National RADIO-TV NEWS

IN THIS ISSUE

Aug.-Sept. 1956

VOL. 17 No. 4

A Tale of Two Frogs

I like this story. I think you will, too.

Through mishap two frogs were dumped into a can of cream.

Both immediately started swimming, jumping and otherwise striving to get out of the can.

One finally decided he'd never make it and quit trying.

His companion kept on struggling.

At the end of the day one frog was dead at the bottom of the can—and the other one was resting on a small mound of butter.

Need more be said about the value of persistence or the unexpected ways it sometimes pays off?

J. E. SMITH, *Founder*

NATIONAL RADIO-TV NEWS

Theodore E. Rose, *Editor*
L. L. Menne, *Editor Emeritus*
F. F. Edwards, *Associate Editor*
J. B. Straughn, *Technical Editor*

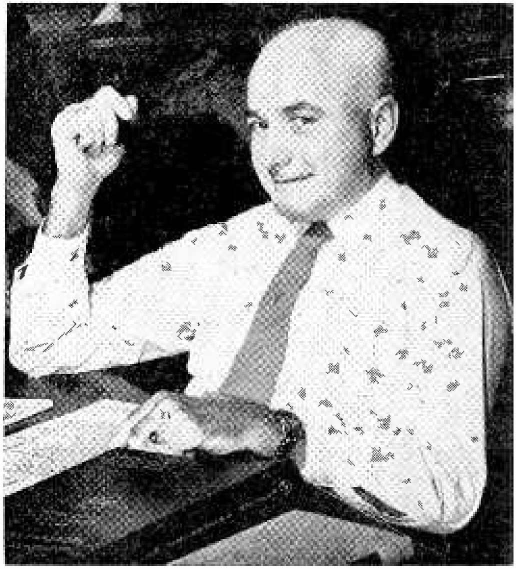
Published every other month by the National Radio Institute, 16th and U Sts., N. W., Washington 9, D. C. Subscription, $1.00 a year. Printed in U. S. A. Second-class mail privileges authorized at Washington, D. C.

SIMPLE CONTROL CIRCUITS

by

LEO M. CONNER

NRI Consultant



Leo M. Conner

AN increasing number of stories are appearing in newspapers and magazines about electronic control systems and new systems are being developed daily.

Unless you are "in the know" some systems seem mysterious indeed! Most control systems, even the very complex ones, are based on simple principles. If you know how the basic control operates, it is then possible to work out applications which will perform complex operations.

Very few of the complex control systems rely on the basic system alone—mechanical or electro-mechanical systems supplement the original control to make the complete operation possible.

Control systems may operate by interrupting a light beam; focusing a light beam on a certain spot; when the capacity between conductors is changed; by sound striking a microphone; or by an rf signal. Regardless of the method of starting the cycle, they all work on a principle of an impulse starting an action which is then carried through to complete the job.

Until recently, many of these control systems were considered as "gadgets" which were amusing but of little practical value. However, industry has found many practical uses for them. The simple control systems shown in this article may be constructed in the home workshop and then adaptations can be found so that useful work can be done in the home or store. Of course, there are many applications that are not shown because of space limitations. There is no reason why you should not work out different applications for your own use or to

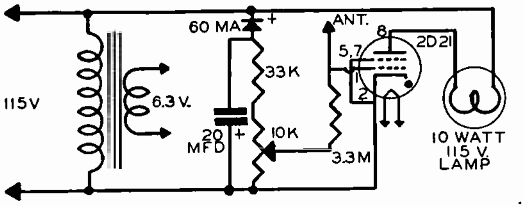


FIG. 1. A simple capacity-operated circuit using a type 2D21 tube as a "relay."

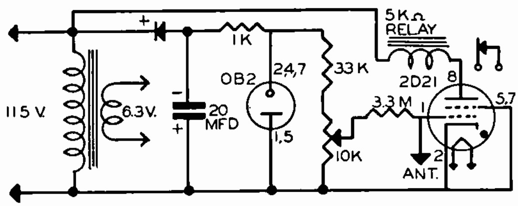


FIG. 2. A more stable version of the circuit shown in Fig. 1.

fill the needs of your customers.

One of the simplest control systems to build and adapt for special purposes is the capacity operated type. There are three different schematic diagrams for a capacity operated system and, as will be shown later, each of them have some variations which may make them more suitable for a certain job than others. These variations will be explained as the circuits are discussed.

Capacity Operated Controls

These capacity operated controls use a tube that may not be familiar to you—the type 2D21 gas tetrode. Notice that the schematic symbol for the tube is very similar to that of a tetrode tube with the exception of the heavy dot at the right of the cathode symbol in the tube schematic. This dot indicates that the tube is a gas tube. The type 2D21 tube is also known as a "relay tube" and as a "grid controlled rectifier." Unlike ordinary tubes, this tube either conducts or does not conduct. There is no partial conducting condition. They are available on the surplus market at very low prices or, of course, they can be purchased at most Radio tube wholesalers.

In the circuit shown in Fig. 1 the tube is used as a "relay" in order to light a 10-watt lamp when anything comes within operating range. The short "antenna" has capacity to ground and when anything approaches close enough to effect the capacity, the tube conducts and causes a lamp to light. The "antenna" can be a wire, plate or any metallic object that has capacity to ground but is not directly grounded.

The 10,000-ohm potentiometer shown in Fig. 1 serves as a "sensitivity control" and there is a good range of adjustment so far as operating distance is concerned. Whenever the tube is in a conducting condition the current necessary to light the 10-watt, 115-volt lamp flows through the tube. When the tube is not conducting, the lamp will be out. Since the tube will not pass heavy currents without burning out, the operations that can be performed by this simple circuit are limited. Do not try to use a larger lamp. The control tube has a 6.3-volt filament and the transformer shown is a cheap filament transformer having only one 6.3-volt secondary. The rectifier shown is a 60-ma selenium type and it must be connected in the circuit with the polarity shown. It is also necessary to observe correct polarity in connecting the electrolytic condenser.

After the circuit is wired according to Fig. 1, it should be placed on the workbench and a 3 foot "antenna" should be connected to tube socket terminal 1. CAUTION: This unit is "hot" with ac from the line and it should be insulated from grounded objects and enclosed in a case in order to avoid contact by animals or persons. The "antenna" wire is isolated from the line by the 3.3-meg resistor and there is no danger of shock in touching this lead.

In making the preliminary adjustments, the sensitivity control should be turned as far counterclockwise as possible. (Be sure to use a knob on the control shaft.) Place the "antenna" wire away from you as far as possible and then plug the unit into the line. Advance the sensitivity control in a clockwise direction in steps of about 10 degrees. Each time you move the control up, bring your hand near the antenna wire. When you have the right sensitivity adjustment, the lamp will light when your hand is close to the wire and go out when you take your hand away. The sensitivity control will enable you to set the distance to the desired value.

A possible use for this system is to control a night light in a bedroom. As an example, the "antenna" wire could be placed around a table with a 10-watt bulb in a lamp on the table. It is possible to build the actual control circuit into the base of some lamps. If you wish to see what time it is, merely bringing your hand close to the table would turn the lamp on and withdrawing your hand would turn it off. Thus it would not be necessary to actually find the control switch with your hand by feeling around in the dark.

One objection to this simple circuit is that changes in line voltage may cause it to operate or increase the sensitivity. On the other hand, drops in line voltage may reduce the sensitivity and make it necessary to bring the object closer

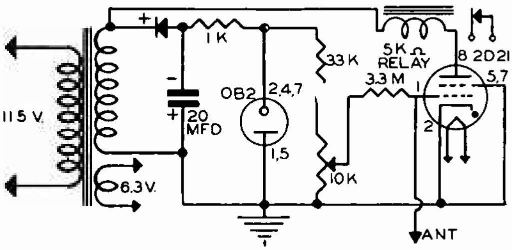


FIG. 3. This circuit provides both voltage regulation and isolation from the line.

to the "antenna." A better circuit for all around control work is shown in Fig. 2. The difference in the two circuits is that voltage regulation has been added to reduce the effect of line voltage changes and a relay has been placed in the plate circuit of the type 2D21 tube so that current for the device which is being controlled no longer flows through the tube. The relay can have normally open or normally closed contacts depending on whether the device is to operate when someone approaches or to shut off when someone approaches.

The type OB2 is a gas filled cold cathode voltage regulator. It has no filament but does have an orange glow when it is operating.

The same statements regarding protection apply to this unit. However, should you construct a case for either unit you should be sure to allow plenty of ventilation since the type 2D21 tube gets quite hot in operation.

If the device that is being controlled draws heavy current, more than the 10 watt lamp, a relay with heavy duty contacts should be controlled by the relay in the control unit or the relay in the control unit should have heavy contacts.

Should you wish to use a longer wire or a larger plate as an "antenna," reduce the value of the 33,000-ohm resistor to 15,000-oms.

Fig. 3 shows the circuit that is safer electrically since it is not connected to one side of the line. The transformer is the type known as a "booster" transformer and it has a secondary winding which is rated at approximately 130-volts at 40-ma in addition to the 6.3-volt filament winding. As shown in Fig. 3, the high voltage secondary is used for connections which formerly were made to the line. Otherwise the circuit and action is the same as for Fig. 2.

Fig. 4 shows some possible control circuits that could be used with the systems shown in Figures 2 or 3.

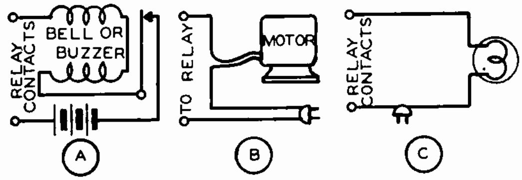


FIG. 4. How other devices can be connected to the capacity-operated control relay contacts.

Light Operated Controls

Although photocells in various forms have been available for a number of years, a comparatively new development in the light sensitive cell field makes it easy to build light controlled devices.

This development is the cadmium sulfide (Cds) photocell. They have high sensitivity and are fairly rugged. In addition, they have low impedance and can provide a current from 8 to 10-ma. The dark resistance of the cell is only a few megohms.

These cells are made from Cds powder and are grown in special furnaces. The crystals are then mounted on electrodes and sealed in glass tubes. The resistance of the cell decreases in proportion to the illumination between one and ten-foot candles. At higher light levels, the resistance continues to drop but not in direct proportion to the illumination.

Figure 5 shows a simple light control circuit using a type Cds3 cadmium sulfide cell. It is suitable for counters, door-openers, burglar alarms and many other jobs. Light intensity may vary from 2 to 50 foot candles. With as little as a 5 foot-candles the relay can be adjusted to give 8 pulses per second. The type Cds3 cell can be obtained from the Standard Piezo Co., Carlisle, Pa. for approximately $3.50. Fig. 6 shows another control circuit using the CdS3 cell and a type 2D21 tube is used as a "trigger control." The type 2D21 is operated with ac on the plate and is self-rectifying so that a pulsating dc is flowing through the relay winding. The pulsations are smoothed out by the electrolytic condenser so that hum and relay vibration are kept to a minimum.

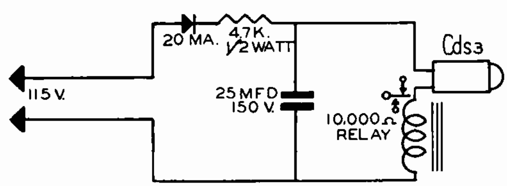


FIG. 5. A simple light-operated control circuit.

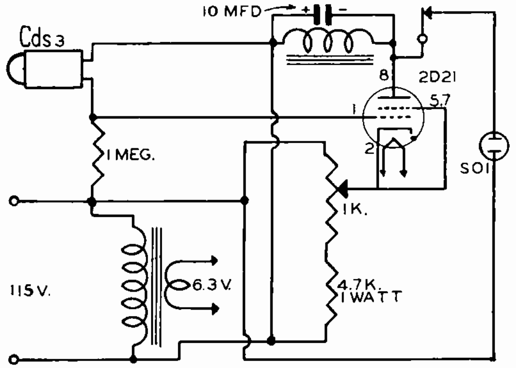


FIG. 6. A light-operated control circuit with greater control over operation.

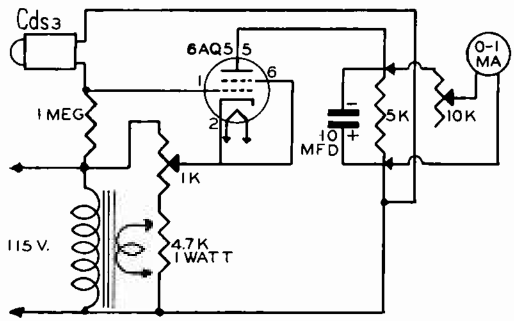


FIG. 7. This circuit gives greatest control over operating range.

The current flowing through the photocell and a 1-meg resistor determine the voltage which is applied to the control grid of the type 2D21 tube. The sensitivity of the circuit is determined by the setting of the 1,000-ohm potentiometer.

When the cell is dark, no current flows and the tube does not conduct. When the cell is illuminated, current flows and voltage is developed across the 1-meg resistor. When the voltage becomes great enough, the tube fires (conducts) and the relay closes.

It should be kept in mind that a control action could be started or stopped when the tube conducts. If the relay contacts are normally closed, the action would be stopped when a light struck the cell. If the contacts were normally open, action would be started when light struck the cell.

The socket, shown as SO1, in Fig. 6 is a connection point for anything that is to be controlled by the circuit. Whenever the relay contacts are closed, the socket will furnish 110-volts from the line. This current does not flow through the control tube.

As with the other gas tube control circuits, that have been described, the circuit is either on or off—there is no intermediate point although some control may be obtained by adjusting the potentiometer.

The control is fast acting and can be used in connection with a light beam in order to count objects. If it became desirable to count the number of people passing through a door, this circuit could be setup on one side of the door with a light beam striking the cell from the opposite side of the door. When somebody came through the door, the light beam would be interrupted, the circuit would "trigger" causing a solenoid to operate and move a counter. Thus, each time the light beam was interrupted, the counter would register.

The system might also be used to open a door when someone passed through the light beam. In fact, this system is already in use in restaurants and supermarkets. Thus, when a person carrying a heavy load passes through a light beam located a few feet from the door, a control system opens the door and holds it open for a time sufficient for the person breaking the beam to pass through the door. The door remains open as long as the light beam is interrupted.

In this type of control system there is no change in the intensity of the light beam and the action is a simple ON-OFF action.

However, because the amount of current in the grid circuit varies with the amount of light striking the photocell we can make some changes in the circuit and use the device for other applications. However, the type 2D21 tube cannot be used because it is either conducting or non-conducting.

If we make changes in the socket connections and substitute a type 6AQ5 tube for the type 2D21 tube as shown in Fig. 7 we can make circuit adjustments and relay adjustments so that the relay will close when a predetermined amount of light strikes the cell. If we replace the relay with a 5,000-ohm resistor we can calibrate a meter in terms of the amount of light striking the cell. By using a system of this sort we can convert the circuit to a color sorter. The operating conditions would first be setup for the amount of light reflected by a white surface and then any color would give less meter deflection with the darkest colors giving the smallest amount of deflection. In order to use the circuit for this purpose it is necessary to provide rigid supports (see Fig. 8) for the light source and the light cell and also to maintain a constant

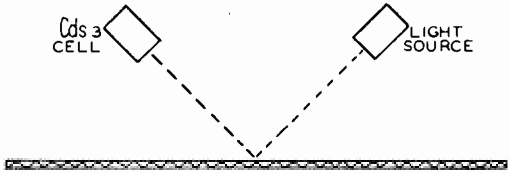


FIG. 8. How light is reflected from objects to be sorted.

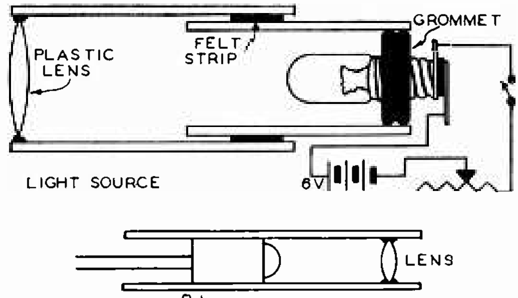


FIG. 9. Simple light source and light sensitive cell mountings.

spacing between the light source and the surface on which the colors are placed. Otherwise changes in distance would affect the light intensity. Notice that in this case we are dealing with reflected light instead of a direct light. This means that we must also take steps to prevent light from other sources from reaching the cell. Light from surrounding sources is known as ambient light and it must be kept to a minimum. It is possible to add a lens system to both the light source and the cell although the type CdS3 cell has a built-in lens. The lens need not be an expensive one—it can be a plastic lens from a dime store magnifying glass. In the light source shown in Fig. 9, a 6-volt battery 6-volt pilot lamp and rheostat are connected in series so that the intensity of the light can be varied. The pilot lamp socket is inserted in the center hole of a half-inch rubber grommet and then the grommet cemented in the end of a half-inch tube which has had the inside painted black. It is not absolutely necessary to cement the grommet in place since friction will hold it but a more rigid mounting is developed by actually cementing the grommet into the half-inch tube.

This tube is then slipped into a slightly larger tube which has the plastic lens cemented in one end. The inside of this tube should also be painted black to keep reflections at a minimum. If the tubes do not have a close fit, a thin strip of felt or cloth can be placed around the smaller tube so as to give a friction grip between the two and at the same time prevent light entering the opening between the two tubes. Then, after the arrangement has been mounted on a rigid support, the light can be focused to a spot by sliding the larger tube back and forth on the small tube.

Keep in mind that in light beam work the angle of incidence is equal to the angle of reflection. Therefore, it will be necessary to have both the light source and the photocell adjusted to the proper angle so that the light will go down from the light source to the object and reflect back on the photocell.

Variations in the amount of light striking the photocell will cause the cell current to vary which in turn causes a variation in the voltage drop across the 1-meg resistor. This will affect the plate current of the 6AQ5 tube causing a change in the voltage across the 5,000-ohm plate load resistor. This voltage will be in direct relationship to the amount of light reflected by the colors and thus the meter could be calibrated in terms of color rather than voltage.

In the experimental circuit used, a 1-ma meter was used in connection with a 12,000-ohm resistor in order to form a 12-volt meter. The meter was then connected directly across the plate resistor and the circuit is adjusted for full scale deflection when a white object is placed on the surface where the light beam is focused

It is interesting to watch the variation in voltage indicated by the meter when one of the paint color cards that is used to show available colors is placed under the light source. The darker colors cause very little meter deflection while the brighter colors cause corresponding increases in voltage.

It is possible to combine the circuits of Figs. 5 and 7 in order to sort objects according to length and color. The objects can be placed on a moving belt and in order to reject all over a certain length you would need only the simple circuit using the CdS cell. To sort the objects according to color you would need one setup using a 6AQ5 tube for each color save one which could be carried on to the end of the belt and selected by virtue of the fact that it was the only one left. Figure 10 shows how a stripe painted on a moving belt can be used to sort objects according to length. If more than one length were to be selected, then you would need a strip for each length and a simple CdS cell control mechanism for each length.

Objects are moved off the belt by means of a solenoid selector system. The relay in the length control circuit causes voltage to be applied to the coil in the solenoid which then pulls the soft iron core into the coil. A lever attached to the core is moved in the desired direction and it strikes any object causing it to move off the

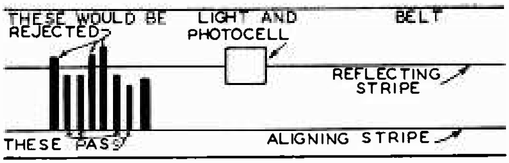


FIG. 10. How objects on a moving belt can be sorted for length.

belt. See Fig. 11.

Here again, industry has used variations with suction being used to remove objects from the belt, air jets being used to blow objects off the belt and mechanical fingers being used to pick them off of the belt.

In selecting different colors, keep in mind that relays with different degrees of sensivity can be obtained. There is also some adjustment on each individual relay so that its sensitivity can be adjusted within limits. By placing a relay in the plate circuit of the 6AQ5 tube and adjusting the relay the circuit can be made to operate on a certain amount of light reflection. Thus, the relay could be made to operate on several shades on darker colors. In a setup which was designed to select a series of colors the lightest colors should be selected first and so on leaving the dark colors for the last selection.

Another use for a light operated controls is in a "commercial silencer" for radio or TV sets.

By shining a light beam on the CdS cell from across the room a relay can be made to operate and open the voice coil circuit in order to kill sound. Of course, the relay should be of the single pole double throw type so that a resistor would be connected across the voice coil when the set was silenced in order to avoid possible damage to the output transformer. In this particular setup so long as the photocell is illuminated the set will be silent.

Many other variations will suggest themselves and some of them may be a source of profit to you.

Relays

From the information that has been presented you can see that relays play an important part in any control circuit. Relays are rated according to sensitivity and the contacts are rated according to current carrying capacity.

The greater the relay sensitivity the less current it can switch and in many cases it is necessary to use a sensitive relay to operate another relay which in turn, causes the mechanism to operate.

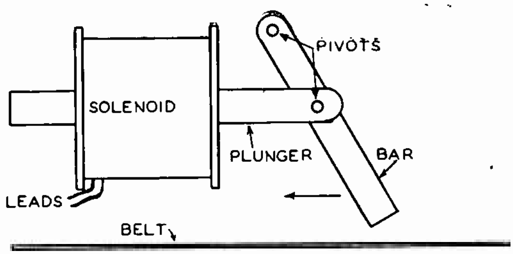


FIG. 11. Exaggerated view—rejector solenoid.

Relays are also designed to operate on either alternating or direct current. If a relay that has been designed for operation on dc is connected in an ac circuit it will hum and chatter. The difference in relays designed for the different types of current is that the ac relay will have a copper ring around one end of the armature while the dc relay coil has no ring. DC relays used in circuits containing pulsating dc can be made to stop "chattering" by connecting an electrolytic condenser across the relay coil.

Contact arrangement may vary from straight single pole single throw up to a number of poles with double throw action. There are also available "stepper" relays which have a number of positions that are obtained by a series of pulses. Each time the circuit operates the contacts move up another step. It would be possible to have as many as 10 contacts with thirty positions available. The first impulse would advance the contact to the first step and then each operation of the relay would advance the operation another step until the entire sequence of thirty steps was completed. The relay would then be in position to start the first step all over again.

There are also relays that are known as "lock-in" types. These relays operate when the control pulse is delivered and then holds even if the circuit is no longer being actuated. This type requires a manual release and is suited for applications such as burglar alarms where the intruder might get close enough to cause an alarm to operate and then back away when the alarm was given. With the lock-in type of relay control the alarm would continue to sound even though the person causing it to operate had left the original position.

From this you can see that the application may determine the type of relay that is used.

The solenoid that has been described is a form of relay but instead of having the core in a fixed position the coil is wound on a tube in which the core slides. The core is normally not centered in the coil and when sufficient current flows through the coil the core is pulled into a central position. This pulling action can be used to operate a lever which in turn could move objects off of a belt. Solenoids are normally operated by relays in the control circuits. Thus the actual control operation is both electrical and mechanical.

When you select a relay for controlling a motor or a device requiring heavy currents it is necessary to choose a contact rating which will safely handle that current. Otherwise, the relay contact will be badly burned and pitted in a short time. If a heavy current flows through contacts that are not rated to stand that current they may be permanently welded together.

Sound Operated Controls

Controls which operate when a certain volume of sound strikes a microphone have been used at times to open garage doors in public garages. These circuits are similar to Fig. 6 except that a microphone replaces the light cell. A sign telling the motorist to "sound your horn" may operate a mechanical door opener. In other cases this wording is used so that an attendant can manually open the door. Incidentally, there are also controls for doors of this type that are light operated. The light cell is mounted in the center of a black circle painted on the door and when the light from a headlight strikes a cell the circuit is actuated and the door opens.

The actual construction of door opening circuits is outside the scope of an article of this type. However, any motor operated door can be controlled by one of these systems.

From these circuits you can go on to many control operations. Your own imagination will give you many ideas and if your town has any industrial plants they are prospects for control devices. Remember all of them start from simple circuits and you will be surprised at the "magic" that can be worked with these circuits.

———*n r i*———

Production Technicians Needed

Openings exist from time to time for Production Technicians with Caroll Electronics Corporation, W. Stephan St., Martinsburg, W. Virginia. Qualified students or graduates should write direct to Jack Frank, Production Manager, at the above address. Give a brief outline of your education and experience in your letter of inquiry.

———*n r i*———

"Just think of it!" exclaimed the romantic young newlywed, "a few words mumbled over your head and you're married."
"Yes," agreed the old cynic, "and a few words mumbled in your sleep and you're divorced!"

Our Cover Photo

The Martin Matador, pictured in the official U. S. Air Force photo, is a new version of the original matador guided missile. It has an entirely new airborne guidance system. The accuracy of this weapon depends on complex electronic circuity. The technicians in industry who build the electronic "brains" for guided missiles do interesting, well paid work, and at the same time make a valuable contribution to the defense of our country and the free world.

———*n r i*———

New Roll Charts Available for Owners of Model 70 NRI Professional Tube Testers

The year of 1956 has seen the introduction of a large number of new receiving type tubes for Radio and Television. Although a new Roll Chart was made available in January of 1956, quite a number of new tubes have been introduced since that date. Another new Roll Chart has been prepared as of July, 1956. Men who have purchased Model 70 Tube Testers having a serial number of 7000 or higher should not purchase these new Roll Charts. Men who own tube testers having a serial number lower than 7000, can benefit by purchasing this new chart.

The new charts are available from the NRI Supply Division for $1.25, postpaid. Please use the coupon below.

ORDER BLANK FOR MODEL 70 ROLL CHART

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

Enclosed is my remittance for $1.25. Please send me a new Roll Chart for my Model 70 Tube Tester. This chart was printed in July, 1956.

Name ....

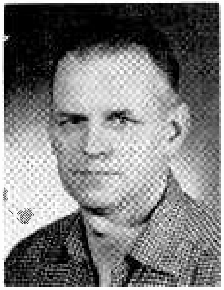
Address ....

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

Student No. ....

If you live in Washington, D. C., please include an additional three cents to cover D.C. sales tax.

Good Jobs, Increased Earnings Result from NRI Training



Started As a Hobby, Now in Radio TV Servicing Full-Time

"When I enrolled for this course I took it as a hobby, but after a few lessons I started radio servicing and with the money I earned I bought instruments. I now do Radio-TV servicing as a full-time job. I operate my own business.

It doesn't seem possible that I could make a living in this field but it has exceeded all my expectations."

Gerald R. Lindsey
400 11th St.
Philipsburg, Penna.

———n r i———

Made $400 Extra In One Year

"Thanks to the NRI course, I started making about $10 a week extra money after the sixth lesson. I am doing Radio work on the side and in the last twelve months, I would say that I have made about $400. I expect to be a service technician for Radios and Televisions in a nearby shop in the near future.

If you really study the NRI course you are able to do the work that ycu have studied about."

Carl W. Cooper
Cherry Valley
Arkansas

———n r i———

Started Spare-Time Servicing After Completing 20 Lessons

"A little over a year ago when I enrolled with NRI I knew nothing whatever about Radio. Now I am servicing Radio and Television receivers part-time. In one month I took in $152.14. Every month my earnings keep getting larger.

The kits in the course really get a fellow started on the right foot. I began servicing Radios at about the twentieth lesson, and began TV servicing shortly after starting the TV section of the course."

Richard Latno
Bradley
Main

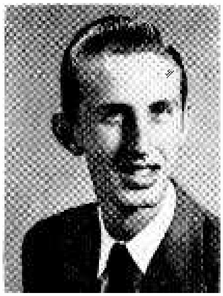
Wins Advancement In Work on Electronic Computers

"When I signed for your course I was a final tester on one of the electro-mechanical counting machines. Just before I graduated, I was assigned to one of the electronic computers as a final tester. Then in January of this year; I was given the assignment as coordinator between two of the company's plants on the 705 Electronic Data Processing Machine.

I am very proud to be a graduate of the National Radio Institute, and to be associated with the International Business Machines Corporation. Thank you for the help and training you gave me. Without it I could not have done so well."

James L. House, Jr.
RFD 3, Grand Avenue
Vestal, New York

———n r i———



Dictating Machine Serviceman

"I am now employed as a dictating machine serviceman by the Lanier Company (main office —Atlanta, Ga.). I am with the bench branch at Winston-Salem, N. C.

After about three months of study, I began earning several extra dollars a week in my spare time and after completing the course I was making about $50 a month in spare time.

I am still repairing Radios in my small shop at home, and have earned over $3000 in the last twelve months."

Larry D. Sledge
2404 Fala Street
High Point, North Carolina

———n r i———

Has Own Full-Time Servicing Business

"I started servicing Radios about three months after I enrolled. When I enrolled I knew practically nothing about electronics.

Five months after my graduation, I set up my own shop and am now doing full-time servicing. I think your NRI course is wonderful. Thanks to the NRI staff."

M. H. Slone
Ulysses
Kentucky

———n r i———

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

Advantages of a VTVM in Radio-TV Servicing

B. van Sutphin

By B. VAN SUTPHIN
NRI Consultant

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

Fig. 1 shows a basic cricuit for a vacuum tube voltmeter. The voltage to be measured is impressed across resistor R1, which is in series with the bias developed by resistor R2. When the voltage existing between the cathode and the grid of a tube is changed, the plate current will change. This change in plate current is indicated by the meter connected in the plate circuit. Resistor R3 and condenser C serve as an ac filter to prevent any ac voltages from appearing on the grid of the tube.

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

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

With no signal applied to the input circuit (between point X and point Y), resistor R11 is adjusted so that equal currents flow in the two sections of the bridge. This means that the voltage at the plate of each tube will be equal, no current will flow through the indicating meter, and the meter will read zero.

Now, if the grid of VT1 is made more positive by coupling an external voltage source to the circuit, the plate current of this tube will increase and the plate voltage will decrease. At the same time that the bias on VT1 is decreased by the external voltage, the extra current flow through resistor R7 causes the cathode of VT2 to become more positive which effectively causes the grid of VT2 to become more negative. This causes the plate current to decrease and under these conditions, the plate voltage will increase. This condition of having the plate current through one tube increase at the same

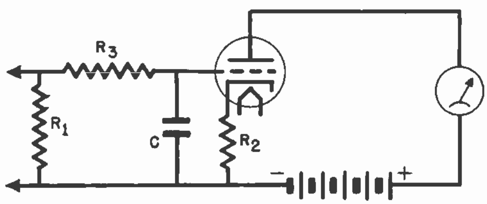


FIG. 1. Basic circuit for a vacuum tube voltmeter.

time that the plate current through the other tube decreases makes the instrument even more sensitive.

The effect of applying an input signal is to decrease the plate resistance of VT1 at the same time that the plate resistance of VT2 is increased. Therefore, the circuit gives greater sensitivity than a simpler vtvm employing only one tube. In actual vtvm's, the indicating meter may be connected between the tube plates or between the tube cathods. The operation is the same in either case.

The circuit of Fig. 2 also includes a provision for more than one voltage range. By tapping down on the voltage divider (consisting of R12, R13, and R14), only a part of the total voltage existing between points X and Y is actually applied to the grid of VT1. Resistor R5 and condenser C serve the same purpose as in the circuit of Fig. 1. Together they act as a filter to keep ac components of the input signal from appearing at the grid of VT1 and causing random meter fluctuation.

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

Advantages of the Vacuum Tube Voltmeter

The most important advantage of a vacuum tube voltmeter is that the input resistance is held constant *at a high level.* Referring to Fig. 2, the total volume of R12 plus R13 plus R14 is the only circuit element which is connetced directly across the points where voltage is to be measured. The total resistance of this voltage divider can be made quite high—as high as 10 megohms. If the instrument is designed to have a basic range of 3 volts when the switch is set to point 1, this means that you have an input sensitivity of 3.3 megohms per volt on this range. Compare this with the input resistance of a 1000 ohms-per-volt instrument set for the 3-volt range—input resistance, 3000 ohms!

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

Once a vacuum tube voltmeter like that in Fig. 2 has been calibrated, it will maintain calibration for long periods of time. A dual triode tube is normally used instead of two separate tubes. As the tube ages and the current flow through it decreases, it decreases equally in both sections. This means that the bridge will maintain a balance even though the current has changed. If two separate tubes were used they would probably age differently, the current in the two sections would decrease at different rates, unbalancing the bridge.

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

The Model 11 NRI Professional Vacuum Tube Voltmeter

Fig. 3 shows an instrument of the type we have been discussing. This instrument has dc voltage ranges from 3 volts to 1200 volts. With the addition of a high voltage probe, it is possible to measure voltages as high as 30,000 volts—particularly useful in servicing TV receivers.

It has ac ranges from 3 volts to 1200 volts giving accurate reading over a frequency range from 25 cycles to 3 megacycles. An accessory rf probe is available for this instrument that extends the frequency range to 250 megacycles. The instrument has a wide range ohmmeter scale that will accurately measure resistance as low as 0.5 ohms and as high as 2000 megohms. In addition, it has a special feature of a zero-center scale that has been especially designed for use

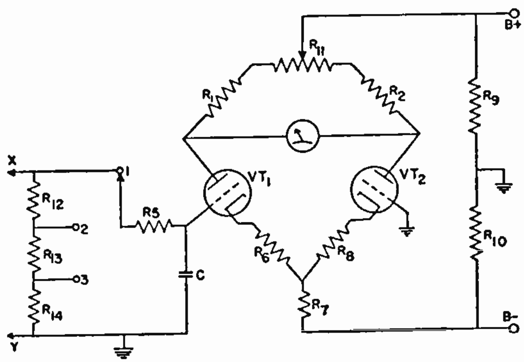


FIG. 2. Simplified basic circuit used in most bridge-type vacuum tube voltmeters.

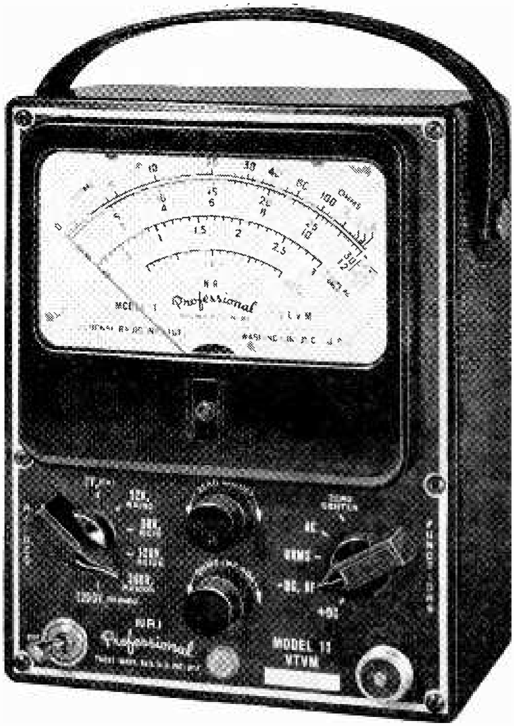


FIG. 3. The Model 11 NRI Professional Vacuum Tube Voltmeter.

in aligning FM sets and the sound circuits of TV receivers.

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

To provide additional accuracy in dc voltage measurements and to decrease the effect the instrument has on the circuit where voltage is being measured, a 1-megohm isolating probe is used on the standard test probe. With the addition of this probe, it is possible to measure the dc bias at the grid of an oscillator tube without shifting the oscillator frequency appreciably.

Because of the high input resistance, and the extreme accuracy, the vacuum tube voltmeter is the most popular instrument for use in service shops today. This is particularly true in TV shops where it is often necessary to measure slight voltages in high resistance circuits without upsetting the circuit operation. Because of the many ranges available, a vtvm can be used to check almost any type of electronic circuit. It is the ideal instrument for use in both Radio and TV servicing.

Let's discuss some of the measurements that a serviceman must take in servicing the equipment.

DC Voltage Measurements

The most important measurement to the serviceman is measurement of the supply voltages to the various tubes in other parts of the equipment. Because of the vtvm's extremely high input resistance, these voltages can be measured in all circuits—including the high resistance circuits so common in modern equipment—without greatly affecting the circuit operation and accuracy of voltage readings.

To measure the plate and screen supply voltages in a receiver, simply set the vtvm for +DC measurements, connect the COMMON lead of the instrument to the B— point in the set and then touch the dc probe to the various points where you wish to measure voltage.

To further illustrate the importance of high meter input resistance, consider the circuit shown in Fig. 4. Notice that the screen dropping resistor is 4.7 megohms and the plate dropping resistor is 1 megohm. An attempt to measure the screen voltage with a low resistance voltmeter would give a completely erroneous reading because the test instrument would load the circuit quite heavily. While the vtvm loads the circuit to a certain extent, it is possible to switch to a lower voltage range while maintaining the constant input resistance. Therefore, the voltage will not change as you switch to a lower range to obtain a more accurate reading.

Equally accurate voltage readings will be obtained in all circuits. Even though the extremely high resistance is not absolutely necessary when measuring the voltage in low resistance circuits, the extreme accuracy is desirable. Therefore, it is best to have a vtvm and use it at all times regardless of circuit resistance. Therefore, you will be assured of accurate results in all tests.

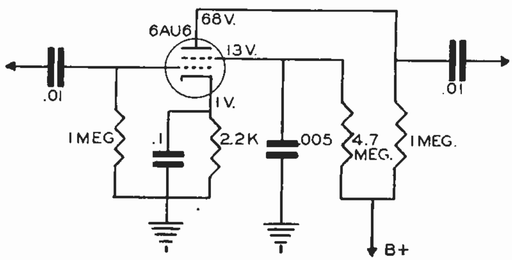


FIG. 4. Typical pentode audio amplifier circuit.

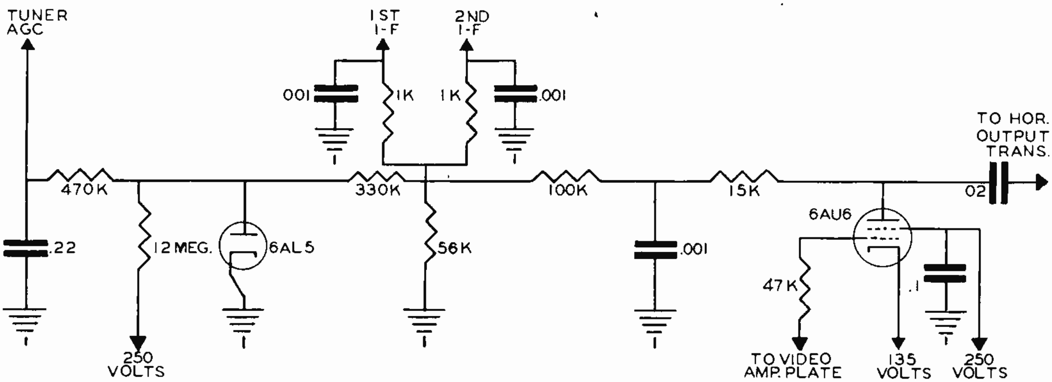


FIG. 5. A "keyed" agc circuit with a delay network to reduce the bias applied to the tuner and a bias clamper.

The —DC voltage ranges are particularly important in such measurements as checking the oscillator grid voltage, and checking avc and agc voltages. With this feature, it is unnecessary to change the connection point of the COMMON lead of the vtvm, provided it has been connected to the receiver B— point previously.

To check the oscillator grid voltage, merely switch to the —DC position and touch the probe to the oscillator grid pin of the tube socket. In every case, you should obtain a negative voltage at the oscillator grid. With the instrument set to the —DC position, the meter will swing upscale, and you can read the actual voltage.

In checking the agc voltage in commercial TV receivers, there are some special problems that may be encountered. Fig. 5 shows the agc circuit of a commercial receiver. Let's discuss this circuit for a moment.

This is a keyed agc circuit. In this circuit, the composite video signal is fed to a separate tube which is biased well beyond cutoff. The plate voltage for the keyed agc tube is in the form of a pulse obtained from the horizontal output transformer. This pulse occurs only during horizontal retrace.

The composite video signal is applied to the grid of the tube through the 47K-ohm filter resistor. The horizontal retrace pulse occurs at the same time as the horizontal sync pulse portion of the composite video signal. The circuit is designed so that the horizontal sync pulse drives the grid of the tube positive with respect to the cathode. Since the pulse obtained from the horizontal output transformer drives the tube plate positive at the same time, the tube can conduct at this time. It cannot, however, conduct during the remainder of the sweep cycle when there is no positive pulse at the plate of the tube.

For a given TV signal strength, the amplitude of the horizontal sync pulse remains constant at all times. Therefore, the amplitude of the horizontal sync pulse is truly indicative of the signal strength. If the signal strength decreases, the amplitude of the horizontal sync pulse will also decrease and the current flow through the keyed agc tube will decrease. Of course, the pulse fed back from the horizontal output transformer remains constant at all times.

When current flows through the tube, the electrons must flow through the series combination of the 56K-ohm resistor, the 100K-ohm resistor, and the 15K-ohm resistor. The direction of current flow is such that the ungrounded end of the 56K-ohm resistor becomes negative with respect to the common B— point. This negative voltage, which varies with variations in signal strength, is used as agc voltage for the receiver. The voltage across this resistor is fed to the first and second video i-f stages through separate agc filter networks each consisting of a .001-mfd condenser and a 1K-ohm resistor.

The voltage existing across the 56K-ohm resistor cannot be applied directly to the front end tuner unit because the voltage is too high. It would overbias the rf stage in the tuner and cause cut-off. To decrease the bias supplied to the front end tuner unit, a delay network consisting of a 330K-ohm resistor connected in series with the agc line to the tuner and a 12-megohm resistor connected back to the B+ line is used. This 12-megohm resistor feeds a slight positive voltage to the agc line for the tuner and overcomes a portion of the negative bias thereby reducing the over-all bias applied to the tuner. To prevent the agc line for the tuner from ever going positive even in case of a defect in the agc network, a clamper diode is connected between the tuner agc point and B—. If the negative voltage across the 56K-ohm resistor disappears, the tuner agc line will become positive, and the plate of the diode will become positive. Under those conditions, the diode will, of course, conduct and effectively "kill" the positive voltage. Now let's discuss some of the problems connected with measuring voltages in this circuit.

The voltage developed across the 56K-ohm resistor is the agc voltage for the receiver. In testing the operation of the agc circuit, therefore, you would set the test instrument for —DC voltage measurements and then check the voltage at the ungrounded end of the 56K-ohm resistor. If there were no negative voltage available at this point, you would then have to check the remainder of the circuit to determine just what is wrong.

First, you would check the 6AU6 agc amplifier tube since a defective tube would "kill" the agc voltage.

If you find the tube to be good, you would then start checking the voltages in the remainder of the plate load circuit for the agc tube.

First, you would check the voltage existing across the .001-mfd condenser which is connected from the junction of the 100K-ohm resistor and the 15K-ohm resistor to ground. If you obtained negative voltage at that point, you would then have to check the .001-mfd capacitors in the networks feeding the first and second video i-f stages. If one of those capacitors shorted, this would effectively connect a 1K-ohm resistor in parallel with the 56K-ohm resistor and therefore reduce the agc voltage to a very low value. The ohmmeter section of the vtvm is ideal for this purpose. Merely switch the instrument for ohmmeter measurements and check directly across the suspected condenser.

If you find no negative voltage at the ungrounded side of the .001-mfd condenser in the plate circuit of the agc tube, you would then check the voltage at the plate of the agc tube. With an instrument such as the NRI Model 11 Professional VTVM, this is very simple. Simply touch the dc test probe to the plate connection of the tube. You should obtain a negative reading. If the vacuum tube voltmeter that you have, however, does not have a separate isolating resistor *at the end of the test probe*, you must add one. To do this, simply twist the lead of a 1-megohm resistor around the test probe and then touch the other end of the resistor to the plate connection of the tube. This additional resistor prevents loading of the ac pulse at the plate of the agc tube and consequent upset in circuit operation.

If, in your initial test, you found that normal negative voltage existed at the ungrounded end of the 56K-ohm resistor and at the junction of the resistor and the condenser in the agc filter network to each video i-f stage, you would then have to check the voltage on the tuner agc line. In this circuit you would check the voltage at the plate of the 6AL5 clamper tube. Failure to obtain voltage at this point would indicate that the 330K-ohm agc feeding resistor was open. Normal agc voltage at the plate of the 6AL5 but no voltage at the tuner agc point would indicate that the 470K-ohm feeding resistor was open or that the .22-mfd bypass capacitor was shorted. Each component could be checked separately with the ohmmeter section of the vtvm.

This circuit is considerably more complicated than those you will commonly encounter in receiver servicing. This one was particularly chosen, however, to illustrate all of the varied problems that might be encountered in servicing agc circuits, and to illustrate the importance of high meter sensitivity. With the high value resistors used in this circuit, attempting to read the relatively low voltages with a less sensitive instrument than a vtvm would surely upset the voltages in the circuit and perhaps lead to erroneous results.

Remember that the input resistance of a vtvm is constant and does not change as you switch to a lower voltage range. Therefore, a vtvm does not appreciably load a circuit, even when you use the low voltage dc ranges of the instrument.

AC Voltage Measurements

In general, extremely high input resistance is not too important on the ac ranges since most ac measurements are those of filament voltages and ac supply voltages.

There are, however, some cases in service work where a high resistance ac voltmeter is important. A vtvm is desirable since it has high input resistance on the ac ranges and is therefore satisfactory for use in testing special circuits.

Another special feature of the NRI Model 11 VTVM is that a dc blocking condenser is included in the instrument itself on all ac voltage ranges. Therefore, it is possible to measure the ac voltage in those circuits where dc voltage is also present without the necessity for connecting a separate dc isolating condenser. Also, the instrument has wide frequency range (± 3 db from 25 cycles to 3 megacycles) and is therefore satisfactory for measuring audio voltages in servicing high-fidelity equipment.

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

To measure the ac output of a power transformer, attach the COMMON lead of the voltmeter to one side of the winding and the test probe to the other side. The voltmeter will then read the potential between these two points.

When checking transformers in this manner, always use the highest ac voltage range for the initial measurement. The range switch can then be reset, if necessary, to obtain a usable reading.

Most servicemen prefer not to attempt measuring the voltage across the entire ac secondary since this places considerable load on the rectifier tube in the voltmeter. To decrease the voltage applied to the rectifier tube in the voltmeter, measure the voltage existing between the center tap and each end of the high voltage secondary and then add the two voltage readings. This will indicate the total voltage across the entire transformer secondary. Incidentally, the voltage across each side of the secondary should be equal.

The vacuum tube voltmeter, set for ac measurements, will also measure voltages at audio frequencies. This useful feature makes it possible to directly "signal trace" in the audio stages of a receiver. To do this, tune in a signal and then check the audio voltage at the grid and plate of each audio tube. If a signal is available at the grid of a tube, and not at the plate, some defect exists in that circuit.

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

In alignment work, the ac function of the vtvm is useful in checking the audio signal voltage across the loudspeaker voice coil, or between the plate of the audio output tube and B—. Since the vtvm has a built-in dc blocking condenser, an accurate reading of the ac voltage at the plate of the audio output tube is possible without the necessity for adding a separate blocking condenser.

Ohmmeter Measurements

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

In modern equipment, high value resistors are becoming more and more common. Notice the plate and screen resistances used in the circuit shown in Fig. 4, and the resistors used in the agc circuit shown in Fig. 5. For proper circuit operation, it is important that these resistors maintain their value. A substantial change in the value of one of the resistors is almost sure to upset the circuit operation and cause trouble. Therefore, it is important that you have a high range ohmmeter available for use in receiver testing.

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

To measure a resistor, first adjust the ohmmeter section of the instrument as described in the instruction manual. Then connect the two test leads to the two ends of the resistor. Adjust the range switch until the meter pointer is on an easily read portion of the scale (near, or slightly above, the middle). Mentally apply the necessary multiplying factor to the reading observed on the meter. For example, if the needle comes to rest at 10 on the OHMS scale, and the range switch is set to R x 100, multiply 10 by 100 to get the value—1,000 ohms. Most vacuum tube voltmeters, like the NRI Model 11, have the resistance ranges arranged in steps that are multiples of 10. This makes it easy for you to apply the multiplying factor by adding the appropriate number of zeros to the reading observed on the scale.

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

By switching to a lower range, coils and i-f transformers can be checked. It is important, however, that the coil to be tested be completely disconnected from the circuit. Then connect one ohmmeter lead to one end of the winding and the other ohmmeter lead to the other end.

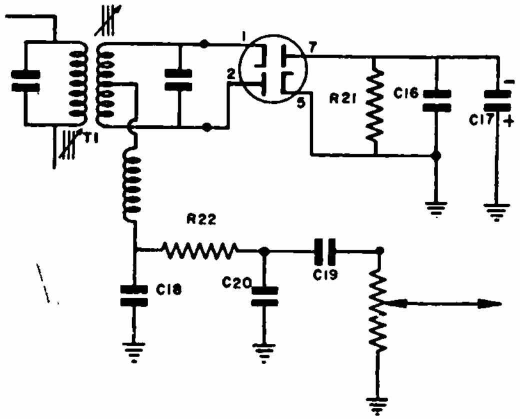


FIG. 6. Typical ratio detector circuit used in an FM or TV receiver.

When using the ohmmeter for continuity tests in servicing, do not use the lower ohmmeter ranges (R x 1, and R x 10) too often, because this will cause somewhat more rapid discharge of the ohmmeter batteries. In normal use, the batteries in the ohmmeter circuit will last their "shelf life." Also, you should take care not to attempt to measure continuity of battery tube filaments using the R x 1 scale. When the instrument is set to the R x 1 scale, the 3-volt ohmmeter battery is likely to burn out the filaments of battery tubes. There is no danger, however, if the instrument is set to one of the higher ohmmeter ranges.

Zero Center Scale

The NRI Model 11 Vacuum Tube Voltmeter has a specialized feature that is not found in most service instruments today—a zero center dc voltage scale. This scale is arranged so that the zero center mark on the scale is at the center and the meter reads positive voltage by deflecting the pointer to the right, and negative voltages by deflecting the pointer to the left.

To use the zero center dc voltage scale of the instrument, set the function switch to the "ZERO CENTER" position and set the "ZERO ADJUST" control so that the meter pointer rests over the zero on the black scale that is marked "ZERO CENTER."

Fig. 6 shows a typical ratio detector circuit that might be used in an FM or TV receiver. Let's consider the value of the zero center scale in aligning this receiver.

In the initial stages of alignment, the test instrument must be set for —DC voltage readings and connected to measure the voltage existing across audio bypass condenser C20. The individual i-f transformers, and the primary of the ratio detector transformer, are then adjusted for maximum voltage across condenser C20.

To align the secondary of the ratio detector transformer, two 100,000-ohm resistors in series must be connected across voltage stabilizing condenser C17. The test instrument is then set for zero center measurements and connected to measure the voltage existing between the junction of the 100,000-ohm resistors and the ungrounded side of condenser C20. With the signal of the proper frequency fed to the circuit, the secondary of the ratio detector transformer is then adjusted for zero voltage reading.

The procedure for adjusting a discriminator circuit is somewhat similar in that zero center readings will also be required in that case.

Accessory Probes

In the modern service shop, accessory probes are highly desirable because they will increase the usefulness of a basic instrument and allow special tests to be made. In this way, the accessory probes make the serviceman's job easier.

RF Probe. The rf probe available for the NRI Model 11 Vacuum Tube voltmeter extends the frequency range of ac voltage measurements to 250 megacycles.

To use the rf probe with this instrument, initially adjust the instrument as you do normally. Then set the Function switch to the "—DC, RF" position, and connect the rf probe. The range switch can then be set to the appropriate range to measure the rf voltage.

Caution: There is a voltage limit on the crystal contained in the rf probe. It is 120 volts peak (85-volt rms) for the probe for the NRI Model 11. This peak voltage should never be exceeded in testing.

To use the rf probe, attach the probe ground lead to the nearest B— point, and then touch the probe tip to the point where an rf voltage measurement is desired. There is a built-in series capacitor, and the rf voltage can therefore be measured in the plate circuit of tubes.

By feeding a signal to the input of a receiver and measuring the strength of the signal available at the plate of each successive stage, you can get an idea of the gain of the receiver. To obtain accurate readings, however, you must be sure to readjust the alignment trimmer after you have connected the rf probe to allow for the internal capacitance of the probe itself.

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

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

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

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

High Voltage Probe. Another accessory that is available for the NRI Model 11 Vacuum Tube Voltmeter is the high voltage probe which allows dc voltage measurements up to 30,000 volts. To use this accessory, set the function switch to the "+DC" position and the range switch to 1,200 volts. Then remove the dc isolating probe and slip the high voltage probe over the normal probe. When the high voltage probe is correctly inserted, a slight click will be heard.

Now connect the negative lead of the voltmeter to the chassis. Touch the tip of the high voltage probe to the point where the measurement is to be made. There will be slight arcing as you approach the high voltage point. This is normal. When making measurements in high voltage circuits, always keep your hand well behind the safety flanges on the multiplier probe, and keep one hand in your pocket.

When the high voltage probe is connected properly, read the voltage on the 0-30 scale of the instrument and multiply the scale reading by 1,000 to determine the actual voltage. For example, if the scale reading is 14 on the 0-30 volt scale, the actual value of the voltage is 14,000 volts. This ability to measure the high voltage available in the receiver is particularly important in checking TV receivers for complaints such as insufficient raster brightness or picture blooming.

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

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

—n r i—

NEW CATALOG illustrates more than 100 different service aids which TV and radio service dealers may find beneficial in promoting their business. The 16-page General Electric Tube Department's 1956-57 promotional catalog is available through G-E tube distributors. Aids displayed in the booklet include identification signs, public relations packets, window streamers and service clothing.

Technical Ramblings

By B. VAN SUTPHIN

NRI Consultant

Subject: Rebuilt Picture Tubes

A FEW days ago, I talked with a local student who was having trouble with his TV receiver; the problem, "no raster." He mentioned that a year or so ago, a serviceman sold him a new picture tube for $18, and that he was sure this picture tube was no good because it was a rebuilt tube.

Further discussion of the case revealed that he had a defective high voltage rectifier tube in the receiver. Installation of the new rectifier in this set solved his problem and he was able to obtain a good picture.

This person's feeling on the subject of rebuilt picture tubes is a common one. Many servicemen do not understand what is involved in properly rebuilding a picture tube. This is particularly true among beginners. Let's examine this subject a little more closely.

How Picture Tubes Fail

One of the most common faults existing in a picture tube is an internal short between the filament and the cathode, or between the cathode and control grid. The general complaint resulting from this defect is "no control of raster brightness," or "no picture."

In some cases, it is possible to restore the picture tube to normal operation by "burning out" the short with the application of relatively high voltage between the two shorted elements. This is frequently done.

If the short exists between the filament and the cathode of the picture tube, adding a separate filament transformer for the picture tube **only** and connecting this transformer so that neither side of the picture tube filament is grounded will sometimes solve the problem. This does not always work, however, because a "hum bar" may appear in the picture.

A short between the cathode and the control grid that cannot be "burned out" makes it necessary to replace the picture tube.

Another very common picture tube defect is weak cathode emission. In some cases, this can be corrected by applying higher than normal filament voltage—approximately 8.5 volts—to the picture tube. This is done with a picture tube booster.

In many cases, permanent installation of a picture booster is not necessary since application of higher than normal filament voltage for a short time will often restore the cathode emission. Here's the procedure.

Using a standard tube tester (like the NRI Model 70) and a Picture Tube Tester Adapter, test the picture tube normally. Make a note of the exact emission reading.

Then adjust the Filament control and the Line control of the tube tester so that 8.5 volts, measured with a separate voltmeter, is applied to the picture tube filament. After fifteen minutes check the emission at normal filament voltage and again note the exact reading. If the emission has increased, continue applying the higher voltage and checking the emission each fifteen minutes (with normal filament voltage) until the emission no longer increases or one hour has passed, whichever comes first. If the emission does not increase after the first fifteen minutes, the tube is useless and must be discarded.

A less common defect is failure of the phosphor coating on the face of the picture tube. This defect will cause low over-all brightness, a "satiny" or "silvery" appearance to brightly lit areas of the picture, or a negative picture when the contrast is turned up. The only solution to this problem is replacement of the picture tube.

Picture tubes become gassy occasionally. This is evidenced by a blue glow between the elements in the neck of the tube and a blue cast to the picture. There is no solution to this problem except replacement of the picture tube.

The procedure for burning out shorts in a picture tube or correcting weak emission by applying higher than normal filament voltage is, at best, a "hot shot" method which does not always give dependable results. Many servicemen use these methods, however, to restore the set to normal operation for a short time until the customer can save enough money to purchase a replacement picture tube. If you ever decide to do this, you should warn the customer that the "cure" you are using is not permanent, and that he will need a new picture tube in a short time.

Picture Tube Rebuilding

Picture tube rebuilding is an entirely different matter. When properly done, it does not involve any "hot shot" temporary measures. A very involved process is followed in rebuilding a picture tube, and a picture tube properly rebuilt will give satisfactory service for a long time.

The glass envelope is one of the most expensive parts of a picture tube. By retaining the original glass envelope, but adding a new phosphor coating, new aquadag coatings (inside and outside), and a new electron gun assembly, new tube performance can be obtained at considerable saving. Actually, re-using the glass envelope of a picture tube is essentially the same as re-using a milk bottle.

Let's see exactly what is done to a picture tube during the rebuilding process.

First, the glass envelope is carefully examined for scratches or other imperfections. Particular attention is paid to the tube face. Small scratches are buffed off but tubes with deeper scratches that might weaken the tube envelope are discarded. Many picture-tube rebuilding concerns will not accept any picture tube that has even the slightest scratch on the picture tube face.

The next step involved is letting air into the picture tube under controlled conditions so that the tube will not implode. This is generally done by removing the base of the picture tube and then breaking the small tip which was originally used in evacuating the tube. This lets air rush into the tube.

The neck of the tube is then cut with a gas torch and part of the tube neck, with electron gun inside, is removed.

The original phosphor coating and the aquadag coatings are then washed off. A new phosphor coating and new aquadag coatings are added, in the same manner as it is done in a regular tube factory where picture tubes are manufactured.

A new tube neck with the electron gun already installed is then fitted on the original shell. All the parts in the electron gun assembly are new. The neck assembly is attached to the shell assembly by heating the glass with a gas torch. After this, a vacuum pump is attached to the evacuating tip on the neck of the tube, and the air is drawn out of the tube. The tip is then sealed so there will be no chance of air leaking in.

When the rebuilding process is completed, the tube is tested—often by connection in an operating TV receiver.

The finished product is an entirely new tube—except for the glass shell. A new phosphor coating, new aquadag coating, and a new electron gun assembly have been installed. In appearance and operation, the tube is as good as new.

How to Buy Rebuilt Tubes

Many readers will now be saying, "This sounds fine, but how do I get these tubes, and how can I tell the ones that have been honestly rebuilt from those that have been rebuilt by the 'hot shot' method?"

As is true in purchasing almost anything else, you must rely on the dealer to a certain extent. While it is true that a picture tube that is properly rebuilt should give good service for as long as a new tube would, some manufacturers sell tubes that have not been properly rebuilt. For that reason, we recommend that you always deal with a reputable concern that will stand behind the products it sells. Properly rebuilt tubes are generally guaranteed for one year. There may be a large wholesaler in your area who sells rebuilt picture tubes. If you are interested, you might call some of the wholesalers and ask them.

We do not recommend that you purchase rebuilt picture tubes from a small unknown wholesale company with a small ad in one of the popular radio magazines. If you wish to purchase rebuilt picture tubes by mail, deal with one of the larger wholesale companies—one that publishes full page advertisements in the popular radio magazines. Almost all of these companies stand behind their tubes.

To determine whether a particular picture tube has been rebuilt, carefully examine the neck of the picture tube. If the neck of the picture tube is not perfectly smooth, but shows ripples where the glass has been annealed, this definitely indicates that the picture tube has been rebuilt and should give satisfactory service.

———*n r i*———

Californian: Now in my state we can grow a tree that size in about a year. How long did it take you to grow that one?
Floridan: Can't say for sure, but it wasn't there yesterday.

N.R.I. ALUMNI NEWS

Louis E. Grossman .... President
F. Earl Oliver .... Vice Pres.
Howard B. Smith .... Vice Pres.
William Fox .... Vice Pres.
Herbert Garvin .... Vice Pres.
Theodore E. Rose .... Executive Secretary

NOMINATIONS FOR 1957

Most members of the NRI Alumni Association this year may participate in two election campaigns: they may vote for the President and Vice-President of the United States and also for the President and four Vice-Presidents of the NRI Alumni Association.

According to some political observers it's going to be a "hot" election campaign for the office now held by Mr. Eisenhower. Whether Republican or Democrat, whoever occupies the White House next January will know he's been in a fight.

By comparison our own little NRI Alumni Association campaign will be quite friendly and pleasant. There will be no hurling of charges and counter-charges, no attacks on the candidates' integrity or honesty, no rigging of votes at the poles, nor any of the other less desirable practices associated with election campaigns.

The first step in our NRI Alumni Association campaign is to nominate our candidates. The two men who receive the largest number of votes for the office of President will become the candidates for that office. The eight men given the largest number of votes for the office of Vice-President will be the candidates for that office.

The deadline for voting for candidates is August 25, 1956. Your ballot must reach NRI by that date. Mail your ballot well in advance of that date to make sure it reaches us before the deadline.

Then from among the candidates nominated members will elect, by ballot, the President and four Vice-Presidents of the NRI Alumni Association for 1957.

This method of electing officers is in accordance with our Constitution, Article VI, which reads as follows:

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

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

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

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

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

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

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

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

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

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

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

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

December 31 will bring to a close the term of office of Mr. Louis E. Grossman, New Orleans, La., as President of our Association. Mr. Grossman has been and continues to be a valuable and enthusiastic member of the Alumni Association. Not only did he take the lead in forming and establishing the New Orleans Chapter but he has provided his recreation room in which to hold the meetings of the chapter, and serves his chapter in many other ways. We need more men with the initiative, energy and resourcefulness of Lou Grossman—men who see what needs to be done and do it! Our hats are off to you, Lou!

An outstanding candidate for President for 1957 is Mr. Elmer E. Shue of Towson, Maryland, a community just outside Baltimore. Mr. Shue is a former Vice-President. He ran a strong race against Mr. Louis Grossman for President last year. This could be Mr. Shue's year. He is a loyal member of the Baltimore Chapter where he has held office in several capacities. He has long been a strong supporter and participant in his chapters' activities.

Except for Mr. Herbert Garvin who will more or less retire from his Radio-TV activities this year, our present Vice-Presidents are candidates for re-election. They are Mr. F. Earl Oliver of Detroit, Mr. Howard B. Smith, of Springfield, Mass., and Mr. William Fox of New York.

If Mr. Shue is nominated for President, likely candidates for his present office as Vice-President might be Mr. Joseph Dolivka of Baltimore, Mr. John I. Babcock of Minneapolis, Mr. Frank Skolnik of Pittsburgh, Mr. Jules Cohen of Philadelphia.

The names of other possible candidates are listed under "Nomination Suggestions" on Pages 26 and 27. These names are given merely to aid Alumni Association members select their candidates. You may vote for whomever you wish so long as he is a member of the NRI Alumni Association and is otherwise qualified to hold office in the Association. Please note that the names are suggested on the basis of geographical location in the United States and Canada.

It is your privilege to vote for the candidates of your choice. Take advantage of your privilege and, above all, be sure to send your ballot in to reach us not later than August 25. Use the Nomination Ballot on Page 27.

———*n r i*———

"IN common things of life lies the strength of the nation. It is not in brilliant conception and strokes of genius that we shall find the chief reliance of our country, but in the home, in the school and in religion. America will continue to defend these shrines. Every evil force that seeks to desecrate or destroy them will find that a Higher Power has endowed the people with an inherent spirit of resistance."

—Calvin Coolidge

Meet T. E. Rose

It is a real pleasure for me to introduce your new Director of Graduate Service and Executive Secretary of the NRI Alumni Association—Theodore E. Rose.

As many of you will realize, Ted Rose has been serving NRI men for many years. Since coming with NRI in 1930, he has advanced to a position of great responsibility in the Student Service Department.

So now, his experience richly qualifies him for this promotion to one of the top executive positions at the National Radio Institute.

I have known Ted for more than twenty-five years. He is one of those fellows you like instantly—the first time you meet him. And as you get to know him better, you realize why your first impression was so favorable. You find him to be able and capable—as dependable as the sunrise—and unfailingly cheerful and agreeable.

During the quarter of a century Ted Rose has been associated with me, the only serious criticism I have heard directed his way, has been concerning his choice of rank-smelling cigars!

But cigars and all—I believe you'll soon decide that Thedore Rose is a "natural" for the position of Director of Graduate Service and Executive Secretary of the NRI Alumni Association. You will like him personally—you will respect his ability to handle the duties of his important position.

J. E. Smith

Nomination Suggestions

T. E. Berryhill, Pomerene, Ariz.
Gordon E. DeRamus, Selma, Ala.
Don Smelley, Cottondale, Ala.
Myron Rhodes, Little Rock, Ark.
A. R. Waller, Keo, Ark.
Joe. E. Stocker, Los Angeles, Calif.
Herbert Garvin, Los Angeles, Calif.
A. W. Blake, Denver, Colo.
Chas. Bost, Leadville, Colo.
Albrecht Koerner, Stamford, Conn.
Joseph Medeiros, Hartford, Conn.
Gary Robinson, Stamford, Conn.
Eric Woodin, Naugatuck, Conn.
Wm. F. Speakman, Wilmington, Del.
Jos. Certesio, So. Wilmington, Del.
George Cury, Washington, D. C.
Wm. G. Spathelf, Washington, D. C.
Glen G. Garrett, Bonifay, Fla.
Fred Sandfort, Winter Park, Fla.
Stephen J. Petruff, Miami, Fla.
W. P. Collins, Pensacola, Fla.
Raymond Marsengill, Atlanta, Ga.
R. R. Wallace, Ben Hill, Ga.
Joseph Bingham, Twin Falls, Idaho
H. C. Eskridge, Gannett, Idaho
Erwin Andrews, Batavia, Ill.
R. A. Haltzhauer, Joliet, Ill.
Fred J. Haskell, Waukegan, Ill.
Jerry C. Miller, Skokie, Ill.
Herbert Lausar, Chicago, Ill.
R. R. Mitchell, Chicago, Ill.
Harold Bailey, Peoria, Ill.
Dick Michael, Hartford City, Ind.
Chase E. Brown, Indianapolis, Ind.
Paul Knapp, Evansville, Ind.
H. E. McCosh, Charles City, Iowa
E. C. Hirschler, Clarinda, Iowa
C. Hopkins, Hutchinson, Kans.
Wm. B. Martin, Kansas City, Kans.
K. M. King, Wichita, Kans.
Wm. Troxell, Lexington, Ky.
R. B. Robinson, Louisville, Ky.
L. H. Ober, Alexander, La.
R. J. Crochet, New Orleans, La.
Walter Dinsmore, Machias, Maine
Harold Davis, Auburn, Maine
Ralph E. Locke, Calais, Maine
Elmer E. Shue, Towson, Md.
Jos. Dolivka, Baltimore, Md.
Edwin Kemp, Hagerstown, Md.
G. O. Spicer, Hyattsville, Md.
Manuel Enos, Fall River, Mass.
Louis Crestin, Boston, Mass.
Howard B. Smith, Springfield, Mass.
Omer Lapointe, Salem, Mass.
John I. Babcock, Minneapolis, Minn.
Warren Schulze, St. Paul, Minn.
Arthur J. Haugen, Harmony, Minn.
Ray Williams, Minneapolis, Minn.
F. Earl Oliver, Detroit, Mich.
Chas. H. Mills, Detroit, Mich.
Harry R. Stephens, Detroit, Mich.
Robert Kinney, Detroit, Mich.

Patrick Van, Gulfport, Miss.
Robert Harrison, West Point, Miss.
Chas. E. Newton, Kansas City, Mo.
A. Campbell, St. Louis, Mo.
C. W. Wichmann, Inverness, Mont.
Earl Russell, Great Falls, Mont.
V. S. Capes, Fairmont, Nebr.
Albert C. Christensen, Sidney, Nebr.
C. D. Parker, Lovelock, Nev.
L. R. Carey, Elko, Nev.
Arthur Cornellier, Dover, N. H.
Geo. Stylianos, Nashua, N. H.
J. A. Stegmaier, Arlington, N. J.
Delbert Delanoy, Weehawken, N. J.
Claude W. Longstreet, Westfield, N. J.
C. Evan Yager, Albuquerque, N. Mex.
Solomon L. Ortiz, Raton, N. Mex.
Willy Fox, New York, N. Y.
Richar Croop, Syracuse, N. Y.
Thomas Hull, New York, N. Y.
Phil Spampinato, New York, N. Y.
Robert Lawson, Poughkeepsie, N. Y.
James Outlaw, Greensboro, N. C.
Irvin Gardner, Saratoga, N. C.
Max J. Silvers, Raleigh, N. C.
Arvid Bye, Spring Brook, N. Dak.
Wilbur Carnes, Columbus, Ohio
H. F. Leeper, Canton, Ohio
Chas. H. Shipman, E. Cleveland, Ohio
Byron Kiser, Fremont, Ohio
L. O. Marcear, Tulsa, Okla.
Emil Domas, Ritter, Oreg.
Folia T. Hall, Portland, Oreg.
Jules Cohen, Philadelphia, Pa.
Frank Skolnik, Pittsburgh, Pa.
Elmer E. Hartzell, Allentown, Pa.
Chas. J. Fehn, Philadelphia, Pa.
Frank Mendes, Providence, R. I.
James F. Barton, Greer, S. C.
Edw. K. Lukkes, Springfield, S. Dak.
John Wenzel, Gettysburg, S. Dak.
Newell M. Comer, Tullahoma, Tenn.
A. V. Craig, Memphis, Tenn.
Oscar C. Hill, Houston, Texas
Dan Droemer, Ft. Ringgold, Texas
N. G. Porter, Cedar City, Utah
M. S. Galloway, Portsmouth, Va.
Frank Chory, Norfolk, Va.
Wm. Harvell, Richmond, Va.
B. C. Bryant, Alburg, Vt.
C. R. Thompson, Vancouver, Wash.
Alfred Stanley, Spokane, Wash.
C. Blomberg, Aberdeen, Wash.
Jennings Avey, Martinsburg, W. Va.
S. J. Petrich, Milwaukee, Wisc.
Harold Brown, Laramie, Wyo.
Charles A. Smith, Cheyenne, Wyo.
M. Martin, New Westminster, B. C., Canada
E. D. Smith, Winnipeg, Man., Canada
H. V. Baxter, St. John, N. B., Canada
W. F. Arseneualt, Dalhousie, N. B., Canada
Donald Swan, Springhill, N. S., Canada
C. McMaster, Amherstberg, Ont., Canada
G. Favreau, Montreal, P. Q., Canada
Thos. Crooke, Saskatoon, Sask., Canada

Nomination Ballot

T. E. Rose, *Executive Secretary*
NRI Alumni Association,
16th and You Sts., N.W.,
Washington 9, D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1957.

(Polls close August 25, 1956)

MY CHOICE FOR PRESIDENT IS

....

City ....State ....

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. ....

City ....State ....

2. ....

City ....State ....

3. ....

City ....State ....

4. ....

City ....State ....

Your Signature ....

Address ....

City ....State ....

Student Number ....

Louis E. Grossman, President of NRIAA, Congratulates T. E. Rose, New Executive Secretary

Louis E. Grossman (left) was at National Headquarters on an official visit as T. E. Rose (right) succeeded Lou Menne as Executive Secretary of the NRIAA, and Director of Graduate Service. J. E. Smith is smiling his good wishes as Grossman congratulates Rose.

Accompanied by his charming wife, Lou spent three days in Washington, met members of the NRI Staff, and got a close look at the Alumni Association Headquarters. Although no stranger to Washington, this was Lou's first visit to the school.

The Grossmans were special guests at a farewell dinner for Lou Menne given by NRI executives the night before his retirement. They were also entertained at a dinner at Lou Menne's home, and at lunch by J. E. Smith. In addition, they were able to get in a little sightseeing.

Chapter Chatter

New Orleans Chapter, at an earlier meeting this year, voted to oppose a bill proposed in the state legislature to provide for the licensing of radio-tv technicians. Following the vote the members got busy lining up as much influence as it could in support of its opposition to the measure.

Word has reached National Headquarters that the bill was killed in the state legislature. Here is an example of the power that NRI Alumni Association chapters can bring to bear on measures affecting the radio and television industry in their areas.

Vice-Chairman Oscar Hilding has made some very welcome and interesting talks on the use and action of transistors and on the horizontal sweep circuit. These talks were followed by Question and Answer periods, which we feel are an important and valuable part of our chapter meetings.

We are very fortunate in having arranged with Mr. James Lilly, local representative for the Motorola Company, to deliver a talk on the alignment procedure for Television sets.

We continue to hold our meetings in the recreation room of National President Louis E. Grossman, 2229 Napoleon Ave. NRI students and graduates in this area will be given a warm welcome. Write or telephone Chairman Alfred Francis, 1928 Louisa St., New Orleans 17, La., or Secretary Anthony Buckley, 305 Serpas Dr., Arabi, La.

Detroit Chapter as usual has suspended chapter meetings during July and August. Also as usual the chapter held its summer stag party at the Chry-Moto Club, in Windsor, Ont., Canada, where everyone spent a very enjoyable evening.

Regular meetings will be resumed in September. Meetings are held on the second and fourth Friday of each month at 431 East Congress St., Detroit. Meetings begin at 8 o'clock. Students and graduates in the Detroit area who might like to attend our very interesting meetings should contact Chairman Edward V. Green, 9458 Knodell Ave., or Secretary James Kelley, 1140 Livernois, Detroit.

Springfield, Mass. Chapter was given an unusual treat in the form of a talk by Chairman Nystrom on Tone Generators. It was fascinating to hear the true fidelity of different tones produced on electronic organs.

Chairman Nystrom also showed us how a Radio or Television set could be aligned by using a certain frequency; also demonstrated how the oscilloscope could produce higher fidelity traces than the human ear could detect.

A recent meeting of the Flint, Mich., Chapter. In shirtsleeves (because he has to work so hard?) is Chairman Warren Williamson.

Vice-Chairman Howard B. Smith told us about his recent visit to NRI headquarters in Washington; of the hospitality extended to him while he was there; about the fine job National Headquarters is doing to keep students and Alumni members happy and contented with the feeling of being glad they belong to this wonderful organization.

Our Secretary is Marcellus Reed, 41 Westland St., Hartford, Conn.

Flint (Saginaw Valley) Chapter was very pleased at a talk given by Mr. C. Crawford of the Sentinel TV Corporation on How to Service And Align Color Television Receivers.

Incidentally, our attendance is on the increase especially from the Saginaw and Bay City area.

We are suspending meetings during July and August but students in the Saginaw Valley interested in attending our meetings when we resume them in September should get in touch with Secretary George Rashead, 38 East Marengo Ave., Flint 5, Mich.

Philadelphia-Camden Chapter really out-did itself with a magnificent dinner in celebration of Lou Menne's retirement as Executive Secretary of the NRI Alumni Association.

The celebration was held in Brookline Hall, Philadelphia. It was attended by Mr. J. E. Smith, Mr. L. L. Menne, the guest of honor, Mr. J. B. Straughn, and Mr. Ted Rose, successor to Lou Menne, from National Headquarters. Representatives from not-too-distant chapters—Pittsburgh, New York, Springfield, and Baltimore—

Lou Menne holding plaque presented to him on behalf of all the chapters of the NRI Alumni Association. Others are; left to right: John Pirrung, Chairman of the Philadelphia-Camden Chapter; J. B. Straughn, J. E. Smith, and Ted Rose, all from National Headquarters; and Jules Cohen, Secretary of the Philadelphia-Camden Chapter.

also attended. Many of them brought their wives, who added considerably to members' enjoyment of the evening.

Besides talks by Mr. J. E. Smith, Mr. Menne, Mr. Straughn, Mr. Rose, and by guests from other chapters, those present were highly entertained by a group of talented youngsters known as the Duffy Dancers.

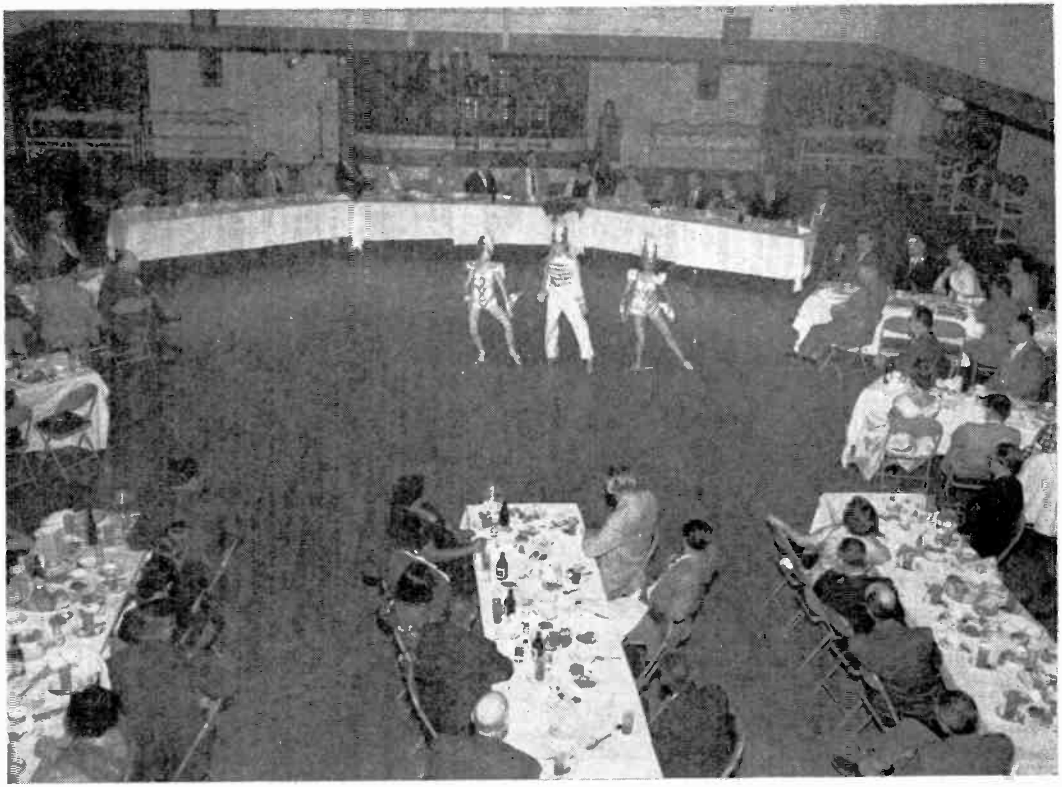
The Philadelphia-Camden Chapter deserves a hearty vote of thanks for this splendid testimonial to the retiring Executive Secretary, Lou Menne.

This dinner just about crowded off the boards all the other activities of the chapter, but there is one sad note that we must record here. That is, the passing of one of the chapter's old and reliable members, Ben Smith. He will certainly be missed by all the members of the chapter.

The Philadelphia-Camden chapter is one of the most spirited and active chapters in the Alumni Association. There's always something interesting and instructive going on at the meetings and being planned for future meetings. Any prospective members of the chapter should communicate with Secretary Jules Cohen, 7124 Souder St., Philadelphia 49, Pa. about attending the meetings.

New York Chapter, not to be outdone by the Philadelphia-Camden chapter, also held a dinner in tribute to Lou Menne's 20 years' service as Executive Secretary of the NRI Alumni Association and to mark his retirement from that office. Lou Menne was much impressed, even a little flabbergasted, about all the "fuss" (as he called it) made over his retirement. Nevertheless, it was obvious that this dinner, as well as the one given him by the Philadelphia-Camden chapter, was heartwarming to him and one that he will always treasure.

We wish to state once again and to emphasize that NRI students in the New York area are as welcome to attend our meetings as graduates.



Philadelphia-Camden Chapter's farewell dinner for Lou Menne on May 28, 1956. Guests being entertained by one of the many acts of the Duffy Dancers.

We bring up this point again because there seems to have been some misunderstanding among our membership about this. The only difference between students and graduates as far as membership in a local chapter of the NRI Alumni Association is that students are not eligible to vote or to hold office. But they will enjoy meeting our members and will learn as much from our meetings as graduates.

Our meetings have been suspended for July and August but beginning in September we will again meet on the first and third Thursday of each month at St. Mark's Community Center, 12 St. Mark's Pl. (between Second and Third Avenues) New York. Our Chairman is Thomas Hull, 11918 223rd St., Cambria Heights, New York. Our Secretary is E. E. Paul, 6 Gateway, Bethpage, L. I., New York. Graduates or students who would like to come to our meetings should get in touch with either Chairman Hull or Secretary Paul.

Milwaukee Chapter members were the guests of Mr. Bill Armstrong, Supervisor of TV Station WXIX, Milwaukee, during a visit to the station on a conducted tour while the station was in operation. For the first time our members saw themselves on TV as the camera was focused on them in one of the station studios.

Apparently our members found this tour interesting and instructive, for we are now planning to arrange a similar tour of the new VHF station WITI-TV, Whitefish Bay, Wisconsin.

Contrary to the practice of some local chapters, the Milwaukee Chapter members voted unanimously to continue our regular meetings throughout the summer. This is an indication of the kind of interest our members take in our chapter meetings.

We meet on the third Monday of each month, 8:00 P.M., at Petrich's Radio and Television Shop, 5901 W. Vliet St., Milwaukee. We want all NRI students and graduates to know that we will be pleased to have them come to our meetings. For information about this write or telephone Chairman Ernest V. Bettencourt,

One of the highlights of the New York Chapter's farewell dinner for Lou Menne. Left to right: Tommy Hull, Chairman; Phil Spampinato, Vice Chairman; Emile E. Paul, Secretary; Lou Menne, holding radio receiver presented to him by the chapter as a farewell gift; and Frank Catalano, Treasurer.

3407A North First St., Milwaukee 12, Wis., or Secretary Robert Krauss, 2467 N. 29th St., Milwaukee.

Hagerstown (Cumberland Valley) Chapter is trying out a new scheme for notifying members of meetings. The scheme was designed to create more interest and thereby increase attendance at the meetings. This is a step in the right direction. Perhaps more chapters—no matter how good their attendance may be — ought to give more thought to similar schemes, regardless of the size of present membership.

We have suspended meetings for July and August, will resume them in September when we plan to have a banquet.

Students and graduates in the Cumberland Valley are extended a cordial invitation to our meetings, which we hold on the second Thursday of each month at the YMCA Building. Our chairman is Edwin M. Kemp, 618 Sunset Ave.; our secretary is John Pearl, 13 Fairground Ave., Hagerstown.

———*n r i*———

"Parties who want milk should not seat themselves on a stool in the middle of a field in the hope that the cow will back up to them."
—Elbert Hubbard.

INDEX

Here and There Among Alumni Members

Graduate Paul Miller, of Maumee, Ohio. is Authorized Distributor in Ohio and Southern Indiana for Bendix Television and Ford, Lincoln and Mercury Automotive Radio Parts. He has installed a Service Clinic for the benefit of his dealers, and now lists over 200 Technicians who purchase Electronic parts through his firm.

———n r i———

Alumnus Merle L. Conroy is now in full time TV-Radio Servicing in Arkansas City, Kansas. Also has an amateur station, call letters KOCRI.

———n r i———

Joaquim Almeida, of Lonsdale, R. I., is now working at a local navy base in Radio and Radar, under Civil Service.

———n r i———

Everett Barsam, of Watertown, Mass., is now employed with the Tremont Television and Appliance Co., Boston, Mass.

———n r i———

Basil N. Sowder, of Roanoke, Va., writes that he turns out around four hundred dollars worth of repair work a month, working part time. Has more repair business than he can handle.

———n r i———

Walter S. Eckert, Jr., of Mt. Ephraim, N. J. has been in business for himself for the past year. He operates Walt's TV and Radio Service.

———n r i———

Preston Purkiss is now in charge of the sound equipment at the Green Forest High School, Green Forest, Ark.

———n r i———

Graduate J. M. Beckie, of Alameda, Calif., reports spare time earnings from TV and Radio servicing of about $1500 for the past twelve months.

———n r i———

Irving E. Miner, of Cornell, Ill., writes that business is good. He has a Motorola Agency, but is happy to stress service.

———n r i———

Graduate Harry M. Andrew, of Delaware Water Gap, Penna., is doing a lot of work on outside sound systems for resorts in his area. He is also in charge of the Radio-TV Service Department in his local Sears Roebuck Store.

———n r i———

Kenneth A. Hudson, of St. Johnsbury, Vt., now has his own full time business called Hudson's Wayside Television Sales & Service.

Alumnus Edward Keast has finished Radio Repair School in Camp Gordon, Ga., and is now a Field Radio Repairman with the U.S. Signal Corps, stationed overseas.

———n r i———

George C. Tinker is now in charge of Radio Station WTYC's sub station in Fort Mill, S.C. He is also "on the air" with his own show and operates the complete station at the same time!

———n r i———

R. C. Myers, owner and operator of Myers Radio & TV Clinc, Spartanburg, S.C., reports that his monthly business has reached $1500 to $1800 level on just radio and TV servicing. He employs three technicians besides himself. Graduate Myers is considering branching out into Radio-TV sales soon.

———n r i———

Graduate William F. Kline, of Cincinnati, Ohio, was recognized recently by his Zenith distributor for his outstanding sales record during the past year.

———n r i———

David L. Mott is Chief Engineer of Station KELP, El Paso, Texas. His job includes all maintenance responsibility for their transmitter, studio equipment, and two mobile news units.

———n r i———

Congratulations to Graduate Albert Patrick of Tampa, Fla., who was recently one of the Grand Prize winners in Philco's "Round the World" trip award. He describes circling the globe via Pan American Airways as a "once in a lifetime thrill." Patrick operates one of the largest appliance and television dealerships in his area.

———n r i———

Graduate James P. Araujo, of Fall River, Mass., has qualified as a Senior Radio Mechanic in his local National Guard Unit.

———n r i———

Gongratulations to NRI Graduate William A. Noah, Jr., of Albany, N. Y. Noah is President of Television Service Association, Inc., of Albany, N. Y. He owns and operates his own successful TV service business handling both Black & White and Color TV.

———n r i———

Raymond Barnett, Chief Engineer of Station KBOM, Bismark, N. Dak., is directing the modernization of his station facilities.

———n r i———

J. Ovilda Beaudin, of Baie Comeau, Canada, who is Chief Electrician for the Quebec North Shore Paper Co. Woods Department, has just added the maintenance of 50 company TV sets to his many duties. He also maintains two Company FM stations plus his local police FM station.

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

Second-class mail privileges authorized at Washington, D. C.

Forwarding Postage Guaranteed

Mr Francis H Fingado 25236-G 4A
1653 California St
Denver 2 Colo