show on the normally black-and-white screen. To correct this trouble, replace one at a time, each tube in the chrominance section, beginning with the demodulator stages until the hum disappears. Replacing the faulty tube will generally correct the trouble.

Complete Loss of Color

If the operation of the receiver is normal for monochrome pictures, the next thing is to test its operation for color reproduction. The first symptom we will take up is complete loss of color. A color-bar generator can be used to track down the section of the receiver responsible.

Testing With an RF Signal. After the receiver has been tested for normal monochrome operation, apply the output signal of the color-bar generator across the antenna terminals of the receiver. While the rf signal is being applied to the receiver, the color saturation control should be turned up nearly to maximum, and the fine-tuning control should be varied throughout its range. The saturation control is set to maximum because the receiver might be capable of producing color, but of very low amplitude. In some color sets, complete lack of color can also be caused by misadjustment of the hue control; therefore, it should also be rotated throughout its range.

If the colors are correctly reproduced when the rf signal from the color-bar generator is being received, the original complaint may have been caused by misadjustment of the color saturation control, the hue control, or the fine-tuning control. Also, the antenna may not be properly oriented or the lead-in wires may be defective. These operating and antenna defects may be present without seriously detracting from normal monochrome operation, but still reduce the chrominance part of a composite signal enough to affect the color.

Testing With a Video Signal. If color is not seen when the rf color signal is applied to the antenna input terminals of the receiver, the next step is to inject the video signal from the color-bar generator at the video input of the receiver. In most cases, the terminals of the generator can be connected to the input of the video section without removing the chassis from the cabinet. If the video diode detector crystal is accessible on top of the chassis, the output lead of the generator can be clipped to the output terminal of the crystal. Probably you will find this procedure the most convenient one to use.

Another method is to use an adapter socket between the first video amplifier tube and its chassis socket. The clip lead of the generator can be connected to the terminal that leads to the control grid of the video amplifier tube.

A third method that can be followed if neither of the other two procedures can be used is to remove the first video amplifier tube, and bend one end of a piece of hookup wire around the control-grid pin. Replace the tube, being careful not to short the lead to any of the other pins or to the chassis. With the tube firmly seated in its socket, the output lead of the generator can be connected to the uncovered, loose end of the wire. By applying the video signal from the color-bar generator, the trouble can be localized either to the rf and i-f sections or to the chrominance sections.

Color Lost in the RF and I-F Sections. If color does appear, the trouble is in the rf and i-f sections. The alignment of the rf and i-f sections should be checked in accordance with the manufacturer's alignment procedures. The response of these sections must be broad and flat in order for the chrominance signal to pass. The frequency response characteristics could be incorrect and not affect the quality of the monochrome picture.

Color Lost in the Chrominance Sections. If color is not reproduced when the video signal from the color-bar generator is applied to the video circuits, the trouble is in the color circuits. The

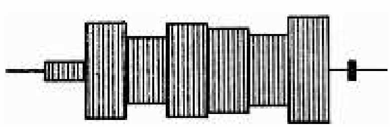

FIG. 4. Waveform of chrominance signal at input of demodulators.

color circuits which are to be checked are shown in Fig. 3.

The first service step is, as usual, to check the tubes in the stages most likely to cause the trouble, when defective. These are the tubes in the band-pass amplifier, the color afc, and the color-killer circuits. It is not necessary, at first, to test the color-demodulator tubes, because both would have to be defective at the same time in order to cause a complete loss of color. This would be a rare occurrence.

There are a total of nine stages in the color section of the receiver shown; but because some

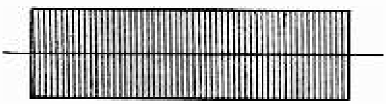

FIG. 5. Waveform of 3.58-mc reference signal at suppressor grids of demodulators.

use dual-purpose tubes, there are actually only five tubes to be checked. The band-pass amplifier and the burst keyer are in one tube envelope; the burst amplifier and one phase detector are in another; the 3.58-mc reference oscillator and the afc control reactance tube are in a third; the quadrature amplifier and the other phase detector are in a fourth; and the color-killer and the fifth video i-f amplifier, which is not shown in this part of the schematic, are in a fifth.

If replacing these tubes does not restore color reproduction, the cause of the trouble is the failure of a component within the circuits being checked. Let's see what a logical trouble-shooting procedure would be. We will assume that the chassis is out of the cabinet, and a video signal is being applied to the input of the first video amplifier.

The most logical place to start looking for the cause of the trouble is in the inputs of the color demodulator or synchronous detector stages. These are the 6BY6 tubes, VI 32 and VI 33 in Fig. 3. In order for them to operate normally, the chrominance signal must reach the control grids of these stages and the CW reference signals must reach the suppressor grids. If either the chrominance or the reference signals are missing there will be complete color loss.

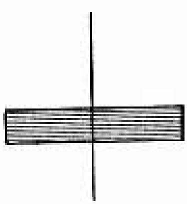

FIG. 6. Waveform of burst signal at input of phase detectors.

With an oscilloscope, check for the chrominance signal at the control-grid of the demodulators, and for the CW reference signals at the suppressor grids. The chrominance signal should be similar to the one shown in Fig. 4 and the CW reference signals like Fig. 5. (The exact patterns will vary, depending upon the type of color-bar generator used.)

1. *Chrominance and CW Reference Signals Present.* If the chroma signal and the CW reference signals are present, the trouble is probably in the demodulator stages themselves. Since the symptom we are discussing is a complete lack of color, the defect must be in a circuit common to both demodulators or both tubes would have to be bad at the same time (which rarely happens). In the circuit of Fig. 3, the screens of the two demodulators are returned to the voltage source through a common 12.5K-ohm resistor. If this resistor were to open, no voltage would be supplied to the screens and neither demodulator stage could operate. Similarly, a defect in the 20-mfd capacitor by-passing this resistor would affect both stages.

2. *Reference Signals Present but Chrominance Signals Lacking.* If the reference signals are present at the color demodulators but no chrominance signals are present at the control grids, something is preventing the chrominance signal from passing through the circuit of the band-pass amplifier, V116A.

Check back through this circuit with the oscilloscope until you find the signal. You then know that the cause of the trouble is between this point and the input of the demondulators. For example, if the signal is present at the input grid of the band-pass amplifier but not at the plate, the loss of the signal may be caused by a drop in plate or screen voltage or it could be caused by the fact that the stage is held at cut-off by the action of the color-killer, V112B. A voltage check could be used to determine the actual cause of the faulty condition. If the control grid has a high negative potential, circuit checks should be made to determine why the color-killer circuit is biasing the band-pass amplifier to cut off.

The color-killer is normally held at current cut-off by a negative potential applied to its control grid. This negative potential is developed by one of the phase detectors, V129B and V130B, and is always present as long as there is a color burst signal being received. When the color burst is absent at the phase detectors, the color-killer is allowed to conduct and to bias the band-pass amplifier to cut-off.

Check for the color burst at the phase detector inputs with an oscilloscope. It should be similar to Fig. 6. If the oscilloscope check shows that the burst signal is reaching the phase detectors, then check the circuit of the color-killer. In the circuit shown in Fig. 3, the control grid of the color-killer would go to zero potential if the capacitor between grid and chassis were to be-

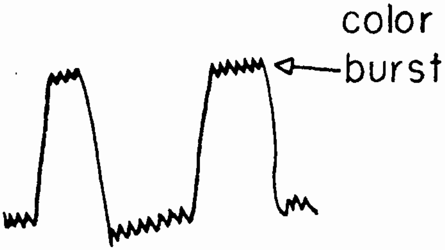

FIG. 7. Waveform of signal at grid of burst amplifier.

come shorted. The color-killer would therefore conduct and bias the band-pass amplifier, resulting in loss of color.

If the oscilloscope test shows that the color burst is not present at the phase detector inputs, test the burst amplifier circuit with the scope. The color burst should appear at the plate of the 6AN8 burst amplifier tube V129A. The signal at the input of this stage should be the composite color signal, which would appear like that shown in Fig. 7. If this signal is present at the input but not at the output, test the operating voltages and components associated with the burst-amplifier circuit.

The burst amplifier is caused to conduct during horizontal-retrace time by a keying pulse, either a pulse from a burst-keyer stage, such as V116B in Fig. 3, or a pulse taken from a winding on the horizontal output transformer. Because the color burst is transmitted during horizontal retrace time, only the color burst will be amplified by the burst amplifier. If the keying pulse is lost, the burst amplifier is in a non-conducting stage at all times; consequently, no color burst would appear at the output. Fig. 8 shows the waveform of the keying pulse.

3. *Chrominance Signal Present but Reference Signals Absent.* If the chroma signal is present but the reference signals are lacking at the input of the color demodulators, the color-sync circuit is the probable source of the trouble. The section of the color-sync circuit in which the cause of the trouble could be located consists of the 3.58-megacycle oscillator V131B and the quadrature amplifier V130A in Fig. 3.

When the reference signals are missing at the demodulator suppressor grids, it is the result of one of two things. Either the 3.58-megacycle reference signal is not being generated by the oscillator, or it is being lost between the oscillator and the output of the quadrature amplifier. Checking with an oscilloscope for a signal at the grid of the quadrature amplifier, will tell you whether to suspect the oscillator or the quadrature-amplifier circuit. If the signal is present at the grid of the quadrature amplifier, the signal is being lost in this circuit. The normal servicing procedure of voltage and resistance checks will determine which component has failed.

If the 3.58-megacycle signal is missing at the grid of the quadrature amplifier, the cause of the trouble is in the oscillator circuit. Loss of the output signal of the oscillator can be caused by detuning of the 3.58-megacycle output coil in the cathode circuit or by a bad crystal in the grid circuit. With either a detuned tank circuit in the cathode or a bad crystal, the plate voltage of the oscillator drops almost to half its normal reading. Substitution is the most positive way to check for a faulty crystal. If the crystal is not at fault, voltage and resistance checks should be made to determine what part has failed.

Now then, let us summarize the steps of the trouble-shooting procedure for the condition of complete loss of color. If a normal black-and-white picture can be produced by the color set, apply an rf signal from a color-bar generator to the input of the receiver. The antenna terminals of the set are the input in this case. If color appears on the screen after the controls have been properly adjusted, test the antenna installation for either improper orientation or defective lead-in lines.

If the signal is not produced when the rf signal is applied to the antenna terminals, reconnect the color-bar generator, and use its video signal at the input of the video section. The results obtained will determine whether the cause of the trouble is ahead of or after the video input circuit. If color appears, the trouble is in the rf or i-f section, since these stages are ahead of the video input. The alignment of the rf-if sections should be checked in accordance with the manufacturer's instructions and with test instruments that are reliable.

If color does not appear when the video signal of the color-bar generator is used, the trouble is in one of the color circuits somewhere between the point where the chrominance signal is sep-

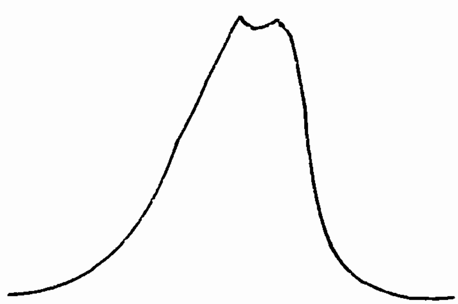

FIG. 8. Waveform of keying pulse at burst amplifier.

arated from the composite color signal and the output of the demodulators. If the chassis is still in the cabinet, check the tubes in the band-pass amplifier, afc, and color-killer circuits by the substitution method.

When the chassis is removed from the cabinet, check the character of the signals at the demodulators with an oscilloscope. If you find that both the chrominance and reference signals are present at the input of the demodulators, the trouble is in a circuit common to both demodulators.

If the chrominance signal is absent but the reference signals are present, check back through the band-pass amplifier stage for the circuit containing the defect that is preventing the chrominance signal from reaching the demodulators. If a color-killer is used and is biasing the band-pass amplifier to current cut-off, check the color-killer circuit or check for the absence of the color burst at the phase detectors. The color burst signal can be lost anywhere between the burst take-off point and the phase detectors. If you find that the correct signal is present on the grid of the burst amplifier but the color burst is not present at the plate, check for the loss of the keying pulse from the horizontal output transformer or the keyer stage.

If you find that the chrominance signal is present but the reference signals are absent at the demodulators, check the 3.58-megacycle oscillator stage and the quadrature-amplifier circuits to locate the circuit defect causing this trouble.

Loss of Saturation

A color can be analyzed as to its hue, saturation, and brightness. A color television set determines the hue by comparing the phase of the chrominance signal with the phase of two reference signals. If the phase relationships are not correct, the hues will be incorrect. The intensity or saturation is determined by the amplitude ratio between the chrominance and luminance signals. If this ratio is changed, saturation will be affected. In the following discussion, we will consider the luminance signal to be normal, because any serious change in it would show up in a monochrome picture.

Loss of saturation shows up as excessive luminance or brightness in the reproduced colors. The colors appear in pastel shades instead of deep or saturated shades. A pastel shade is produced by combining white with a fully saturated color. Since pure white light contains all colors, if the signal from a color-bar generator shows up as pastel colors, all three of the color picture tube phosphors must be emitting a percentage of the total light output during the scanning of each color bar. This means that each primary color bar contains some light from the other two primarys and that each secondary color bar contains some light from its complementary color. For example, the red bar normally contains light from only the red phosphor. When this color bar becomes less saturated, it will also contain some light from the green and the blue phosphors. The cyan bar normally contains light from only the green and blue phosphors. The cyan bar will be less saturated when light from the red phosphor is added.

This loss in saturation comes about because the signals applied to the picture tube are unable to cut off each beam at the proper time. Since we know the luminance signal is normal, it is likely that the excessive amount of light is caused by a deficiency in the color difference signals. Color difference signals are usually designated as R minus Y, B minus Y, and G minus Y. A color-difference signal is equal to a color signal minus the luminance signal. The I and Q reference signals are also color difference signals. They are developed when specific proportions of R minus Y and B minus Y signals have been combined.

It may be assumed that the inability of these signals to cause proper picture tube beam cut-off is due to insufficient signal amplitude. Since it is seen that all of the colors are de-saturated, the signals from both of the demodulator sections must be lacking in signal strength. In some cases, a condition of de-saturated colors can be compensated for by advancing the saturation control. However, if it becomes necessary to advance the setting of this control beyond its usual position in order to obtain satisfactory color saturation, a circuit defect is indicated. Either the chrominance signal or the CW reference signals applied to the demodulator stages are lacking in sufficient amplitude.

In the circuit in Fig. 3, the tubes which might cause a loss of color saturation are the band-pass amplifier, the quadrature amplifier, and the burst amplifier. A faulty tube in the band-pass amplifier stage cannot provide the proper amplification of the chrominance signal; a faulty tube in the quadrature amplifier stage will not provide the needed amplification of the 3.58-megacycle (CW) reference signal; and a faulty tube in the burst-amplifier stage may not amplify the burst signal enough to cut off the color-killer circuit completely, which would increase the bias on the band-pass amplifier and reduce the amount of amplification provided by this stage.

If replacement of the band-pass amplifier, the quadrature amplifier, and the burst amplifier tubes does not remove the fault causing loss of saturation, the chassis will have to be removed and the signals at the input of the demodulators observed on an oscilloscope. To see whether or

(*Continued on page* 18)

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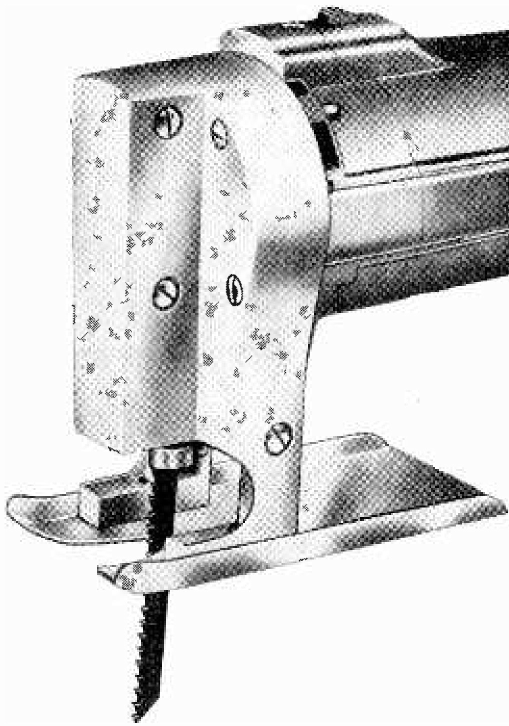

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(*Continued from page* 15)

not the amplitude of the chrominance signal is normal, the oscilloscope screen should be calibrated. A 9-volt peak-to-peak chrominance signal is satisfactory at the input of the demodulator stages.

Chrominance Signal Lacks Amplitude. If you find that the chrominance signal is lacking in amplitude at this point, observe the signal at the grid of the band-pass amplifier. The normal waveform of this signal is similar to that shown in Fig. 4. However, the amplitude will be considerably less than the chrominance signal checked at the input of the demodulator stages. It should be about ½ volt, peak-to-peak. If the amplitude is not normal, the band-pass amplifier may not be providing the proper amount of amplification. The voltages around the stage should be measured. A low plate or screen voltage could cause the trouble, or the bias of the stage may be too high.

Insufficient signal amplitude at the grid of the band-pass amplifier may be an indication that the 4.5-megacycle trap in the cathode circuit of the first video amplifier may be detuned and acting as a high impedance at the frequency of the chrominance signal. Check the amplitude of the signal at the input of the first video amplifier. If a normal signal is observed at the input of the first video amplifier, check the adjustment of the 4.5-megacycle trap. The purpose of this trap is to prevent the beat frequency between the video and sound carriers from appearing as interference on the face of the picture tube. Normally, there will be a 1.2-volt, peak-to-peak signal at the grid of the first video amplifier and its appearance will be similar to that shown in Fig. 4. If you find that the signal at the input of the video amplifier is not satisfactory, the band-pass characteristics of the video i-f section should be checked. This section may be misaligned and therefore may not be providing enough amplification of the input chrominance signal.

If you read a negative voltage at the grid of the band-pass amplifier, the color-killer may be conducting. The color-killer is used to prevent operation of the band-pass amplifier during monochrome reproduction. It is usually held at cut-off by a negative voltage formed at one of the phase detector stages by the incoming burst signal. If the burst signal is weak, it will not develop enough negative voltage to keep the color-killer circuit at cut-off. As a result, the color-killer tube will conduct, and a negative voltage will be developed in the plate circuit. This negative voltage will appear at the grid of the band-pass amplifier and will reduce the gain of the stage.

Observe the burst signal at the phase detectors. If it appears to be considerably less than 28 volts peak-to-peak, the voltages around the burst amplifier stage should be measured. If no faults are found in the voltages around the burst amplifier stage, the alignment of the burst-amplifier transformer should be checked. Fig. 6 shows the waveform of a normal burst signal at the input of the phase detectors.

Reference Signals Lack Amplitude. If you find that the amplitude of the chorminance signal at the input of the demodulator stages appears to be normal, the reference signals applied to these stages should be checked next. Fig. 5 shows how these signals should appear. The normal peak-to-peak voltage is about 11 volts. Insufficient signal amplitude shows that the signal from the 3.58-megacycle crystal oscillator is not being properly amplified. The quadrature amplifier may not be increasing the strength of this signal sufficiently. A voltage check around this stage should help in locating the reason for this trouble.

Chrominance and Reference Signals are Normal. If you find that the amplitude and shapes of the waveforms from both the chrominance and reference signals applied to the demodulators are normal, the lack of saturation indicates that the gain of each of the two demodulator stages has decreased by an equal amount. Since it is fairly unlikely that the two demodulator tubes will become equally weak at the same time, some circuit component common to these two stages is probably causing the trouble.

Referring to Fig. 3, we note that the screen grids of the two demodulator tubes have a common voltage supply. If the filter capacitor in this circuit becomes leaky, the voltage applied to these screen grids will be reduced. Similarly, an increase in the value of the 12,500-ohm resistor will lower the screen-grid voltage. A sufficiently low screen-grid voltage in the demodulator stages will cause a loss of color saturation.

Loss of Color Synchronization

Another defect in a color picture is caused by loss of color synchronization. Loss of color synchronization is indicated by horizontal or diagonal stripes of different colors on the picture tube screen. These stripes may be either moving or they may be stationary. This symptom results when the frequency of the reference signals is incorrect. If the defect causes the frequency of the oscillator to be unstable, the stripes will be seen to be in constant motion. On the other hand, the stripes will be stationary if the oscillator is actually operating at the incorrect frequency, but is stabilized by the reactance tube or control stage. If there is only a small number of diagonal stripes, the frequency of the oscillator is only slightly off. But, if there are many stripes, the frequency is far from the normal rate.

The cause of loss of color synchronization will be found in some circuits ahead of the 3.58-megacycle oscillator. The first service step to follow is to check the control tube V131A in Fig. 3. This is the logical tube to check, because you know the burst amplifier and phase detectors are operating or the color killer would conduct and there would be no color in the picture.

In a set that does not have a color killer, it would be necessary to check the burst amplifier and phase-detector tubes also. If tube replacement does not remedy the trouble, a circuit check should be made. When testing the circuit, the most logical place to begin is in the oscillator control (reactance) stage V131A. By making a thorough voltage check, we can determine whether the operating voltages in this stage are

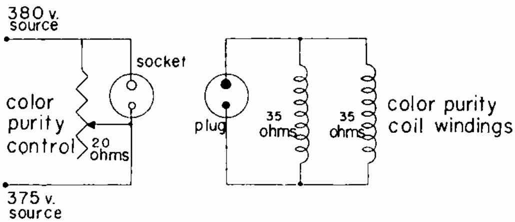

FIG. 9. Color purity coil and control circuit for RCA Model CT-100.

correct or not. With incorrect plate or screen voltages at the control tube, the 3.58-megacycle oscillator will fall out of synchronization.

If you find that the plate and screen voltages are normal, the next circuit point to check is at the control grid of the V131A control tube. The voltage should be from .5 to .9 volt positive, depending upon the setting of the hue control. However, with a defective component in the circuit ahead of this point, the voltage at the control grid will be affected. For example, if capacitor 2C275 were to develop a short to ground, no correction voltage would appear at the control grid, and loss of color synchronization would result.

Another example would be if either 2200-mmf capacitor feeding the phase detectors became faulty, the voltage at the grid of the oscillator control tube would become quite negative and this would cut off current flow through the control tube. The control tube would no longer govern the operation of the oscillator; therefore, the reference signal would drop out of synchronization with the incoming burst signal. A voltage check at the phase detectors would tell whether or not there was a faulty component in these stages. For instance, if the input 2200-mmf capacitor connected to V129B were to open, the voltage at the cathode would drop far below normal. Under normal operation, the voltage at the cathode of V129B and the voltage at the plate of V130B are equal in value but are opposite in polarity. If these voltages are found to be unbalanced, the cause of the trouble is probably in the circuit of the phase detectors.

Troubles With Color Purity

Another defect that can affect a picture is called color contamination. This means that in some areas of the picture the color is not pure, but is tinged with another color. This may also show up in a monochrome picture, too.

When there is color contamination, the gun beams in the crt are not hitting the proper sets of phosphor dots on the portions of the screen where there is contamination. In order to get satisfactory color purity, the electron beam from the red gun must be striking only the phosphor dots which emit red light, the beam from the blue gun must hit only the phosphor dots which emit blue light, and the beam from the green gun must strike only the phosphor dots which emit green light. The positions of the beams are controlled by the purity control and the field-neutralizing control. When a set is serviced for color contamination, the adjustments of the purity devices associated with the picture tube should first be checked. If adjusting the purity devices does not correct the contamination, the purity circuits and the mechanical devices should be checked for defects. The circuit of the purity coil and control is shown in Fig. 9. If you find that adjustment of the purity control has little or no effect, unplug the coil and measure its resistance with an ohmmeter. If the resistance of the coil is within tolerance, check the resistance between the center control arm and one end while rotating the arm through its range.

If the purity control is open, excessive current is allowed to flow through the purity coil, since there is no shunt resistor. This current produces a very strong magnetic field around the coil. The position of the three beams from the guns is greatly affected by this strong magnetic force. And as a result, the center of the raster moves off-center in relation to the screen and the colors become contaminated.

Another control that affects color purity is the field-neutralizing control. The field-neutralizing coil with its control is shown in Fig. 10. The purpose of this circuit is to obtain color purity at the edges of the screen. After a pure red screen (except at the edges) has been obtained during the convergence set up procedure, the field-neutralizing control is adjusted so that maximum purity will be obtained along the edges. If this cannot be achieved, test the circuit shown in Fig. 10 by using the same procedure you used to check the purity coil and control.

Fig. 11 shows the information on trouble-shoot-

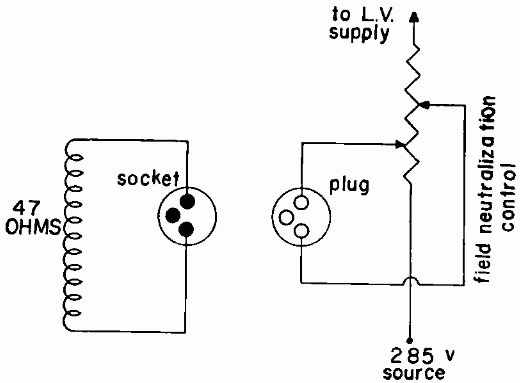

FIG. 10. Field-neutralizing coil and control circuit for RCA Model CT-100.

ing a color-TV set for the symptoms we have discussed here in a convenient tabular form for handy reference.

Zenith Develops Sun Powered Hearing Aid

The sun's free and inexhaustible supply of energy is now available for the benefit of the nation's hard of hearing.

Zenith Radio Corp. revealed this fact recently with the announcement of a revolutionary new eyeglass hearing aid, the Solaris, that operates on free power from ordinary sunlight. It utilizes silicon cells of the same type that power the Navy Vanguard satellite radio transmitter. Zenith engineers say that the amount of light received on a slightly overcast day is enough to operate the solaris efficiently on solar power without using a battery. When light is insufficient, a tiny nickel-cadmium storage battery automatically cuts in to operate the hearing aid. Bright sunlight will not only operate the hearing aid but will also recharge the battery. The silicon cells, transistor circuit and battery are housed in a compact bar designed to fit eyeglass frame fronts.

COMPLAINT	INDICATION	PROBABLE CAUSE
No monochrome picture.	No color observed when rf signal from color-bar generator is applied to antenna terminals.	Defect between input of receiver and chrominance signal take-off.
	Color observed when rf signal from color-bar generator is applied to antenna terminals.	Defect between chrominance signal take-off and output of luminance channel.
Improper gray scale.	Gray raster obtained with contrast control setting reduced.	Defect in matrix section.
	Gray raster cannot be obtained with contrast control setting reduced.	Incorrect screen voltages on picture tube.
Hum in monochrome picture.	Hum bars in picture. Color of bars indicates which gun is receiving hum modulation.	Cathode-to-heater leakage in tube in color section.
No color, but monochrome picture OK.	Correct colors seen when signal from color-bar generator is applied to antenna terminals, saturation control is turned all the way up, and fine-frequency and hue controls are adjusted throughout their ranges.	Color controls are not properly adjusted.
	No color when signal from color-bar generator is applied to antenna terminals, but color appears when signal from color-bar generator is applied to video input of receiver.	RF-IF section misaligned.
	Color does not appear when signal from color-bar generator is applied to video input, but oscilloscope shows chrominance and CW reference signals at input of demodulators.	Defect in part common to both demodulator stages such as screen resistor and capacitor in Fig. 3.
	No chrominance signal at control grids of demodulators.	Defect in band-bass amplifier, color-killer, phase-detector, burst amplifier, or keyer stages.
	No reference signal at screen grids of demodulators.	Defect in quadrature amplifier, 3.58-mc oscillator, or reactance tube stages.
Monochrome picture OK, colors weak.	Chrominance signal weak at input of demodulators.	Defect in band-pass amplifier, 1st video amplifier, color-killer, phase-detector or burst-amplifier stages.
	Reference signals weak at screen grids of demodulators.	Defect in quadrature amplifier stage.
	Chrominance and reference signals weak at demodulators.	Defect in part common to both demodulator stages.
Loss of color sync.	Horizontal or diagonal stripes in picture; if in motion, frequency of oscillator is unstable; if stationary, frequency is stable but incorrect.	Defect in oscillator control circuit; or, in set without color-killer, defect in burst amplifier or phase-detector stages.
Color contamination.	Colors are not pure. Monochrome pictures are tinged with color.	Electron beams not hitting proper phosphor dots. Defect in purity or field-neutralizing controls.

FIG. 11. Trouble-shooting chart for a color TV set.

A Quick Look at the Washington Hi-Fi Show

(*Continued from page* 7)

plete surprise, since the Audio Fidelity disc was the only one announced before the show. In fact, Audio Fidelity marketed the disc before the stereo cartridges were available. Late advertisements show many other stereo discs from Audio Fidelity and rumor at the show indicated that RCA was all set to come out with many more stereo discs. Westrex previously announced that most of the larger record companies have already purchased their stereo cutters. Incidentally, for those who haven't read about the stereo disc system, both discs and cartridges are completely compatible. That is, the stereo cartridge will play standard monaural records and the stereo discs can be played monaurally with standard cartridges.

Since the 47 separate exhibitors at the show demonstrated perhaps hundreds of different items, naturally, it wasn't possible to examine many of the items closely or even remember all of them. However, here is one man's opinion.

Exhibits and Salesmen: Most of the exhibits were the same—one small room lined with tables stacked with equipment and literature and many salesmen running around passing out literature. All of the salesmen were very cooperative and cordial, although most appeared to be either non-technical or unbelievably misinformed. Trying to get technical information from salesmen about their equipment was often humorous. One salesman of an obviously mediocre speaker system blandly replied, "20 to 20,000 cps," when asked the frequency response. Another of an equally mediocre system replied, "30 to 15,000," to the same question. A third salesman, though, made these first two look like pikers. This man claimed to have helped design a certain speaker system, but when asked, he didn't know the frequency response at all! In this respect, one exhibitor—J. B. Lansing—stood head and shoulders above the others. In their room they exhibited only one speaker system. There were no tables full of equipment nor salesmen passing out bales of literature. The speaker system was fed by a single tape recorder and amplifier and tended by an audio engineer who not only was courteous and cooperative, but who knew what he was talking about. This speaker system, by the way, was most impressive.

Weathers Industries: The new Weathers Industries turn-table was very impressive. Unlike any other, it is extremely light and driven by a synchronous 12-pole motor. It appeared to have very low rumble and wow but it was difficult to judge because of the small speaker systems used with it. Unlike any other turn-table, the Weathers FM cartridge, demonstrated with the turn-table, is outstanding in its unusually good tracking. The cartridge tracks with one gram of pressure and will track not only if the turntable is jarred, but also even with it held at a 45-degree angle! The light one-gram pressure makes it just about impossible to scratch records even when the cartridge is dragged across the record surface.

Stephens: The only Stephens enclosures exhibited were of ultra-modern design. With their excellent drivers, they sounded quite good.

Dynakit: The new Dynakit preamplifier was shown. The design is outstanding and the specifications are even more outstanding. It was not possible to judge its operation properly.

Lee: Several new speaker systems of Lee were exhibited, and also the familiar Catenoid. The new systems appear to be just as impressive as the "Cat".

Klipsch: Klipsch showed the standard horn as well as some new smaller versions, with outstanding sound. A new non-corner folded horn, the Heresy, was shown but could not be properly judged since it was used only in a stereo demonstration.

Bogen: Most of the very fine Bogen amplifiers and tuners were exhibited with some new Challenger amplifiers. Unfortunately, no information seemed to be available on these new amps.

Genalex: This General Electric Company of England has built a metal cone loudspeaker which, surprisingly, has no metallic sound whatsoever. They also have a tweeter which they call a "presence unit" which can be used separately or can be cleverly attached to their metal cone 8-inch speaker, converting it to a coaxial unit.

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Intercom-Sound Systems Serviceman Wanted

The Ike Walker Organization, 128 Oakwood Road, Charleston 4, W. Va., writes us about an excellent opportunity for an ambitious young man who would be interested in the installation and service of intercom and sound systems. Prefer a man between the ages of 25 and 35 who has a good knowledge of schematics and basic knowledge of audio amplifiers and relay circuits. Salary based on individual experience and initiative. Car essential; mileage paid. Interested Students or Graduates in the West Virginia area should write or contact Mr. Ike Walker at the above address.

Our Cover Photo

(*Continued from page 7*)

He landed in the organ business instead, and thereby hangs a tale. When he was about ten years old and attending school in England, the land of his birth, he one day found the door to the chapel organ unlocked.

Since the pipes had been fascinating him for some time, he went in, took out the pipes and blew into them, making interesting sounds. After having a good play, he put the pipes back —but not into the right places.

"The next morning at chapel," Stopes recalls, "the organ sounded terrible. The headmaster wanted to know who had tampered with it. I was honest and went to him with my admission. After putting me over his desk and paddling me, he set me to work at getting the pipes back right. I finally did. That was my introduction to the organ."

Stopes' family moved to Canada shortly after his initiation into organ mechanics. His schooling continued there until he was 16, when he

"GUINEA PIG ORGAN"—Arthur Stopes, Lakeland organ builder, is shown playing the pipe organ which he intends to convert into a combination electronic-pipe organ experimentally before building his own design of a three-manual electronic-pipe organ. The top manual (row of keys) is slated to become electronic while the lower manual will remain pipe. The two Siamese cats, Whitie and Brownie, are at their favorite post whenever he plays. (LEDGER Photos.)

went to Garwood, N. J., and started organ work with the Aeolian Co., which specialized in residential organs. Later he worked for the Wurlitzer Co. when it was manufacturing theater organs. These he installed in New York City in places such as the Paramount, Radio City Music Hall, and the old Hippodrome, now torn down.

While installing the Paramount Theater organ, Stopes became acquainted with Rudy Valle, who made his New York debut there right after the theater opened.

The biggest job he ever tackled took three-and-a-half years. That was the world's largest organ which was built right in the convention hall at Atlantic City, N. J., over a period of five years during the thirties at a cost of $1 million. Stopes did finishing tonal work on it, a job he remembers as most enjoyable when beauty pageants took place in the hall.

But he had the most fun with his beer can organ, which he built as a stunt in his spare time in the late thirties. The idea for this oddity was born when he was installing an organ in a new church. As zero hour approached for the first service to be held, the minister and congregation leaders were standing about watching the race toward the deadline. But the last pipe had to be shortened in order to get it to fit under the arched ceiling, and the surgery changed its tone.

In the emergency, Stopes sent out his helper to find a dump and bring back a can about the diameter of the pipe. The helper found a quart beer can. Part of the can inserted into the pipe did the trick by flattening the tone.

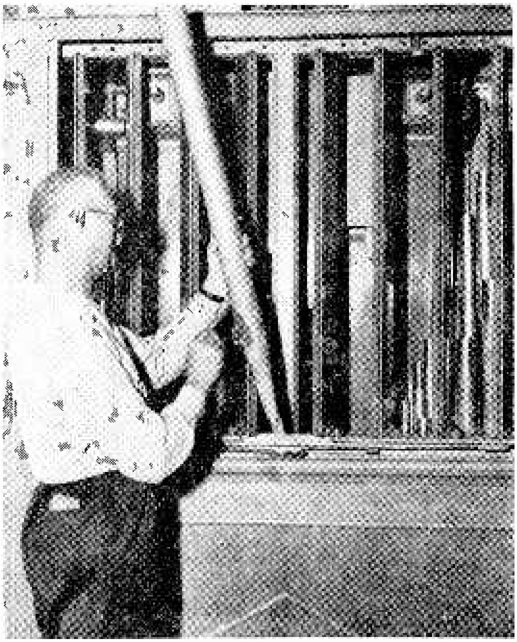
This gave him the idea for his beer can organ. It took 270 cans and two years to build. Pipes were made by removing the tops and bottoms of the cans and soldering them together. He could make one pipe in about eight hours. Besides being the only organ ever made from beer cans, it was the sole organ ever built with a lever that could be thrown to transpose it to any key.

Since Stopes can play only in the key of C, he designed the organ with the lever so that he could accompany vocalists singing in other keys. The only other instrument similarly designed is Irving Berlin's piano—for the same reason. This organ appeared in vaudeville shows in theaters, at amusement places, and on the "Hobby Lobby" show over the CBS network in 1941.

Stopes and his wife arrived in Lakeland two years ago when transferred to this state by the Wicks Organ Co., for which he sells, installs and maintains organs. They picked Lakeland for his headquarters because it is centrally located and because Mrs. Stopes liked the city's name. They came, they saw, and they were conquered.

Their first year in Lakeland they lived in a trailer, sandwiched in between two organs—probably the only trailer in the country so equipped. One of the organs is now housed in Stope's workshop in the rear of his home, just off the Old Auburndale Road, about five miles from the Lakeland city limits.

This organ is to be the guinea pig for Stopes' next big project, which is to design a three-manual (three rows of keys) combination electronic



ONCE IN TRAILER—Stopes is shown adjusting a mechanism in one of the pipes of the organ in his workshop. This organ was one of two that were housed in a trailer in which the Stopes lived their first year in Lakeland. (LEDGER Photos).

and pipe organ. He thinks it can be done for about half the cost of the only existing three-manual electronic organ that sells for $25,000.

First step in creating the hybrid product will be to make the top manual of his laboratory organ electronic, while the lower row of keys will remain pipe. To do this, he has set up electronic circuits in his home for experimental work.

With an oscilloscope he compares wave patterns of organ pipe tones with electronic components, trying to duplicate the pipe tones with electronic tones. When he gets the same tone on the oscilloscope with electronics as with a pipe, he has a "carbon copy" of the original tone.

"That is the only way you can get it," explains Stopes. "The human ear is not delicate enough to sense when a tone is an exact duplication."

Although the pipe organ is still the finest of the two kinds, it can almost be duplicated with fine circuits, according to Stopes. Electronic organs are popular because they take less space and can be built for about one-third to one-half the cost of a pipe organ.

Opportunity For Experienced Aircraft Or Missile Electronic Technicians

Fairchild Aircraft Division of Fairchild Engine and Airplane Corp. is in need of **several hundred** men experienced in aircraft or missile electronics. Applicants must be high school graduates or have equivalent certificates. Write Employment Manager, Fairchild, Hagerstown 10, Maryland and request application for employment form.

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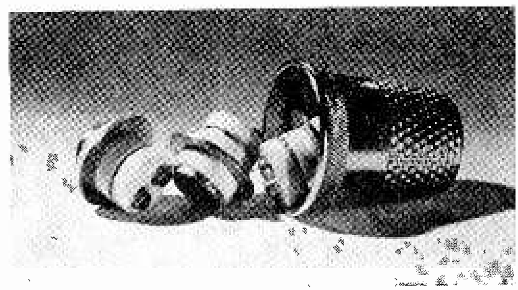


These tiny new GE tubes make a thimble look big. A ceramic type, they are now being produced for designers of high frequency equipment of the future. The new tubes will better the performance of glass tubes under high temperatures and in tough shock and vibration environments met in modern communications, radar and navigation equipment.

"You don't have to fix it young man,—just find it. . . ."

Hi-Fi Corner

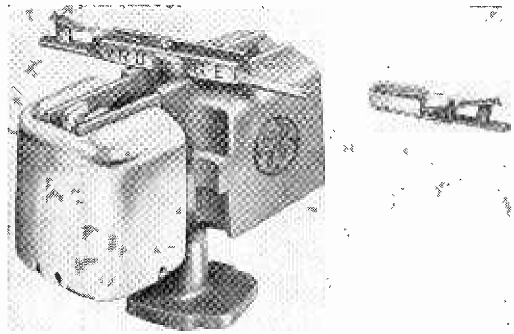
By JOHN G. DODGSON
NRI Consultant

GE Announces New Hi-Fi Cartridge. After its introduction in 1946, the General Electric variable reluctance cartridge was probably the most popular hi-fi cartridge on the market. This cartridge was not only low priced but also had excellent characteristics. It was essentially flat from 30 to 15,000 cycles, had very low distortion and, perhaps, above all it had excellent reliability.

A defective cartridge rarely came out of the factory, and one failed in the field even more rarely. The cartridge was used in many fine high-fidelity systems. However, it did have a few shortcomings for the audio perfectionist. The frequency response, although completely adequate, did not go quite high enough or low enough when compared to the high-priced moving-coil pickups. In addition, the compliance was a little low and it did require 6 grams of pressure for proper tracking. Thus, although most audiophiles started out with the GE cartridge and were satisfied with it, many of them invested in the more expensive cartridges as they improved their systems.

GE has recently introduced a new variable-reluctance cartridge, the VR2. The new GE VR2 cartridge represents a substantial improvement over the previous cartridge, as good as it was. This new unit has the desired extension of the frequency range, being essentially flat from 20 to 20,000 cycles. The compliance has been increased 40%, and the tracking pressure has been reduced 33%. In addition, the new cartridge has a mu-metal electrostatic shield to eliminate electrostatic hum from such external fields as fluorescent light fixtures. and "pops" during playback from build up of electrostatic charges on the record. As shown in the photograph, the new cartridge is narrower than the old, so it will fit in thinner tone arms, which would not accommodate the older RPX series cartridges.

After checking and listening to the VR2 cartridge for several months, I believe that this new cartridge not only satisfies any complaints of the older one, but goes beyond that. In fact, it is difficult to tell the difference between the VR2 and a moving-coil pickup costing more than twice as much.



GE VR II Variable Reluctance Cartridge.

The price of this cartridge, by the way, is unbelievably low. A single-play VR2 can be obtained for less than $7 which is just about the same price as a decent ceramic or crystal cartridge. The triple-play cartridge is available for under $9. A VR2 equipped with a 1 mil diamond stylus can be obtained for under $18.

As before, the new VR2 comes with a wealth of information. The cartridge not only comes in a protective plastic box, but is supplied with all sorts of screws and washers, extra knobs, data sheets, etc. Full information is given on the cartridge specifications and mounting, as well as detailed drawings.

The VR2 cartridge like its predecessor, has easily replaceable "clip-in-tip" styli. Although it may not yet be the best cartridge on the market. it is by far the best buy from your reporter's viewpoint.

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Editor's note: Because of the large volume of mail received from Students and Graduates who would like to read more about hi-fi, we plan to make "Hi-Fi Corner" a regular feature of NATIONAL RADIO-TV NEWS. *Forthcoming issues will keep you abreast of the latest developments in custom sound including stereo tapes and discs, tuners, amplifiers, speakers, enclosures and other data of interest to the serviceman and hobbyist.*

N.R.I. ALUMNI NEWS

Howard Smith .... President
F. Earl Oliver .... Vice Pres.
Jules Cohen .... Vice Pres.
William Fox .... Vice Pres.
Joseph Stocker .... Vice Pres.
Theodore E. Rose .... Executive Secretary

NRIAA President Offers Advice To Students

by Howard B. Smith, Springfield, Mass.,
President of NRI Alumni Association for 1958.

It is now mid-year. Most of us are looking forward to our annual vacation when we can relax at our favorite pastime—fishing, boating, swimming or perhaps a jaunt in the gas buggy to the beach or the mountains. Whatever your vacation preference may be, get out and enjoy the great outdoors which nature has created for you.

Something else has been created to serve you the year-round: the National Radio Institute Alumni Association, which was established for your benefit by the National Radio Institute. Any graduate of NRI is eligible to join and will reap important advantages from his membership.

As a student you are working hard to earn your diploma. After graduation you will need information available to keep up with the rapidly advancing Radio-TV Electronics industry. There are many ways of doing this. You may take more courses, but will they give you the advanced knowledge you are looking for in the particular branch of the electronic art in which you are interested? Another possible way to keep abreast is to subscribe to various trade publications. But this is costly. In my estimation the most logical plan is to become a member of the National Radio Institute Alumni Association. Here you will get the infomation you want, for you will continue to receive the NATIONAL RADIO-TV NEWS and other educational material, and enjoy the other features of membership as well.

Those students and graduates fortunate enough to reside near a local Alumni Association Chapter can affiliate with such a Chapter and participate in the good fellowship, the exchange of ideas, as well as solve their electronic problems through the help and advice of other members **with more experience.**

Howard Smith

Our motto here in Springfield is a small five letter word, THINK. Won't you stop and THINK? Can't you improve your lot by affiliating with NRIAA when you graduate? I am sure you can and once you do will always be glad that you did so.

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Chapter Chatter

FLINT (SAGINAW VALLEY) CHAPTER enjoyed one of the best meetings it has had this year. It was well attended. Chairman William Neumann contacted the Bell Telephone Company and obtained the use of a 16mm sound and color film on Ohm's Law.

This meeting was so successful that former

Secretary Dave Nagel, seconded by Clyde Morrisett, proposed that a film be obtained to show at each meeting. Bell Telephone informed the Chapter that they have an unlimited supply of technical films available.

Notices of the meetings have been sent to all names on the Chapter's roll and dues have been coming in from the seventeen towns comprising the Saginaw Valley Chapter. However, the Chapter want's the members to know that the Chapter is interested not only in their dues but in having more of them attend the meetings. Since these non-attending members have paid their dues it is felt that they are interested in meeting other NRI students and graduates in the area and the best way to do so is to attend the meetings.

The meetings are held at 7:30 PM on the second Saturday of each month at Vice-Chairman's Aaron Triplett's shop, 2538 Walcott St., Flint. For more information about the meetings get in touch with Chairman William Neumann, 1613 S. Kiesel, Bay City, or Secretary George Hinman, 401 N. Lincoln, Bay City.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER'S Chairman John Pearl delivered a timely talk on "Ethics in Servicing," which is receiving a great deal of public attention nowadays. This is a problem that is important to every Radio-TV serviceman and one which he would do well to give his attention to.

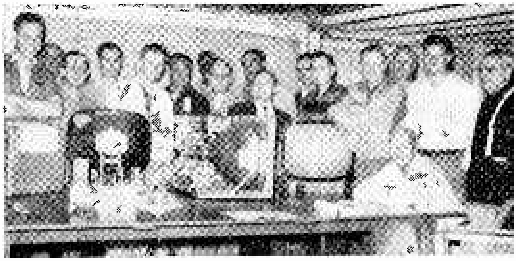
Secretary Edwin Kemp addressed the membership on the Sylvania Accounting System and at a later meeting discussed part-time servicing.

The chapter has announced that after its June 11 meeting, it will suspend meetings until the Fall when they will again be held on the second Wednesday of each month at the Northend Hagerstown Senior High School in Hagerstown. For further information about the meetings and the chapter's activities, students and graduates in the Cumberland Valley should get in touch with Chairman John Pearl, 261 S. Prospect St., or Secretary Edwin Kemp, 618 Sunset Ave., Hagerstown.

NEW ORLEANS CHAPTER was pleased at a lecture by Mr. Gaston Galjour on sync troubles. This lecture was followed by an extensive question-and-answer discussion.

At a subsequent meeting Mr. Galjour, who is the owner of a TV repair shop, gave an equally interesting talk on the use of the oscilloscope in TV repair.

The Chapter is planning a program devoted to short cuts in TV repair to determine the faulty section. This program should prove very helpful to the members.



A meeting of the New Orleans Chapter.

The Chapter meets at 8 PM on the second Tuesday of each month at the home of Secretary Louis Grossman, 2229 Napoleon Ave., New Orleans. All NRI students and graduates in the area are welcome at the meetings. Contact either the Secretary or Chairman Patrick Boudreaux, 1015 Race St., New Orleans.

LOS ANGELES CHAPTER, at the kind invitation of Secretary Thomas McMullen, held a meeting at his home. The members discussed the purchase of kits to be assembled by the members for chapter use. The chapter purchased a VTVM kit from one of the members and Secretary McMullen built up the unit.

Considerable discussion was also given a proposed social event to be held at the Lone Ranger Ranch at Chatsworth, California. This is a locality where a lot of Western movies are made. Western actors re-enact scenes from Western history, complete with gun fights, stage holdups, hangings, and bank hold-ups. Such an outing should prove very interesting to the members and their families, particularly with the complete picnic facilities offered.

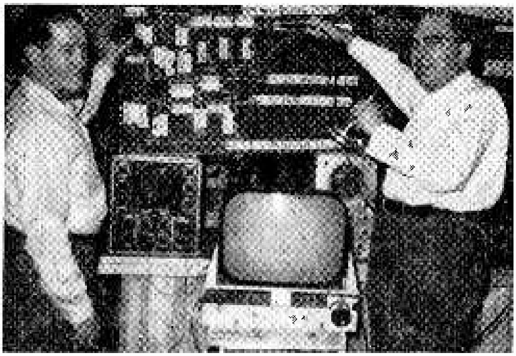
While at his home the members looked over Secretary McMullen's test instruments and the Secretary explained the theory of electronic circuitry in the Elox equipment that he works on. At the close of the meeting Mrs. McMullen served the members a lunch which all enjoyed. This was one of the most successful meetings of the Chapter to date.

It should be apparent from this that the members of the chapter not only further their practical knowledge of Radio-TV at the meetings but also have a lot of fun. Students and graduates in the Los Angeles area who are not now members of the Chapter should take advantage of the opportunity to visit a meeting as a guest to see how much they, too, will enjoy them. The meetings are regularly held at 8 PM on the second Friday of each month at St. Joseph's Catholic School Hall, 1220 S. Los Angeles St. The Chairman is Joseph Stocker, 208 E. Pico Blvd. Secretary Thomas McMullen's address is 1002 W. 187th Pl., Gardena.

DETROIT CHAPTER has enjoyed some unusually fine talks by its own members this winter—so many that only a few of them can be reported here.

Earl Oliver and Ellsworth Umbreit delivered an excellent address and demonstration on the subject of the TV sync separator. John Nagy discussed the question of part-time work for NRI students to gain experience and in this connection suggested that they contact used car dealers and TV shops.

James Kelley led a discussion and gave a demonstration on transistor circuits and also demonstrated transistor testers.



F. Earl Oliver and Ellsworth Umbreit delivering a talk and demonstration on TV sync separator at a meeting of the Detroit Chapter.

Talks by members on equally good subjects—such as tape recording theory, TV dog troubleshooting, sweep alignment, use of the oscilloscope, alignment of all-wave radios—are planned for the future.

Students and graduates in the Detroit area are invited to attend meetings and get the benefit of these instructive talks and demonstrations. Meetings are held at 8 PM on the second and fourth Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit.

For further information contact Chairman John Nagy, 1406 Euclid, Lincoln Park, or Secretary Ellsworth Umbreit, 12523 Racine Ave., Detroit.

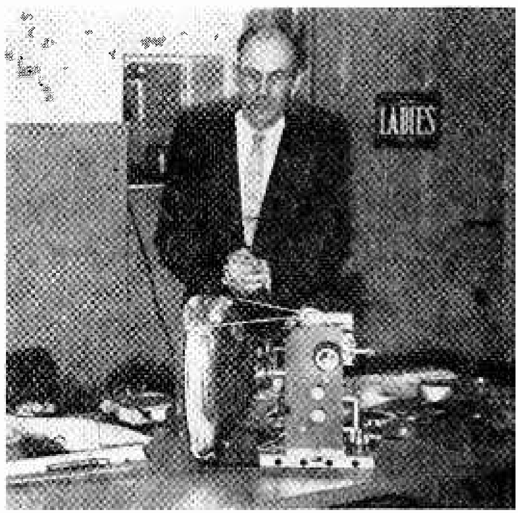
CHICAGO CHAPTER has admitted two new members to its fold. They are Frank Eominski and Will Terrell. Welcome to these new members.

The Chapter reports it has carried over last year's officers to serve again this year, as follows: Walter Nicely, Chairman; Charles Mead, Secretary; Gordon Hull, Treasurer; and Lewis Schick, Librarian.

The Chapter meets at 8 PM on the second and fourth Wednesday of each month at 666 Lakeshore Dr., West Entrance, 33d Floor, Chicago. Secretary Charles Mead points out that the meeting held on the fourth Wednesday of each month was selected for a particular purpose—that of pooling members' talents to demonstrate for each individual and the chapter group as a whole, the technique of locating and correcting defects and misalignment of electronic units such as radio, television, public address systems, amplifiers, phonographs, etc.

Students and graduates in the vicinity who are not members of the Chapter should take advantage of the Chapter's invitation to attend its meetings either as a guest or prospective member. Chairman Walter Nicely, 6441 S. Campbell Ave., or Secretary Charles Mead, 666 Lakeshore Dr., Room 228, Chicago, will be glad to supply additional information about the Chapter meetings upon request.

PHILADELPHIA-CAMDEN CHAPTER, instead of holding a regular meeting, recently made a tour of the Bell Telephone Company. It was arranged by Henry Whelan, who does a considerable amount of work for the Bell Company. Members were divided into groups and were conducted on the tour by six guides. Whereas such tours normally take only a half hour, this one lasted for three hours. The guides extended the members every courtesy and explained everything in detail. It was an intensely interesting tour and was thoroughly enjoyed by all the members.



Bill Heath, Westinghouse Corp. Service Supervisor, speaking at meeting of the Philadelphia-Camden Chapter.

One of Philadelphia-Camden Chapter groups which toured Bell Telephone Company. Seated left to right are guides Bill Phillips, Al Dudley, Bill Bell, Mrs. Marie Sharp, John Triscoli and Chas. Rausch.

At another regular meeting Bill Heath, Service Supervisor for the Westinghouse Corp., spoke on automatic frequency tuners. This lecture was interesting and instructive, and was well received by the members.

The chapter has undertaken a program of charity work which was started by Associate Member Ray Crossman, who is donating his time and efforts to make it possible for blind people to listen to TV programs. His practice is to fix the chassis of a TV set so that only the sound part works. The blind people who receive these sets are pleased and grateful. Harvey Morris is donating chassis and Henry Whelan has donated six. Other members are also turning their junked TV sets over to Ray Crossman for conversion for sound only. The chapter wishes to express its appreciation to Albert Steinberg and Company and the Radio Electric Service Company, of Philadelphia, for donating speakers for these sets.

The chapter reports that the TV Demonstration Panel it has undertaken is well underway. Quite a few of the members are busy on this project and the members as a whole are beginning to enjoy it already.

All students and graduates in the area are cordially invited to attend meetings and take part in these activities. Contact Secretary Jules Cohen, 7124 Souder St., Philadelphia. Meetings are held at 8 P.M. on the second and fourth Monday of each month at the Knights of Columbus Hall, Tulip and Tyson Sts., Philadelphia.

PITTSBURGH CHAPTER Chairman Frank Skolnik delivered an excellent talk to the members on resistance substitution. This was in connection with the raffle of a 25-watt variable resistor which was won by Dave Benes.

At the same meeting Chairman Skolnik, Fred Knoll, Frank Svidro and Tom Schnader worked on the construction of the Dynamic Radio Demonstrator, a major and important project which the chapter undertook this winter and which it is expected will be of great value to members in learning more about radio. The Dynamic Radio Demonstrator is now nearing completion.

At another meeting B. A. Bregenzer, President of the Pennsylvania TV Service Federation, addressed the membership on the forthcoming electronics show and forum to be held in Pittsburgh next September, which will consist of displays by several manufacturers of new equipment and demonstrations of equipment that will not be available for a couple of years.

Like all other local chapters of the NRI Alumni Association, the Pittsburgh Chapter welcomes all NRI students and graduates in its area as guests at its meetings. Those interested should contact Chairman Frank Skolnik, 932 Spring Garden St., or Secretary Kenneth Shipley, 1009 St. Martin, Pittsburgh. The Chapter meets at 8 PM on the first Thursday of each month at 134 Market Pl., Pittsburgh.

BALTIMORE CHAPTER held an "old-timers night" to welcome a visit from the NRIAA Executive Secretary, Ted Rose, and his assistant, Jack Thompson.

Most of the regular business was dispensed with so that more time could be given to informal talks by the visitors, and to the serving of hamburgers and coffee accompanied by jokes and stories. This presented an impressive sight. Fortunately, no one choked on his coffee and hamburger during the laughter following the punch lines of the jokes and stories.

Chairman Dolivka did speak about future programs, however—programs designed to interest new student and graduate members, to help them improve their practical knowledge of Radio-TV by attending the meetings. Ernie Gosnell also expressed the members' appreciation of Chairman Dolivka's efforts in behalf of the chapter. This was a well-earned tribute, for Chairman Dolivka has labored long and hard in the interests of the chapter.

Elmer Shue was scheduled to play a few tunes on his electronic banjo at this meeting, but he laughingly reported that he had been unsuccessful in retrieving it from his grandchildren. They had been impressed by its tone and had insisted on taking it to the country with them. Chapter members are betting that Elmer will get it back someday—when the batteries run down!

The Chapter meets at 8 PM on the second Tuesday of each month at 100 N. Paca St., Baltimore. Students and Graduates are cordially invited to attend. For further information contact Chairman Joseph Dolivka, 717 N. Montford Ave., or Secretary John Woolschleger, 1106 S. Lakewood Ave., Baltimore.

SOUTHEASTERN MASSACHUSETTS CHAPTER informs National Headquarters that the following have been admitted to membership in the Chapter since the last report published in these pages: John Kosior, Harold Aranjo, Simon Cabral, Louis Maranho, Charles Almond, Theodore Cote, and Roger Rioux. A cordial welcome to these new members!

The Chapter has needed a blackboard for some time, to be used in connection with talks and demonstrations. The Chapter now has the blackboard. Program Chairman Walter Adamiec initiated use of it during an excellent talk which he delivered on the stages relative to the operation of a TV receiver. Program Chairman Adamiec is planning a continuation of these talks on the various stages of a TV receiver, during which he will make further use of the blackboard.

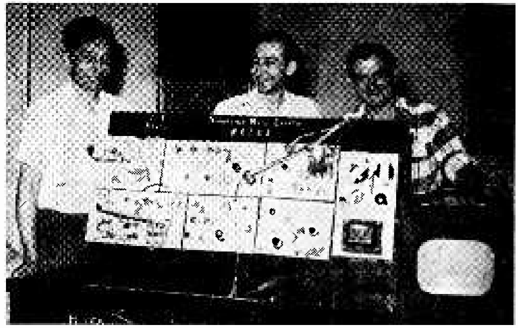
As reported in these pages there has continued to be a bit of confusion about the Chapter's meeting nights. This has now definitely been cleared up. Since the meeting in March, the Chapter has met and will continue to meet on the **last Wednesday** of each month, 8 PM, at the DAV Hall, 120 3rd St., Fall River, Mass. Chairman Michael Lesiak, 20 Cooper St., Taunton, or Secretary Ernest McKay, 16 Austin Court, New Bedford, will be glad to answer any inquiries about the Chapter and the meetings.

MILWAUKEE CHAPTER has reached an important decision: To undertake the construction of the TV Dynamic Board designed by Lyman Brown, Technical Advisor of the Springfield (Mass.) Chapter. By the time this issue of National Radio-TV News is published, the plans for the Dynamic Board will probably be in the possession of the Chapter and the members may already have started on the project.

There could be no stronger reason for students and graduates in the Milwaukee area to attend meetings of the chapter. Once this project gets under way, you will learn a great deal about the practical side of TV Servicing. If you are not a member you will nevertheless be welcome as a guest or prospective member.

Students and graduates interested in attending the meetings should get in touch with Chairman Philip Rinke, RFD 3, Box 356, Pewaukee, or Secretary Erwin Kapheim, 3525 N. 4th St., Milwaukee. The meetings are held on the third Monday of each month at the Radio-TV Store and Shop of S. J. Petrick, 5901 W. Vliet St., Milwaukee.

SPRINGFIELD (MASS.) CHAPTER'S Technical Advisor Lyman Brown has formally turned over the Chapter's TV Demonstration Panel to Chairman Rupert McClellan, who in turn placed it in care of the Custodian, Vice-Chairman Walter Ciszewski. The members got a big thrill at having completed such an undertaking and are confident they will learn a lot from it when used for demonstration purposes. Lyman Brown deserves a great deal of credit for designing and supervising the work on it, also the members who assisted him.



Technical Advisor Lyman Brown and Chairman Rupert McClellan presenting the Springfield Chapter's TV Demonstration Panel to the Custodian, Vice-Chairman Walter Ciszewski.

The NRI VTVM kit purchased by the Chapter from NRI for Chapter use was unpacked at this meeting. It is planned to assemble and wire a small portion of this meter at meetings, devoting possibly an hour to this project at each meeting until the meter receives its final checkout. Lyman Brown as Technical Advisor will supervise the work. He began at this meeting by explaining the meaning of the various symbols found on the schematic. He impressed on some of the new members the importance of thoroughly understanding the meaning of such symbols.

Students and graduates in the Springfield area are cordially invited to the meetings, which are held at 7 PM on the first and third Friday of each month at the U. S. Army Headquarters Bldg., 50 East St., Springfield. Chairman Rupert McClellan, 233 Grove St., Chicopee Falls, or Secretary Howard Smith, 53 Bangor St., Springfield, will be glad to give further information about the meetings upon request.

MINNEAPOLIS-ST. PAUL CHAPTER, as reported in the June-July 1957 issue of National Radio-TV News, held a banquet last spring that was so successful that the chapter repeated it again this spring. This one, too, was highly successful.

A delightful dinner was served at Esslinger's Cafe in St. Paul in an atmosphere of warm good-fellowship and conviviality. The dinner—Western steak with all the trimmings—was delectable. The real treat, however, was that so many of the members' ladies were present to make the occasion that much more enjoyable. The girls add so much to socials of this kind that it's a wonder more Chapters don't hold such functions with their wives and sweethearts attending.

The high spot of the evening was the swearing in of officers to serve for the next year: John Berka, Chairman; Kermit Olson, Vice-Chairman; Harold Lindquist, Secretary; Elmer Buck, Treasurer; and A. J. Lehn, Sergeant-at-Arms.

Following the banquet, Past Chairman John Babcock and Mrs. Babcock cordially invited a few of the members to their home to see the colored picture slides they took of NRI and Washington when they attended NRI's open house celebration last June. The pictures were excellent and proved a fitting climax to an altogether enjoyable evening.

Regular meetings are held at 8 PM on the second Thursday of each month at Walt Berbee's Radio-TV Shop, 915 St. Clair, St. Paul. The Chapter invites all NRI students and graduates in the area to attend meetings. Get in touch with Chairman John Berka, 2833 42d Ave., S., Minneapolis.

NEW YORK CITY CHAPTER wishes once again to extend a hearty welcome to its most recent new members. The Chapter is proud of its record. Almost all guests seem sufficiently impressed with its meetings to become members. This is definite proof that the Chapter's lectures and demonstrations are of substantial value and interesting, and that the members are a friendly group. The more members that join, the better the chapter likes it.

Among speakers at the last several meetings was Thomas Hull, who spoke on the oscilloscope, explaining the various controls, showing how they operate and what they do in forming the wave form on the screen. Frank Catalano gave a talk on how to fix TV tuners, with the help of Jim Eaddy. Jim, who has an enviable knowledge of transistor sets, also volunteered to repair any set the members have trouble with.

Everett Rogers spoke on his experiences with old sets aboard ship. The old-timers got a big kick out of this. Onte Crowe showed how to convert a radio into an intercom set. Frank Zimmer discussed his experience with an ohmmeter that kept getting stuck in one place on the scale and Willie Fox spoke on some of his experiences in repairing TV sets.

Students and graduates in the New York City area who are not attending these meetings are missing out on a valuable opportunity to improve their knowledge of Radio-TV. You will be welcome at the meetings as a guest. Get in touch with Chairman Edward McAdams, 3430 Irwin Ave., New York City, or Secretary David Spitzer, 2052 81st St., Brooklyn. The chapter meets on the first and third Thursday of each month at St. Marks Community Center, 12 St. Marks Pl., New York City.

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(*Continued from page 6*)

each resistor, we need to know the current flowing in each branch. Suppose we measure these currents and find 4.5 amperes flowing through each branch.

When a voltage is applied across a parallel circuit, this voltage appears across each of the branches, so, using the formula $R=E\div I$, the value of each resistor equals 90 divided by 4.5, which equals 20.

In Fig. 3(C), two 20-ohm resistors are connected in parallel with 4.5 amperes flowing in each branch. Since $E=R\times I$, we can find the source voltage by multiplying 20 by 4.5. This gives us 90 volts, the battery voltage.

Ohm's Law could be applied to an ac circuit with equal ease if it were possible to have such a circuit which was purely resistive in nature. However, when capacity and inductance are added to a circuit, the procedure becomes somewhat more involved.

Special formulas must be used to figure the reactance of the parts and the impedance of the circuit. Once this is done, Ohm's Law can be used as easily as in dc circuits.

In Fig. 4 are some problems which can be used for practice. In Figs. 4(A) and 4(C) you are to find the current. In Fig. 4(B) you are to find the voltage drop across each resistor. The answers will be found printed upside down below Fig. 4.

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Transistorized Portable TV

The first truly portable TV set was recently unveiled by Motorola. The receiver uses 31 transistors and is powered by two 5" x 5" x 5" nickel-cadmium batteries. The set consumes about 21 watts per hour as compared with more than 105 by the smallest tube type portable no w on the market. According to the designers, six hours of play can be obtained from one battery charge. It was stated that release of the set to the general public depends upon the availability of new type transistors. Current estimates indicate the transistorized TV portable will be available in about two years.

Graduate Receives Honor Award

Our congratulations to 1939 Graduate Wilfred B. Harrison, employed with the U. S. Department of Commerce, Coast and Geodetic Survey, who has received an honor award "for the design and construction of a successfully operating electrical remote tide gage recorder."

The following article concerns Graduate Harrison's achievement and is reprinted from the Coast and Geodetic Survey Personnel Panorama with kind permission of the Editor, Frances H. Maserick:

"Bill has been with the Survey for over 21 years. He was born in Michigan where he received his education and was a golf "pro" in 1928, 1933, and 1934. He has had varied and progressive assignments since he entered on duty as a seaman on the Ship GILBERT in 1937. In 1939, he graduated from the National Radio Institute as a radio technician. In 1942, he transferred to the Norfolk District Office as a clerk and his responsibilities increased as he held positions of engineering aid, administrative assistant, and in 1957 was promoted to his present position of supervisory cartographer.

In 1956, Bill received an incentive award of $150 for designing and constructing an electrical, remote tide gage recorder. The numerous hurricanes hitting the Norfolk area in recent years had emphasized the need for such an instrument. Highwater warnings one-and-a-half hours in advance and accurate to one-tenth of a foot are now available for downtown Norfolk low areas, thanks to Bill's development of this tide recording device. Bill studied the possibilities of such a repeating device for years before he began actual construction with old surplus property meters and some personal equipment. Many hours of personal as well as official time went into the development of his pilot model, completed in April 1956. Since then there have been six tropical storms and several power interruptions but except for experimental reasons, Bill's recorder has functioned continuously without a failure."

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Local Grad Is Instructor—Writer

A sincere thanks and tip of the hat to Graduate Donald A. Smith, Hyattsville, Md. who writes:

"When I first enrolled in your Radio-Television Servicing course, I was still in high school. Through the study of your lessons, I was working in a Radio shop before graduating from NRI or high school.

After graduation from NRI, I worked in the Radio-TV field until I entered the U. S. Air Force. Because of my training from NRI, I was sent to the guided missile test center in Cocoa, Florida, where I worked on the electronic seeker system of the Lark missile. After my discharge from the service, I worked for a research and development lab as an engineer in electronics and continued to finish my academic education. I also enrolled in the NRI Communications course and before completing it, I received my first class Radio-Telephone license. Again showing me that NRI's clearly written lessons prepare you even before you graduate.

Since 1954, I have held the job of instructor at the Chamberlain Vocational High School, Washington, D. C., and am now Senior Electronics Instructor. I strongly feel that there is no limit which Alumni of the National Radio Institute may reach if they learn what NRI teaches them and follow the advice which Mr. Smith offers.

There seems to be no way I can show my appreciation for the help, knowledge, and downright friendship I have always received from NRI except possibly in some small measure by this letter explaining what NRI has done for me.

I wish to say "THANK YOU."

It is success stories like Graduate Smith's that inspire us to even greater efforts to continue providing the best possible training we can for the industry. Our readers will also be interested to know Donald has reecntly had his *seventh* article accepted by the Zipp-Davis Publishing Co. One article "Card File Transmitter" appears in the May issue of Popular Electronics magazine. We are all extremely proud of you and your accomplishments Donald and wish you continued success for many years to come.

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