National RADIO-TV NEWS

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Dec.-Jan.
1956-1957

VOL. 17
No. 6

Season's Greetings

It is time once again for the time-hallowed greetings that mean so much to us at Yuletide.

No one has ever found a better way to phrase it, so to every NRI student and graduate I sincerely say: A Very Merry Christmas To You and Yours.

It is also time to take stock: to look back over the year just ending—in review of what we have accomplished and the things we have left undone—and to look forward with our plans and hopes for the year about to begin.

Once having reviewed the past year and whatever we did or did not do with it, let's determine that in the coming year we will strive for greater success, greater achievement, both for ourselves and our loved ones.

No one has ever found a better way to say this, either, than in the wish that I and the NRI Staff extend to all NRI students and graduates: A Happy and Prosperous New Year.

J. E. SMITH, *Founder*

NATIONAL RADIO-TV NEWS

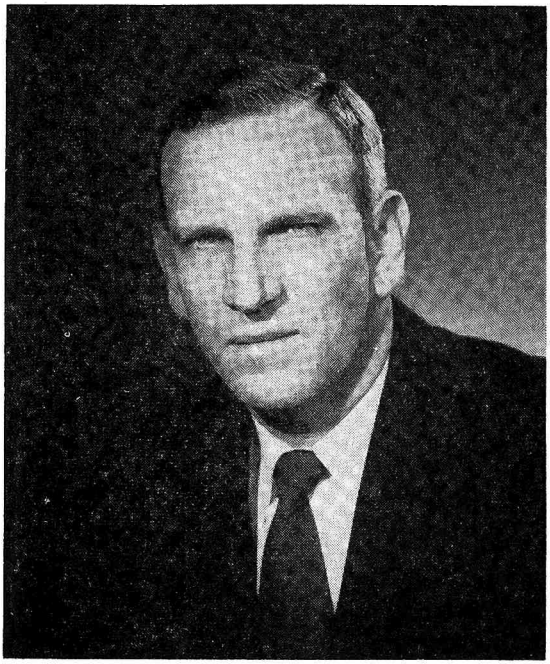
Theodore E. Rose, *Editor*

J. F. Thompson, *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.

J. Morrison Smith Succeeds His Father As President of NRI



J. Morrison Smith

The National Radio Institute—the first school to teach Radio by the home study method—was founded in 1914 by J. E. Smith. From the beginning it has been and remains today the leader in its field of training men for the Radio-TV industry through home study.

Since the day NRI was founded, J. E. Smith has been its President and guiding spirit. NRI students the world over look upon J. E. Smith as a wise and inspiring teacher, a good and understanding friend.

He began his long teaching career soon after graduating from Worcester Polytechnic Institute, B.S., E.E. He is a Senior Member of IRE, Member and Past Chairman of the Washington Chapter of the American Institute of Electrical Engineers, member of the Radio Club of America, ARRL, and of the Adult Education Association of the U.S.A.

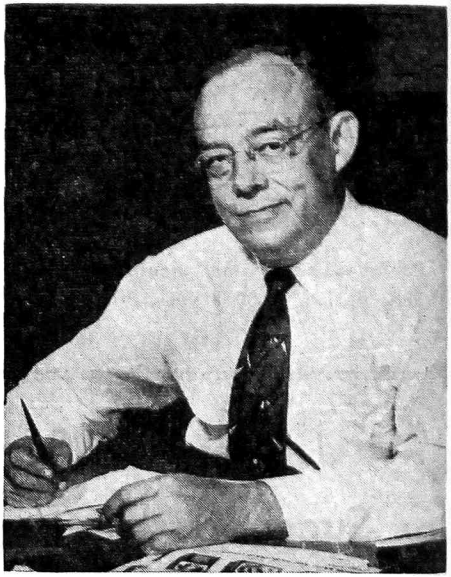
After forty-two years of devoted service to his students and graduates, J. E. Smith has turned over the reins of leadership to his son, J. M. Smith, who succeeds him as President of NRI. Following in the footsteps of his famous father, J. M. Smith also graduated from Worcester Polytechnic Institute, B.S., M.E. He was employed as an Industrial Engineer for eight years by U. S. Steel and DuPont, then joined the staff of NRI in 1945.

J. M. Smith is well qualified to assume the exacting duties of directing and leading NRI. Dedicated to providing NRI students with effective, practical training, he provides the energy and drive so necessary to maintain leadership in training men for the ever-growing, ever-changing, fast-moving Radio, Television Electronics Industry.

However, J. E. Smith is far from retiring. In turning over the Presidency to his son he has divested himself of the arduous day-to-day problems of that office. But he will still take an active and important part in the management of NRI as its Chairman of the Board. NRI will therefore continue to benefit from his long experience, seasoned judgment and sound counsel.

The Great Electronic Mystery

By J. B. STRAUGHN
Chief, NRI Consultation Service



J. B. Straughn

You have probably heard the story about the man who bought a new dog supposed to be an excellent retriever.

He took him duck hunting and every time he shot a duck and sent the dog after it the dog didn't swim out—he walked out on the water, picked up the bird and walked back with it. The man couldn't wait to show this marvelous dog off to his friend, so he arranged a hunting trip. He planned to surprise his friend so he didn't prepare him for the water-walking act.

Each time the friend shot a duck his dog swam out and got it. The first man's dog walked out. The friend didn't comment, so the first man finally said, "Well, what do you think of my new dog?" The friend said "He's all right, but why don't you teach him to swim?"

Some people are like that, but not me. When I see water running uphill or a rabbit chasing a hound it worries me plenty. Recently I had a terrible experience. Ohm's Law suddenly stopped working! Let me tell you about it.

As everyone who has finished the fifth lesson in the NRI Radio-TV course knows, the voltage drop across a resistor is equal to the current times the resistance. If you have three resistors of equal value in a series circuit, the same voltage drop will appear across each. The direction of the current has no effect on the amount of voltage drop—only on its polarity.

If you have the circuits shown in Figs. 1A and 1B, the voltage drops in Fig. 1A should be equal to the voltage drops in Fig. 1B. Recently, while attempting to demonstrate this fact, I built the circuit shown in Fig. 1A and measured 1 volt across each resistor as you would expect.

Then, I reversed the connections to the battery to show that the same current would flow and that the voltage drops would have the same values with reversed polarity (because the battery voltage was reversed).

On checking the voltage drops in Fig. 1B, I found .5 volt across R1, 1.25 volts across R2 and 1.25 volts across R3 instead of 1 volt across each resistor. I didn't believe it, so I reversed the battery and re-checked Fig. 1A, getting the normal 1 volt across each resistor. However, Fig. 1B again, gave voltages of .5 volt, 1.25 volts and 1.25 volts! Obviously the resistance of R1 changed each time the battery voltage was reversed.

I still didn't believe my measurements, so I tried a different meter (same results) and checked the battery voltage in each position (3 volts in each case). I disconnected the battery and clipped my ohmmeter right across each resistor and each one measured 1000 ohms. Reversing the ohmmeter lead had no effect on this measurement.

I tried speaking to the circuit severely and nothing happened. Other instructors gathered around

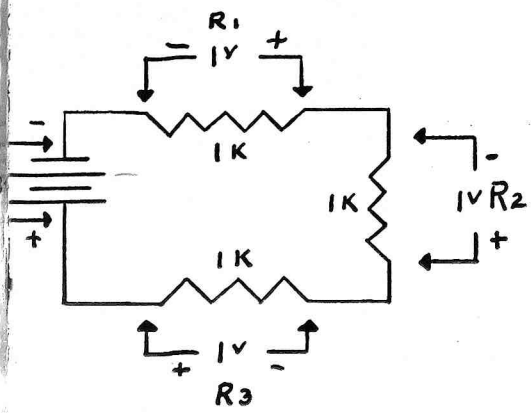


FIG. 1A

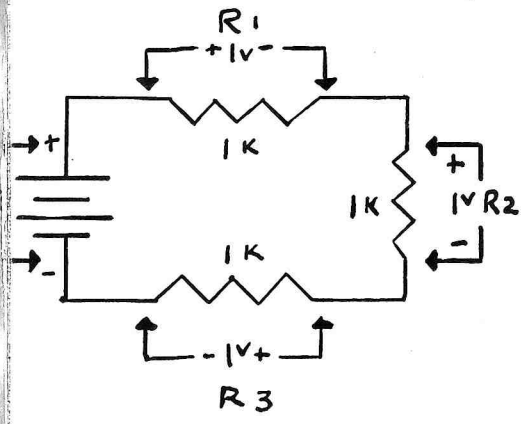


FIG. 1B

s. 1A and 1B. These circuits are identical with the eption of battery polarity. The direction of current v, which depends on the source voltage polarity, ermines the polarity of the voltage drops. In a ely resistive circuit changing the polarity of the rce voltage will have no effect on the amount of rent flow or on the amount of voltage dropped across each resistor.

l we all scratched our heads and thought real rd—nothing happened.

e bright character suggested bathing the istors in fresh goat's milk, but we just ignored a. Somebody else said we could patent the cuit and make a lot of money if we could do nething with it (the circuit—not the money).

ut this time, I decided to substitute another 0-ohm resistor for R1, R2 and R3 in turn, regardless of the fact that the original resistors checked perfectly with an ohmmeter.

The substitution was easy to do since the resistor leads were not twisted together—just held by solder. Touch an iron to the joint, the solder melts, and leads fall apart. I touched the iron to the junction of R1 and R2 and a thin stream of smoke from the unburned rosin in the joint slowly spiraled up to the ceiling while brown rosin merrily bubbled out of the "joint." I didn't go any further; the original R1 stayed in the circuit and this time each resistor showed the same voltage drop regardless of the battery polarity.

What happened was the rosin remaining in the solder gave the junction the properties of a rectifier. This let current flow more easily in one direction than in the other. A check with an ohmmeter which *included* the rosin joint would have shown this condition.

The joint in question looked perfect to the eye —but the smoke and the bubbling rosin told the story. I have, of course, seen many rosin joints but have never before had such a convincing demonstration of their lack of perfect conductivity. Many times holding a hot soldering iron on a joint that looks perfect will cure some symptom that has been driving a serviceman crazy.

To check a joint (it will generally be a nice fat one if unburned rosin is present) touch a flat face of your soldering iron tip to the joint and keep it there until the rosin stops bubbling and the smoke decreases. Excess solder which will be picked up by the iron tip must be flicked off the tip.

If the joint sizzles when heat is applied, someone has been guilty of using paste flux. This should never be used in electronic work—it is hard to burn up the flux and if you don't you are in *trouble.*

If the joint spits and particles fly out when heat is applied, acid core solder has been used. Sooner or later the entire piece of equipment will have to be junked. The fumes will have deposited corrosive acid on parts and coils. The acid will continuously eat into the copper until it is consumed and will form leakage paths between previously insulated terminals.

Even worse is the ribbon solder which can be wrapped around a connection and melted with a match or cigarette lighter. This is not for electronic work—DON'T TRY IT.

Paste flux and acid flux make solder stick to dirty leads but must NOT be used. After all, you wouldn't substitute steel wool for a wash cloth even if it will take dirt off your face a

little quicker. Steel wool is good for pots and pans and so is paste flux and acid core solder.

How to Solder. Just what is a good connection? A connection is good if it is a continuous low resistance metal path. If leads are twisted so clean bare metal is pressed tight enough to prevent air from getting between the joint's surfaces, the connection is good. Air must be kept from the joint surfaces to avoid the formation of a film of oxide which will not conduct electricity. Special tools are required to make an air-tight twist connection. Such connections are not ordinarily used in electronic work.

Because pressure connections (twists) are not practical, we must melt together the leads in a joint, so when they cool we have a continuous unbroken metal path over which electricity can easily flow. Air cannot get at the jointed surfaces and a well made joint will last until it is remelted and taken apart.

Copper wire has a very high melting point and enough heat to melt copper could not be applied without burning up the parts in the circuit. What we do is to coat or plate the copper wire with another metal having a low melting point. Solder, which is a mixture of tin and lead, is used for this purpose. The plating process is called tinning and a copper wire which is tinned has a silvery appearance. If two tinned leads are held together and heat is applied, the solder on the leads will melt and flow together. The addition of only a little more solder forms a strong metal connection between the two wires.

If the wires, part leads and lugs have not been tinned at the factory (they have in your kits) the copper will be covered with a film of oxide which will prevent pure solder from sticking or being plated on the copper.

How the Oxide Film is Removed. A film of oxide will even form on tinned surfaces which have been exposed to air for long lengths of time or on leads covered with rubber insulation. To remove the oxide so tinning can take place or so solder will melt into previously tinned surfaces, a core of rosin is placed in the solder when it is made. The rosin burns up and evaporates during the process of soldering. When the rosin burns up it combines with the oxide which also evaporates. This is the only purpose of the rosin. Removal of the oxide leaves the copper bare or the previous tinning exposed. Now the new solder will stick to it. *It is important to leave your iron on the joint long enough to burn up the rosin or to make it bubble out of the solder on the joint.* ONLY WHEN THE BURNING ROSIN BEGINS TO STOP SMOKING SHOULD YOU REMOVE YOUR IRON. This is where most beginners go wrong. They see the rosin smoke, think some part is being damaged and jerk their iron away from the joint, leaving the rosin mixed in with the solder. Be su the heat from your iron burns up most of t rosin in the joint. ROSIN IS A NON-CO DUCTOR AND IF IT IS NOT FORCED O OF THE JOINT BY HEAT, A VERY POOR CO NECTION WILL RESULT.

The rosin core in the solder is not a cure-a If the oxide film is too thick, the rosin cann remove all of it or if grease or plain dirt is the wire, tinning will not take place. Such a w must be scraped to expose a clean copper s face. In most cases, rubbing the flat tinned s face on your iron tip on the joint while solderi will scrape the copper clean and the sol will stick. In very difficult cases, the wire sho be scraped clean with a knife and then tinn before being mechanically joined for solderi

How to Tin a Lead. To tin a wire or a p lead, put your iron in its stand. Run the ba end of the lead or the part of the wire you w to tin back and forth on TOP of the tinn end of the iron. Melt a little solder on the le and iron tip. The wire, if it is clean, will right up. This should always be done with leads of resistors before they are used. Genera some oxide is formed on them and retinning necessary to make soldering easy.

In the case of hookup wire, the leads of pa condensers, tube socket lugs and parts made w mounting lugs retinning is unnecessary. The sulation on the hookup wire keeps air off tinned surface and there is generally a coat of wax on condenser leads and the mount lugs of coils which prevents oxidation. This w need not be removed before you solder. The h from the soldering iron will remove the wax.

Do Not Use too Much Solder. Remember, le MUST be tinned before you can solder. Do keep on adding more solder at the joint if solder does not stick. Big lumps of solder, i of unburned rosin, don't make a connection.

When you get too much solder on a joint, a you will, remove the excess (all you can off) by melting the joint and flipping off solder picked up by your iron tip. Try to the iron tip under the joint so that grav will make the solder run onto the tip rat than drip off the connection and make a sh to the chassis. If necessary, tilt the chassis hold it up in the air to pick up excess sol ALWAYS LEAVE YOUR IRON ON THE JOI UNTIL ALL THE BURNING ROSIN BUBBL OUT OF THE JOINT or at least until the amo of smoke being released decreases. This avoid a rosin-filled joint.

Of course insulation on wires will smoke if ov heated but this won't cause trouble if the ba wire does not short to anything. You can if the smoke is coming from the connection

rom nearby insulation or a part. As soon as he rosin begins to stop smoking, remove your ron.

eginners are overly careful about possible damge to parts through heat conduction through heir leads. The truth is that only a very few arts can be damaged in this way. Low wattage esistors having a low ohmic value (a few hunred ohms or less) can undergo a change in reistance if overheated. In most circuits this is nimportant. Germanium crystals (diodes), transtors and phono pickups can be ruined by heat onducted from a soldered joint through their eads. To avoid this, hold the lead between the oint and part with pliers. The pliers soak up he heat and it never reaches the part. In all ases you must use enough heat at a joint to horoughly melt the solder and burn up the rosin.

arts must not move while the solder cools. the leads being soldered are held with pliers, old them still until the solder sets up—then ove the leads to see if they are joined together.

hese simple suggestions will make soldering ood connections easy and enjoyable.

clean iron tip is necessary. Remember your on must put out heat. If the tip is covered ith a film or black oxide, you cannot burn the rosin or fully melt solder.

your iron tip is the type that slips down to the barrel of the iron, remove the tip while old. Tap the barrel against your workbench shake out scales of oxide. Scrape all oxide f the tip and reinsert it in the barrel and ghten the holding screw. Do this before heatg up your iron for a session of work.

hen the iron tip gets dirty or pitted, and it ill, refile the copper tip so the surfaces are nooth. Then melt solder on the exposed copper so it will have that shiny, tinned look. *This ust be done before a new iron is put into use.*

a solder gun the heat is produced by a high rrent flowing through the tip. If a poor conection develops between the tip and the gun the rrent is reduced and the tip will heat up slowly. n seconds is the most time it should take e tip to become hot enough to melt solder. it takes longer, tighten up on the nuts holdg the tip to the gun. Don't put a cold tip on joint and hold it there while it heats. Melt little solder on the tip (to show it is hot ough), flip off the excess and then apply the to the joint.

lder. If you should buy more solder locally sure to get thin type RADIO ROSIN CORE OLDER. Solder comes in various thicknesses. r delicate work the thin type is preferred cause there will be less tendency to use too much of it. Top quality radio type Rosin Core Solder consists of 40% tin and 60% lead. If the lead percentage is much higher the melting point will increase and considerable difficulty will be encountered in melting the solder.

NEVER USE ACID CORE OR METAL MENDER SOLDER for electronic work. If ACID CORE SOLDER is used, your equipment will sooner or later have to be JUNKED.

Do not let anyone sell you PASTE FLUX on the idea it is just as good as rosin core solder or that it makes soldering good connections easier. It is not as safe as rosin core solder. The active material in the paste is hard to burn up. It gets into tube socket contacts where it cannot be removed and prevents the tube pins from coming in electrical contact with the socket lugs. The paste is an insulator, not a conductor, and like rosin is only a cleaning material.

Making Connections. In electronic work we must connect wires and part leads to the tube socket lugs and to lugs on transformers and other parts. This is done by slipping the leads into the lug terminal holes. The iron tip is then placed against the joint and the end of the solder touched to the joint. When the joint becomes hot enough the solder will melt and spread lightly over the wires and lug. Remove the solder wire as soon as a small amount (about ⅛ inch) melts.

You will soon discover that it takes some time for the joint to become hot enough to melt the solder. You will also find that melting speeds up considerably if you touch the end of the solder to the iron tip and then slide it from there to the joint. The heat runs along the melted trail of solder and into the tinning on the joint leads and lugs. This method is all right if you don't remove the iron tip too quickly; if the leads to be joined are well tinned; and if you pick up and flip off any excess solder with your iron tip.

Sometimes wires and part leads must be joined without the benefit of an anchor point such as the lug on a terminal strip. Such a joint can be formed by twisting the leads so they hold together or by bending them so they will lie against each other while being soldered.

There are two kinds of connections—permanent connections and temporary connections.

Permanent Connections. These are made by twisting together the leads to be joined or by wrapping the leads around the lugs so they will not fall off. A resistor which is being permanently mounted on a terminal strip is shown in Fig. 2. Note that the leads have been wrapped around the terminals. They are then soldered and the excess length of wire cut off. This joint is con-

Fig. 2. The part leads may be wrapped around the lugs as many times as you wish. Most technicians use just enough of a wrap to mechanically support the part. Any excess lead length is clipped off after soldering.

sidered permanent because when soldered, it is very difficult to take it apart. To remove the leads, heat must be used to keep the solder melted while you try to catch the end of one of the wires with longnose pliers. This is not too difficult if only one part is mounted at the tie point. Generally, however, there will be a number of leads all wrapped around the lug. If you succeed in catching hold of one of the wires and it *happens* to be the outside wire, it can generally be unwrapped and removed. Jerking on the wire while the solder is molten will sometimes untwist the wire but may break the lug or the wire itself. Rather than chance this, most technicians will cut apart a joint while melted, or while cold, with their side cutters and take off the remaining pieces of wire with longnose pliers, reheating the joint if necessary.

Temporary Connections. When you expect to rebuild a circuit, temporary connections are the kind to use. Most of the connections you make in your demonstration kits will be of the temporary kind. To make a temporary connection, the leads to be joined at a lug are just pushed through the hole in the lug so they will stay there. They should stay in place without being held by pliers or by twisting the lead around the lug. Fig. 3 shows an example of a lead pushed through the hole in terminal 1 of a tube socket. The lead is pushed through from the top and the weight of the part will hold the lead in place. Of course, the lead must not be pushed down far enough to touch the metal mounting ring of the socket, or to touch the chassis, as this would cause a short circuit. Once the lead is in place, a small amount of solder is applied. To take such a joint apart, just melt the solder and pull the lead out of the lug hole.

Here is the method used to join the leads of two or more resistors without using an anchor

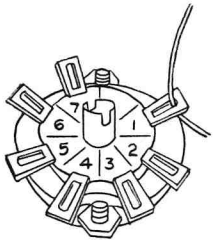


Fig. 3. This lead stays in place by itself when properly positioned. The idea is to leave one hand for the soldering iron and the other to hold the solder.

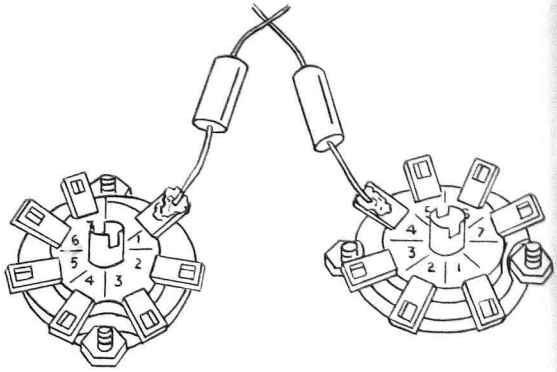


Fig. 4. After resistors are soldered to tube sockets, leads between resistor body and lugs may be bent so the free leads press lightly but firmly against each other without being held in place with pliers. Again you have both hands free for soldering.

support tie point such as a lug. First solder the resistors to the lugs in the circuit to which they are to be joined as shown in Fig. 4. Then bend the resistors so that their free ends press against each other. Solder at the crossover point. The resulting solder joint will look like the one in Fig. 5.

In some cases you cannot arrange the parts so the leads will lean against each other. Then they must be held with pliers so their bare ends touch each other. Since you need one hand for the iron and one to hold the pliers, you must get someone to touch the solder to the joint while you apply the heat from the soldering iron.

Oldtimers often hold a long length of solder between their teeth and move the solder up to the joint and iron if there is no one to help them.

If you first tin the leads so they will take solder easily you can hold them with pliers, pick up a little solder on the tip of the iron and apply it to the joint. In this case leave the iron on the joint a little longer than usual. The heat must flow from the solder to the tinned surfaces and melt the tinning. Don't try this unless the leads to be joined are thoroughly tinned as it can otherwise lead to poor connections. The rosin in the solder picked up on the iron tip will burn up by the time you move the tip to the joint. If the leads are not tinned a connection will not be made. However, if they are tinned the rosin is not necessary.

There will be cases where it is not possible or not easy to get all part leads that join together in the tie point hole. In such a case one lead

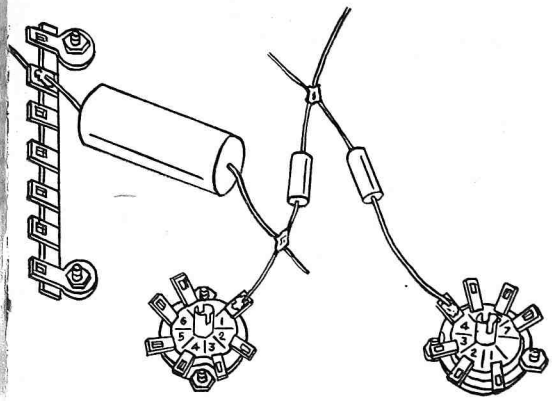


Fig. 5. For experimental work this system is quite satisfactory. If the equipment is to be subjected to jarring all parts should be securely anchored in place. This is the same connection method that was used in Figs. 1A and 1B.

may be soldered at the tie point and the other part lead may be soldered somewhere between the tie point and the body of the first part. This is illustrated in Fig. 5. Here we have two parts, a condenser and a resistor that connect to pin 1 of the left-hand tube socket. The resistor is soldered to the socket pin and the condenser lead, instead of being pushed into the hole with the resistor lead, is tacked to a lead of the resistor. This arrangement is just as good electrically as if both leads were soldered at the No. 1 pin. Such a procedure is particularly valuable if a number of leads are already soldered at pin 1.

Where a number of leads join together at the same point solder them one at a time, reheating the connection each time a new lead is inserted. If you put all the leads in at once and then solder them, the chances are that the leads on the bottom will have no solder sticking to them because sufficient heat did not reach them. WARNING: Don't let the solder build up into a big lump. You may have to apply fresh solder each time a new lead is joined but the excess, once tinning has taken place, must be drained off onto the iron tip and flipped on the floor. (It will come right up and won't hurt a floor.) Keep these points in mind. Remember if you do not learn to make satisfactory soldered connections, you cannot repair, build or work with electronic circuits.

If it is not easy to solder a joint, your iron is dirty or the leads to be joined are oxidized. In either case, you must correct the cause—not pile on more partially melted solder. If you slop on more solder, you'll have trouble and can console yourself by remembering you asked for it!

BIGGEST LITTLE electronic tube in the world —that's the General Electric Company's description of the 80-foot water tower built at the new tube factory the company has under construction at Owensboro, Ky. Occupancy and operation of the new plant will be completed in 1957. This 200,000 gallon water tower was built to the proportions of a 6BK7—a v-h-f tube. These tubes actually are about two inches long. The tank is 84,000,000 times larger, by volume. G.E. engineers are installing floodlights to make it visible to motorists on nearby Chicago-Florida Highway 231.

———*n r i*———

Perhaps the most valuable result of all education is the ability to make yourself do the thing you have to do, when it ought to be done, whether you like it or not. It is the first lesson that ought to be learned; and however early a man's training begins, it is probably the last lesson that he learns thoroughly.

—THOMAS H. HUXLEY

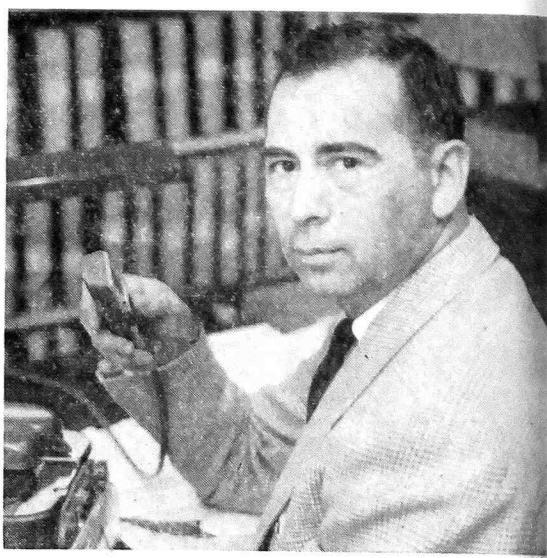
———*n r i*———

America is the only nation where the average man can own and operate an automobile. Not only that, the annual operating cost of an average American family—with allowance for depreciation, repairs, and insurance—probably exceeds the average total income, per family, in any other nation.

Picture and Sound Show Which Tube Is Bad In TV

By JOSEPH SCHEK

NRI Consultant



Joseph Schek

Tube failures account for 80 to 90 per cent of television set breakdowns. Servicemen can make quick, effective repairs by correct tube substitutions when they have an understanding of television receiver circuits as given in this article.

Filament Circuits

It is relatively simple to spot an unlit tube where the filaments are wired in parallel, but put the same defective tube in a series-parallel filament circuit and its detection becomes more involved.

See Fig. 1 for a typical series-parallel filament circuit used in a number of popular models that you will undoubtedly be called upon to service time and again.

Most usually, the open filament of one tube will disrupt the continuity of its series string. Since the remaining series string still forms a complete circuit across the power source, each tube will light brighter than normal. This overload is due to the open parallel circuit and will be corrected when the defective tube is replaced and the normal total filament circuit resistance is restored.

If the 16KP4 burns out in Fig. 1, none of the tube filaments will light. An open in R1 will have the same effect. In most cases, however, only one of the filament strings will be out.

The serviceman should quickly spot those tubes not lit and start substituting good tubes, one at a time. A handy gadget to use to avoid tube substitution is a compact simple continuity filament indicator wired with a battery and pilot light. When a tube with a normal filament is inserted into this tester, the pilot lamp glows. This tester is available from any parts wholesaler and has even been widely distributed to the general "do-it-yourself" public. Of course an ohmmeter can also be used to individually check filament continuity on each tube as it is removed from the defective string.

Sections of series filament circuits will not operate when a filament-to-cathode short has provided a filament return path to B— so filament voltage cannot reach other tube filaments. In this case, a filament continuity check would be useless. Some TV set manufacturers (bless their far-sighted hearts) paste a sticker on the chassis showing the filament circuit schematic. It is then a simple matter to determine the shorted tube by locating the last operating tube that is immediately preceding the tube that is not lit. For example, in Fig. 1 if the 6AB4, 6BC5 and 12AT7 tubes at the right end of the upper string did not light, you would suspect a cathode-to-heater short in the 12AT7 whose grounded cathode is shown.

Picture tube filaments that appear to be intermittent may be repaired by resoldering, if the trouble is caused by poor contact of the leads within the base filament pins.

A knowledge of TV circuit action is required to spot suspicious tubes when all filaments light normally. Fig. 2 shows a block diagram indicating the direction of the signal paths between the essential stages common to all television receivers. Let us see how an understanding of Fig. 2

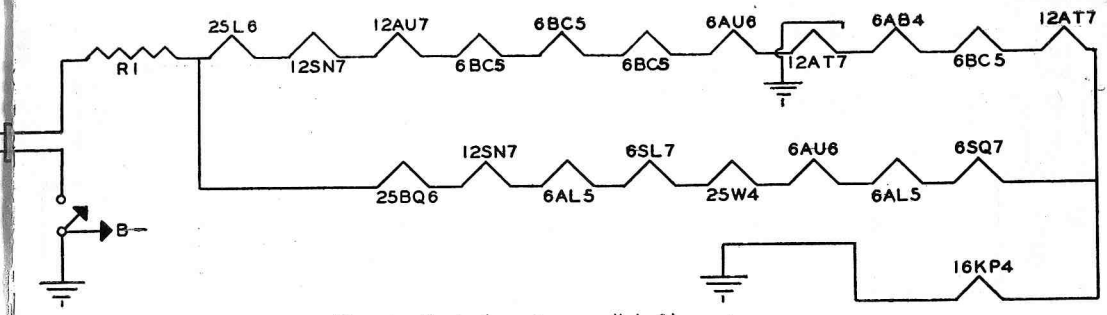


Fig. 1. Typical series-parallel filament.

wl show you which tubes should be substituted
various symptoms.

The RF Amplifier Stage

aulty rf tube will produce varying symptoms
ending upon the nature of its defect. A weak
ture with excessive snow indicates an rf
e with low emission or amplification, assum-
of course that the antenna system is in fair
pe.

ture rolling, weaving or pulling on one or
re channels may be caused by cathode-to-
ment leakage within the rf amplifier. This
a common symptom where the rf amplifier
e is not usually suspected of being the cause.

rrent TV models use tuners with cascode rf
plifiers of the 6BK7, 6BQ7, and 6BZ7 tube
es. Picture flashing can usually be traced to
intermittent breakdown of this tube type.
late-to-cathode short will cause an unusually
vy power supply drain that can result in a
wout of the low voltage rectifier tube.

The Mixer and Oscillator Stages

xer and oscillator tube functions are usually
nbined within one glass envelope. Widely used
es for this purpose are the 6J6, 12AT7, 12AV7,
3 and 6X8.

ually, the oscillator section fails rather than
mixer half. Most frequently reception on
channels only will indicate a defective os-
ator tube. Where the oscillator tube is com-
tely dead, there will be excessive snow but no
eption on any channel.

receivers using the 6J6 are subject to micro-
onics that can be minimized by replacing this
e. It may be necessary to slightly re-tune the
illator coil slugs to compensate for any
nge due to the internal capacity of the re-
cement tube.

er-element leakage can cause poor sync and
ture distortion. Where this condition varies in degree between channels, the oscillator tube should be checked by substitution. Filament-to-cathode leakage may cause a tunable hum that will pass through to the audio stages and be amplified with the normal sound signal.

The Video I-F Stages

A weak or dead video i-f tube results in no picture. Unstable vertical or horizontal hold may be caused by a gassy video i-f tube cutting off sync signals by overloading its grid and disturbing the common agc circuit. Control grid-to-cathode leakage will give the same effect because the agc voltage will be reduced. Frequently, dark bars in the picture will be caused by filament-to-cathode leakage of the video i-f tubes. Unstable operation of the video i-f tubes can be checked by tapping these tubes and observing the results. Most commonly used in the video i-f stages are 6AU6, 6CB6, and 6AG5 tubes.

The Video Detector Stage

A video detector stage can either be of the vacuum tube diode type or of the germanium crystal semi-conductor type. Frequently, the agc voltage is derived from the video detector load circuit, so that overloading or weaving may be produced by a defective video detector. A weak picture or no picture will result from a defective detector tube.

The Video Amplifier Stage

A weak or negative picture with little contrast and weak sync may be caused by a video amplifier with low emission. In some model TV sets, an internal short within the video amplifier will cut off the electron beam and kill the raster. Typical video amplifier tube types are the 6CB6, 6K6, 6AC7, 6AG7, and 12AU7 tubes.

The Sound Stages

Weak, distorted, intermittent or no sound is generally due to defective sound i-f, detector or af tubes.

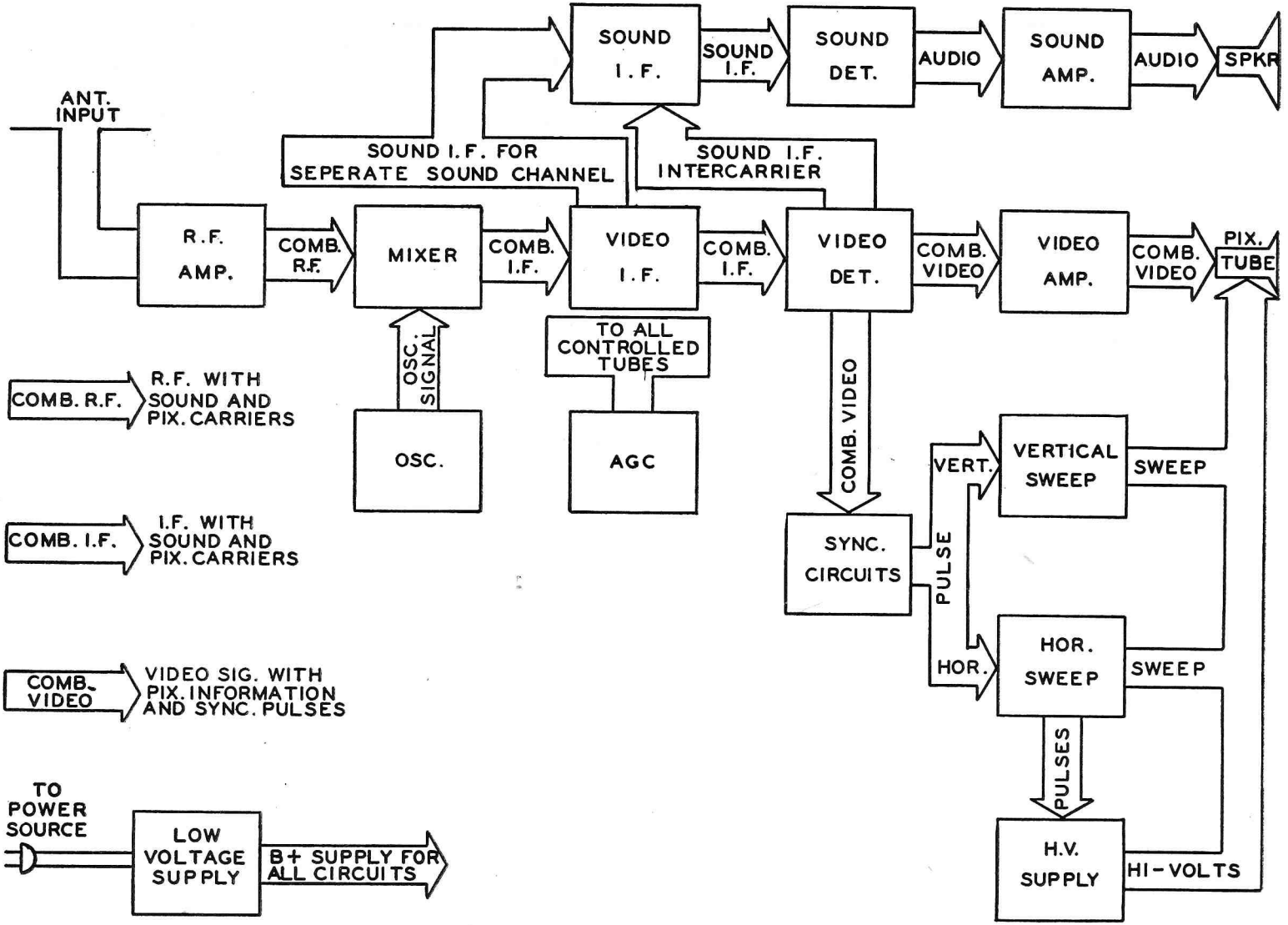


Fig. 2. Block diagram of stages common to all television receivers.

Poor picture focus can be caused by low current operation of the audio amplifier output tube. Voltage division is often secured by connecting the audio output tube cathode to the B+ circuits of the video i-f amplifiers. When the audio output tube becomes defective this circuit arrangement will cause the video i-f stages to become disabled, killing the picture and sound i-f.

Tube types 6AU6 and 6BA6 are most frequently used for sound i-f stages. The 6AL5 dual diode is commonly used for the detector stage. The first audio tube is usually a 6AT6, 6AV6, or a 6SQ7. A 6T8, 6SQ7 or 6S8 is frequently used to combine the functions of detection and first audio amplification. Tube type 6BN6 can be used to combine all three functions of i-f sound amplification, detection and first audio amplification. Most frequently used audio output tubes are the 6K6, 6V6, 7C5, 6AQ5, 6AS5 and 25L6.

The Vertical Stages

The vertical oscillator and amplifier may be combined in a single tube or two separate tubes may be used for these functions.

Defective vertical tubes will cause vertical deflection to fail and result in a thin horizontal line. It is best not to allow this thin bright horizontal line to remain on the picture tube face because a permanent impression may be left on the picture tube screen coating. Turning down the brightness control, when circuit testing, will prevent this damage.

Presence of gas within the vertical tubes will cause poor vertical sync, vertical fold-over or insufficient vertical height.

Frequently a sync section is made part of the dual triode tube containing the vertical oscillator section. Therefore, do not overlook a symptom of no horizontal and vertical sync that can be caused by a failure of this section alone.

In some current TV models, the vertical oscillator is a separate section of a dual purpose tube that also contains the third video i-f stage.

Changes may take place within the vertical oscillator tube that will prevent the normal range of the vertical hold from compensating for these changes. The vertical hold control in this case will not be able to control the direction of vertical rolling—try a new vertical oscillator tube.

Tubes used for vertical deflection are 6SN7, 6C4, 6U8, 12AU7, 12BH7, 6S4, 6W6, 6V6, 6BQ6 or the 6C5.

The Sync Stages

Weak or dead sync tubes will cause unstable or complete lack of either or both horizontal or vertical holds. Frequently used types for the sync stages are the 12AU7, 6SN7, 6U8 and 6X8.

The Horizontal Stages

The horizontal oscillator can be completely disabled by a shorted 6AL5 horizontal phase detector. This tube is usually not suspected as being responsible for killing the high voltage circuit.

A faulty horizontal oscillator tube may cause lack of high voltage, picture pulling, horizontal instability and insufficient width. Tube types usually employed in horizontal oscillator circuits are 6SN7, 12AU7, 7AU7, 7N7, or 12BH7.

A defective horizontal output tube can produce some peculiar symptoms. A bad horizontal output tube will cause dark vertical bars, or ragged picture outlines and, most annoying, an intermittent condition that will cause the high voltage to fail only after operating for several days.

When the set is allowed to cool and then turned on again, the set will play for another undetermined period before cutting out and repeating this on-off high voltage condition.

Lack of horizontal width or high voltage and picture pulling can be caused by a faulty horizontal output tube. A suspected horizontal output tube can be made to completely break down if it is operating intermittently, by removing the horizontal oscillator tube for a period of about thirty seconds. This will remove the bias of the horizontal output tube and cause it to draw excessive current which will then permanently disable the border-line tube. The serviceman can now make the tube substitution feeling confident that this will cure the TV receiver's intermittent operation.

The horizontal output tube is called upon to handle large amounts of current and high voltage peaks. In some cases, initial replacement will fail to provide satisfactory service. The serviceman may need to make several substitutions before finding one that gives normal operation.

Most frequently used horizontal output tubes are the 6BQ6, 6CU6, 6BG6, 6CD6, 6AU5, 6AV5, 19BG6, 25BQ6 and 25CD6.

The Damper Stage

A faulty damper tube will disable the high voltage. Most frequently a short develops between the filament and cathode which will blow out the protective fuse in the damper circuit, killing the high voltage.

This short can also be intermittent and cause picture flashing with a momentary sizzling noise.

An arc can be seen within the damper tube during this breakdown which will then be easily identified as the cause of the high voltage trouble.

The types 6W4, 6AX4, 25W4, 5V4, 6V3 and 6AU4 are used as damper tubes.

The High Voltage Rectifier Stage

Lack of a raster can be frequently traced to a faulty high voltage rectifier tube. Occasionally, the glass cracks allowing air to fill the tube. This will cause a characteristic singing sound when the circuit is being operated.

Presence of gas will prevent sufficient high voltage from being applied to the picture tube. This condition will cause the picture to bloom or expand and lose focus as the brightness control is advanced. In cases where the gas is excessive or the filament has opened, no raster will be produced. Filament current for the high voltage rectifier is obtained from the high voltage circuit and not from the power transformer or power circuit as is the case with all other tubes in the TV receiver.

Types 1B3 and 1X2 are most usually employed as high voltage rectifiers.

The Low Voltage Rectifier Stage

A complete failure of the low voltage rectifier will disable the entire receiver.

However, in many cases the rectifier emission falls off and this results in low output voltage. This may cause insufficient width, lack of high voltage, or decreased vertical height.

Occasionally a complete short within the low voltage rectifier can blow out the set primary fuse or the house fuse itself. On rare, sad occasions, this heavy current drain will permanently ruin the power transformer.

For those TV receivers that require the power supply to furnish large amounts of current at substantial B voltage, an extra heavy-duty low voltage rectifier tube, the 5U4GB, is available. This is a direct substitute for only the 5U4. Most commonly used rectified types are the 5U4, 6X5, 5Y3 and 5V4 tubes.

Allow the rectifier tube to cool before handling because a nasty burn can result from direct skin contact.

The AGC Circuits

A considerable number of TV models use separate agc amplifier tubes. Faulty operation of this tube will cause signal overloading, loss of video and sound or unstable vertical and horizontal hold. Filament-to-cathode leakage in this tube will produce circuit instability that will cause picture pulling.

Frequently employed tube types in this circuit are the 6BE6, 6AU6, and sections of the 6U8 and 12AT7.

The Picture Tube

A weak picture tube will show a dim image when the set is first turned on. Then gradually the picture will show increased contrast. This condition may temporarily be relieved by installing a booster that will act to increase the picture tube filament voltage. The disadvantage of using a booster is that the filament life may be shortened.

Frequently some foreign matter will lodge between elements within the picture tube gun, causing uncontrollable full screen brightness. These particles may be removed by *gently* tapping the picture tube neck during its operation and observing the results obtained. Not all picture tube shorts can be corrected in this way.

In some cases this condition can be detected and actually measured by an ohmmeter reading between the socket pins of the picture tube. It is sometimes possible to clear up a short but the socket must be removed from the picture tube. When exposing the picture tube base pins, firmly grip the base when removing the tube socket. This is to prevent the base from pulling loose where it is cemented to the tube neck and breaking the electrode leads soldered to the tube base pins. Next, energize the primary of a small standard receiver power transformer and intermittently apply the ac high voltage secondary leads to the base pins of the shorted elements. Be careful not to come in direct contact with the lead wire ends because of possible shock. Also do not connect the voltage source to the picture tube filament pins as this would burn out the filament.

Reseat the picture tube socket and check the operation of the picture tube to see if its performance has improved. If it has, you have saved someone the price of a picture tube replacement.

I hope the information in this article will enable you to develop your effect-to-cause reasoning that will lead to faster TV servicing by accurate trouble diagnosis.

———*n r i*———

Home is a place where we grumble the most and are treated the best.

NRI ACCREDITED BY NATIONAL HOME STUDY COUNCIL

History of National Home Study Council

The National Home Study Council, organized in 1926, is an association composed of outstanding home study schools in the U.S. One of the chief purposes of the Council is to establish standards for advertising practices, quality of instruction materials, and business practices. Home study schools are required to meet these standards in order to qualify for and maintain their membership in the National Home Study Council. To this extent the Council has always been an accrediting agency.

Council Strengthens Accrediting Program

Recently the National Home Study Council rebuilt and strengthened its accrediting program, formalized stricter standards, and appointed a new and well qualified Commission of home study and outside educators to determine whether a home study school meets the new requirements for accreditation. The new Commission consists of:

William Bethke, *Chairman,* Vice President of LaSalle Extension University and Chairman of Illinois State Board for Business Schools.

Dr. Herald Hunt, *Vice-Chairman,* Eliot Professor of Education, Harvard University.

Earl L. Bedell, *Divisional Director,* Vocational Education, Detroit Public Schools.

Dr. E. C. Estabrooke, *Secretary and Educational Director,* American School and American Technical Society.

William A. Rogers, *Vice-President,* International Accountants Society.

W. Lane Schulze, *Director,* Chicago School of Nursing.

Jack C. Staehe, *Vice-President,* Aldens, Inc.

Dr. John Studebaker, *Chairman,* for 14 years U.S. Commissioner of Education and now Chairman, Editorial Board of Scholastic Magazines.

John C. Villaume, *Executive Vice-President and Dean of Faculties,* International Correspondence Schools.

NRI Among First Schools Accredited

On September 1, 1956, the Accrediting Commission of the National Home Study Council announced that it had included the National Radio Institute in its first list of accredited home study schools.

What Accreditation Means

Accreditation means that NRI fulfills the strict educational, ethical and business standards adopted by the Accrediting Commission of the National Home Study Council. It means that the Accrediting Commission found that NRI meets the following requirements:

- It truthfully advertises its courses and services.
- It offers educationally sound and up-to-date courses.
- It has a competent faculty.
- It accepts only qualified students.
- Its tuition charges are fair and reasonable.
- It has demonstrated ample student success and satisfaction.
- It is financially responsible.

Dr. Homer Kempfer, Executive Director of the National Home Study Council, states that "more people will enroll for private home study courses this year than entered college this fall as freshmen, but only half of them will be enrolling in accredited schools."

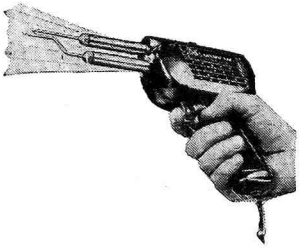
To NRI students accreditation means that they can pursue their courses with the confidence that they are getting their training from a school that has been thoroughly examined and found reliable by a competent and responsible agency. NRI graduates can take reassurance from the fact that they secured their training from an accredited school.

Christmas Suggestions For You

In this issue, and the October-November issue of NR-TV News, we give a complete though condensed catalog of the items that can be purchased through the NRI Supply Division. Further information will gladly be given upon request. Monthly time payments can be arranged for all test instruments, All NRI test instruments are covered by standard RETMA warrantly. Order blank on page 18 includes all items listed in this issue and in the October-November issue. Be sure to place orders early for delivery by Christmas.

Weller Model 8100K Soldering Kit $7.95 Value. NRI Price $5.95, Postpaid

Contains 100-watt Weller "Junior" Soldering Gun; Soldering Aid and Soldering Brush; Roll of Resin-Core Solder. An ideal gift.

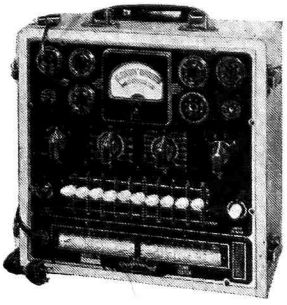


Weller Dual-Heat Soldering Guns

Model D-440 rated at 100-150 watts. For Radio-TV work. List price $14.90. NRI price only **$10.73, postpaid.**
Model D-550 rated at 200-250 watts. Heavy duty. List price $16.25. NRI price only **$11.71, postpaid.**

NRI Replacement Parts Kit $24.75, Including Tool Box

Just the thing for starting Radio and TV work. Most commonly needed replacement parts. Regular dealer's net price would be over $50 for this assortment. Shipping weight 15 pounds. Sent express collect. **Your price, $24.75.**

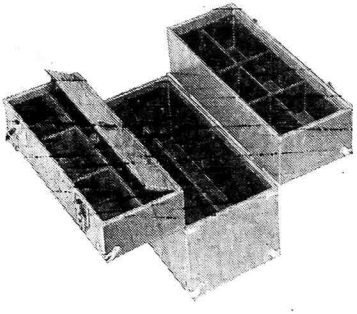


Model 70 NRI Professional Tube Tester Price $49.75

Designed to test the latest Radio and Television tubes. Convenient, built-in roll chart. Approved RETMA emission circuit minimizes possibility of obsolescence.

Ten separate four-position tube element switches. Eight tube test sockets. Fifteen filament voltages. Handsome, hardwood case. Size: 10¾" x 10¾" x 6¼". Actual weight, 11 lbs. Shipping weight, 13 lbs. Sent express collect. 50-60 cycle, 110-120 volts, ac required.

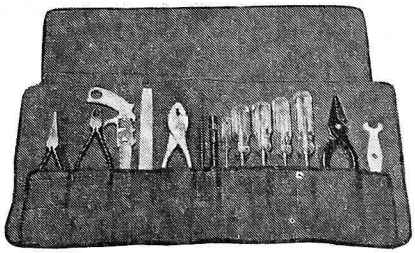
TV Picture Tube Adapter: For use with all NRI Tube Testers, Models 66 through 70. Provides cathode emission check, short and leakage test. **$4.98 postpaid.**



NRI Deluxe Tube Caddy Only $12.95, Postpaid

Handsome, professional in appearance. One-fourth inch plywood construction. Protected by metal hardware. Covered with attractive, long-wearing luggage type fabric.

Opens from center. Holds up to 200 tubes in assorted sizes. Plenty of room for VTVM and small tools. Light weight—easy to carry. Size: 16⅜" x 8" x 13½". Net weight 8 lbs.



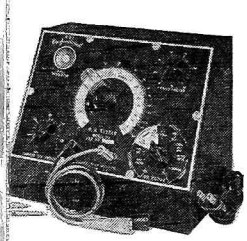
NRI Professional Tool Kit
Only $8.95, Postpaid

Here is a real money-saving value. If bought at dealer's net prices, the tools alone would cost you at least $10.50. NRI's price is only $8.95 including the long-wearing canvas carrying case.

Contains fourteen carefully selected, professional quality tools, packed in roll-up carrying case. These tool kits are used in NRI's own laboratories. We recommend them as just the thing for your NRI experiments, and for professional Radio and Television service work.

Use Order Blank On Page 18

All test instruments and the NRI Parts Kit are shipped by Railway Express, charges collect. Other items are shipped parcel post, prepaid.

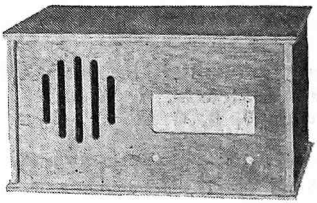


Model 113
NRI Professional Resistor-Condenser Tester
Price $39.95

Speeds up service work. Gives you more confidence. Tests all types of condensers used in Radio and TV. Uses highly accurate bridge-type circuit to measure capacity and resistance. Power factor test for electrolytics. Dual range, extra-sensitive leakage test circuit, applies actual working voltage up to 400 volts.

Four Capacity ranges—10 mmf to 1500 mfd. Four Resistance ranges—1 ohm to 150 megohms. Test leads and instructions included.

Maroon, crackle finish cabinet. Etched panel. Size: 8⅝" x 7" x 6¾". Actual weight: 6 lbs. Shipping weight: 7½ lbs. Sent express collect. 50-60 cycle, 110-120 volts ac required.



Cabinet for Your NRI Radio
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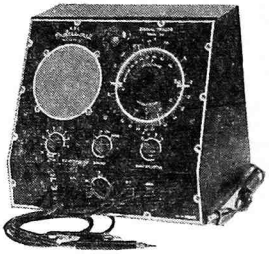
Well-seasoned, natural wood, unpainted. Mailed to you knocked down. Fun to assemble. Be sure to order the proper cabinet for the radio built from parts supplied with Kit 7E (six tubes), Kit 7RK (five tubes) or Kit 7W (five tubes).



Model 34
NRI Professional Signal Tracer
Price $57.50

Signals can be traced from antenna to loudspeaker. Trouble is quickly localized in dead receivers. Greatly assists beginners or experienced serviceman in finding stubborn cases of hum, noise, or distortion. Sources of oscillation in r.f. or i.f. stages can be quickly isolated. Two separate inputs make the instrument ideal for tracing down intermittent trouble.

One special use for this instrument is in measuring the "gain-per-stage." Also, because this instrument uses two stages of tuned radio frequency amplification, it can readily be used for alignment purposes. A Signal Generator is not essential. The actual broadcast station signal is used instead. The instrument is practically fool proof—anyone can safely use it. Detailed instruction manual is included. Specifications:

Power requirements—50 to 60-cycle, 110-120 volts a.c., only. Sturdy maroon crackle finish case—12" x 8¼" x 10¼". Handsomely etched aluminum panel. Tubes included: 2—6BA6; 1—6SQ7; 1—6K6-G; 1—6E5; and 1—5Y3-G. Frequency coverage is 170 kc. to 11.6 mc. in four bands. Five inch dynamic loudspeaker provides audio output. Also has visual output indicator. Standard 90-day RETMA Warranty.

Actual weight—15 lbs. Shipping weight—18 lbs. Shipped by express, collect. Please use order blank on page 18. **Price $57.50.**

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☐	TV Picture Tube Adapter	$ 4.98
☐	NRI Replacement Parts Kit	$ 24.75
☐	NRI Deluxe Tube Caddy	$ 12.95
☐	Model 56 TV Oscilloscope	$147.50
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Job Opportunities for Licensed Graduates

WGMS of Washington, D. C., wants a man with 1st class telephone license. Contact Mr. Charles Ray at WGMS.

Television station WFLB of Fayetteville, North Carolina, is in immediate need of 2 technicians holding 1st class licenses. Salary open. Write to Mr. J. H. Buck or phone Fayetteville 27136 collect.

WFRP of Savannah, Georgia, wants a 1st class licensed engineer. Write to Mr. John G. Williams, General Manager, WFRP.

WING, Dayton, Ohio, wants 2 engineers with 1st class Radio-Telephone licenses. Contact Mr. Howard B. Ryan, Chief Engineer.

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Openings For Young Men in Electronic Field in Up-State New York

The Long Lines Plant Department of the American Telephone and Telegraph Co. which maintains long distance telephone, teletypewriter, radio and television circuits has openings for men between the ages of 17 to 26. Inquiries should be addressed to Mr. W. G. Hanna, Central Office Chief, American Telephone and Telegraph Co., 280 Genesee Street, Utica, New York.

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Pay the Right Price

"IT'S UNWISE TO PAY TOO MUCH, but it's unwise to pay too little. When you pay too much you lose a little money, that is all. When you pay too little, you sometimes lose everything, because the thing you bought is incapable of doing the thing you bought it to do. The common law of business prohibits paying little and getting a lot—it can't be done. If you deal with the lowest bidder, it's well to add something for the risk you run. And, if you do that, you will have enough left to pay for something better."—Selected

J. G. Dodgson

A Transistorized High-Fidelity Preamplifier

By J. G. DODGSON
NRI Consultant

t has often been said that a high-fidelity sys-em is only as good as its weakest link. This rticle is concerned with one of the weakest nks of the system and one that is often over-ooked—the transmission of the signal from the utput of the cartridge, through the cable from he cartridge to the preamplifier, and finally hrough the preamplifier to the tone control mplifier stages.

he preamplifier section of many high-fidelity rstems is surprisingly poor as compared to ie remaining tone control-power amplifier ages. Most of the troubles encountered are im, noise, phase distortion, and frequency dis-rtion. In almost all cases the specifications and uare wave response illustrations given by the anufacturers for their amplifiers neglect to ate that these specifications, and especially the uare wave response illustrations, were taken ith the signal fed through the tone control-wer amplifier sections but *not* the preamplifier ction.

the preamplifier section of the Hi-Fi ampli-r the very low output signal of the cartridge ust be amplified considerably. In addition, ere must also be equalizers for the record aracteristic curves. All record characteristic rves require some method of boosting the bass sponse or reducing the high frequency re-onse. This is usually accomplished by degen-ation which reduces only the higher frequen-es.

e tube preamplifier, like all other stages in e complete system, produces some distortion. though careful design eliminates most of the equency and harmonic distortion, little can be ne to get rid of the phase distortion caused by e R-C coupling. This phase shift introduced by e preamplifier cannot be eliminated in the re-maining stages of the amplifier. The phase shift will result in over-all poor sound quality affecting especially the transient response and considerably increasing listening fatigue.

Hum is a very great problem in preamplifiers since the desired signal from the pick-up cartridge is so very low. The popular high-fidelity magnetic cartridges such as the Fairchild, Pickering, and General Electric have outputs ranging as low as from 5 to 30 milli-volts.

Microphonics, due to loose tube elements, become quite important in high gain preamplifier stages. Not only can this condition cause the usual audible oscillation howling as well as supersonic oscillation but also causes intermittent noise. This, of course, is in addition to the usual shot effect tube noise.

All vacuum tubes have some cathode-to-heater leakage and when this leakage is slightly above normal, the hum problem becomes very serious. Some preamplifiers, but only in the higher cost units, minimize the hum problem by providing dc voltage for the heaters of the preamplifier tubes. Although this may minimize the hum problem, it cannot affect the microphonic problem.

In the low price and medium price amplifier (up to $100) it is very often necessary to carefully choose tubes for the preamplifier before a satifactory tube can be found. For example, out of eleven preamplifier tubes, the author found only one that was satisfactory so far as hum and noise were concerned. This percentage is not at all unusual, but, of course, varies both with tube type and with the amount of hum and noise tolerable by the user. In addition, the higher quality high-fidelity systems are more critical since the speaker systems are better

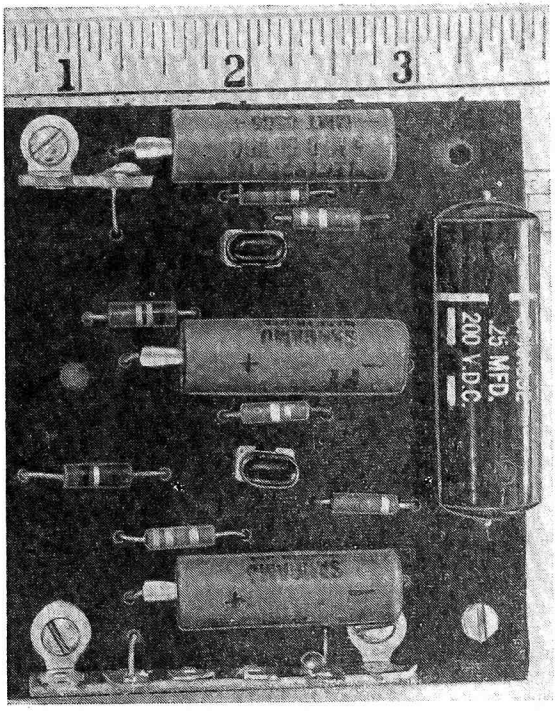


Fig. 1. The Transistorized High Fidelity Pre-amplifier.

able to reproduce hum as well as shake loose tube electrodes causing either noise or a microphonic condition to occur.

In addition to the problems encountered in the preamplifier itself, the cable between the cartridge and the preamplifier is also a source of difficulty. Even though the cable itself is shielded, it tends to pick up hum voltage. More important, the cable represents considerable shunt capacity. Ordinary single conductor shielded cable used for phonographs has a capacity of as much as 60 mmf per foot. Thus even a short 3-foot length cable would have a minimum of 180 mmf and the usual 5 or 6-foot length cable would have a capacity as high as 300 mmf.

Although the shunt capacity to ground does not decrease the high frequency response to any great degree (since the preamplifier reduces it anyway to provide record equalization) the capacity tends to resonate with the magnetic coil inductance. These resonances occur at high frequencies, and depending on the capacity and the impedance in this circuit, can noticeably affect the listening quality of the overall system. This is especially true when this system is of high quality and the reproducer is capable of good high frequency response. The high frequency peaking results in very harsh sounding,

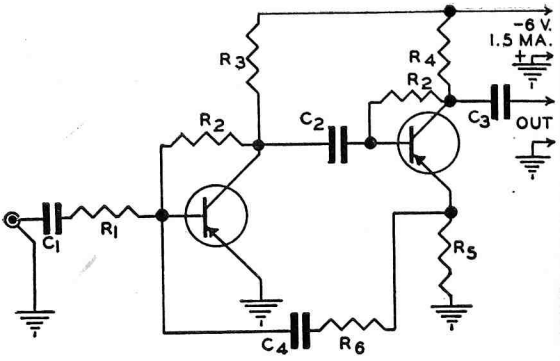


Fig. 2. Schematic Diagram of the Pre-amplifier.

peaky response. Elimination of these cable induced defects is very noticeable and results in cleaner, clearer, high frequency response.

The transistor preamplifier described in this article represents an attempt to eliminate hum, microphonics, phase shift, and high frequency peaking, caused by the preamplifier and input cable characteristics in the author's high-fidelity system.

The simple transistor preamplifier shown in Fig. 1 seems to do the job very well at a minimum cost. At the time of the writing, the preamplifier components cost somewhat less than $10 using type 2N34 transistors and about $7 using type 2N35 transistors. Since the transistor prices are constantly decreasing, the over-all cost of the unit can also be expected to decrease. The cost of the preamplifier also includes the cost of the batteries.

The preamplifier as shown in Fig. 2 is quite simple and consists of only two stages. Both of these are of the common emitter type voltage amplifier stages.

The magnetic cartridge is connected between the input and ground and completes the input circuit. The signal from the cartridge passes through the coupling condenser C1 and resistor R1 which both properly load the cartridge. This signal is amplified by the first transistor and appears across the transistor collector load resistor R3. The resistor R2 provides the proper bias and will need to be changed with different transistors due to the variable characteristics of these units. More about this later.

The amplified signal voltage across resistor R3 is passed through coupling condenser C2 to the input base of the second transistor stage. As before, resistor R2 supplies the proper bias and the amplified signal voltage appears across the collector resistor R4. The output signal passes through coupling condenser C3 and is fed

through the cable to the main amplifier.

Notice that the emitter in the first stage is grounded directly while in the second stage it is grounded through a 22-ohm resistor. Therefore a portion of the signal voltage amplified in the second stage appears across the 22-ohm resistor R5 and is in turn fed back through resistor R6 and condenser C4 to the base in the first stage. This resistor-condenser combination R6-C4 provides high frequency feedback to compensate for the RIAA record curve characteristic. They may be varied to compensate for other recording curves. The values shown approximate the RIAA curve fairly close at the bass end but do not have sufficient high frequency feedback to conform exactly with the curve at the treble end. This was done deliberately to somewhat boost the high frequency response in order to compensate for the cartridges. To more closely follow the RIAA recording curve, condenser C4 can be increased to .5 mfd. However, it is suggested that the circuit be built as shown and carefully tested by listening. If the high end response seems excessive, C4 can then be increased. Incidentally, condenser C4 appears rather large in the photograph since it was a 200-volt unit. It need only have a voltage rating of 6 volts.

This transistor preamplifier was specifically built for use with both the General Electric RPX series cartridges and the Pickering series D240, both of which the author uses in his high-fidelity system. The only difference in operation is that the Pickering cartridge has a higher output. However, no overloading of any kind from the higher output cartridge was encountered. The maximum input voltage for the unit before overloading is approximately 100 millivolts. The output of the Pickering cartridge is rated at 30 millivolts while the General Electric cartridge output is rated at 10 millivolts. The average output of both cartridges is usually under the rated values and seldom over them.

The output voltage of the preamplifier varies from approximately 2 volts to 8 volts since the preamplifier RIAA equalizer automatically boosts the low frequencies and reduces the high frequencies. The average 2-volt output is more than sufficient for driving most high-fidelity amplifiers. Incidentally, overloading in the amplifier may result unless this preamplifier is fed to a stage in the high-fidelity amplifier that contains a gain or loudness control. If this is not convenient as far as the input jacks of the amplifier are concerned, then a ½-megohm or 1-megohm potentiometer can be connected to the output terminals of the preamplifier. This will not produce distortion or affect the frequency response.

The frequency response of the preamplifier was carefully checked by square waves with a Tetronics Model 105 square wave generator and an NRI Model 56 Oscilloscope. As you can see from Fig. 3, square wave response is quite satisfactory from 20 cycles to 30,000 cycles. In fact, square wave response was satisfactory beyond 50,000 cycles and did not tend to severely round until 70,000 cycles was reached. These square waves were plotted with a 15-millivolt input signal fed into a 470,000-ohm load. The load was connected to the end of a two-foot, two-conductor shielded cable.

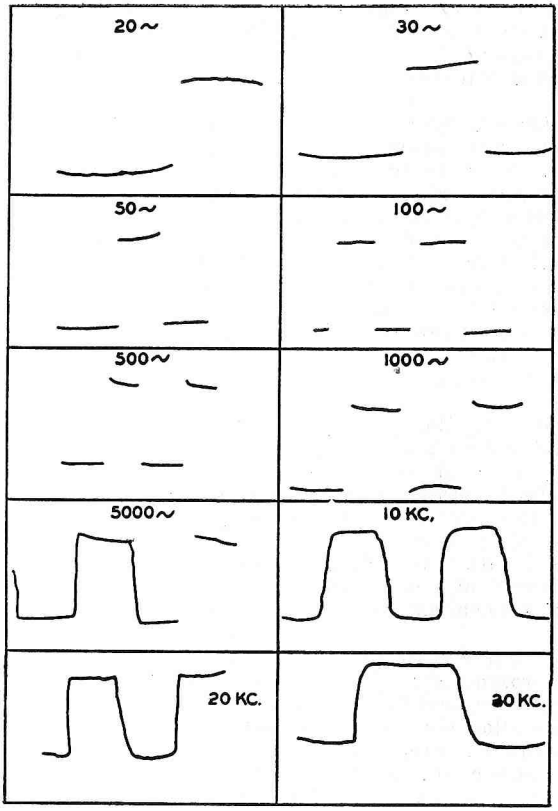


Fig. 3. Square-wave response of the Pre-amplifier.

As was previously mentioned, resistor R2 in both transistor stages provides the proper bias for the stages. The characteristics of these transistors are somewhat variable and the bias resistors will need to be varied between 100,000 and 500,000 ohms for proper operation of the stages. The bias resistors should be chosen for a collector voltage of —2.5 to —3.5 volts measured between the collector and the common ground. Several transistors were tried in the circuit by the author and although many of them would work satisfactorily with the values chosen for the two specific transistors, some improvement was found by varying these resistors.

Furthermore, some of the transistors tried did not work to my satisfaction with the original resistors. These resistor values affect the gain of the transistor stages.

Although the transistor stages completely eliminate hum problems in a preamplifier, they do not eliminate the noise problem. In fact, most transistors are inherently more noisy than tubes. However, it is the total hum and noise at the output of the preamplifier (with no signal input) that is important. Although the transistor noise may be equal to the tube noise, the hum will be completely eliminated in the preamplifier. The total noise and hum was found to be 9 db below the total hum and noise of the comparable tube preamplifier.

Changing the operating voltage of the preamplifier does not change the frequency response to any great degree although it does change the output voltage. Although the original operating voltage is designated in the diagram as —6 volts, any value between —6 volts and —9 volts can be used with satisfactory results. Six volts can be conveniently obtained by connecting four ordinary flashlight cells (size D) in series.

The current consumption by the preamplifier is approximately 1.5 ma and the cells should last their approximate shelf life. Over one year's operation should be obtained with the average flashlight cells without ever turning the preamplifier off. Note in Fig. 2 that an On-Off switch is not used! The author has installed two 4-volt mercury batteries in series for the operation of his preamplifier and according to the manufacturer's specifications, the cells should last for approximately 3 to 5 years (with this low current drain) without need of replacement.

The transistor preamplifier was specifically designed to be installed right in the record changer or turntable base to completely eliminate the cable troubles previously described. The signal voltage in the cable connected to the main amplifier then becomes about 2000 millivolts instead of the previous 10 millivolts!

You will notice from Fig. 1 that the preamplifier uses standard components. No attempt at all was made to miniaturize the unit although this is apparently quite feasible. The .25-mfd feedback condenser C4 is a 200-volt unit while the 5-microfarad coupling condensers are 50-volt units. Since the supply voltage is only 6 volts, condensers rated at 6 volts could be just as easily used in the unit and would miniaturize it considerably. Similarly, ¼-watt resistors could have been used instead of ½-watt units.

Although transistor sockets were purchased and used in the preamplifier, this is not at all necessary and the transistor leads can be soldered right into the circuit. When doing this, however, be sure to hold a pair of long-nose pliers on the transistor lead between the soldered joint and the transistor to protect it from heat. The only reason the author used the sockets was so other transistors could be more conveniently tried in the circuit to evaluate the difference in transistor characteristics. Of course, there is no harm in using the sockets if desired.

The base for the transistor preamplifier is an ordinary piece of Bakelite which was carefully drilled with a hand drill. No difficulty at all was encountered. It is not necessary to follow the layout shown in the diagram and no attempt is made to give a layout since it is not at all critical. The layout shown in Fig. 1 was somewhat haphazard and it was found by the author after completion of the unit that a better layout could result in some shorter leads. Deliberate indiscriminate placing of leads did not affect the response in any way. However, in wiring the preamplifier, it is suggested that the input and output leads be kept away from each other to prevent any possible oscillation even though none was noticed in the original unit. That is, keep the base and collector components and leads away from each other. Since the power supply is pure dc, no difficulty at all is encountered with hum pick-up as is usually encountered in building tube preamplifiers. In addition, the transistors need not be shielded to minimize microphonics as is done with tubes and the entire unit can be mounted in any position whatsoever. It is advisable to keep it away from heat and to prevent exterior hum pick-up in the leads. The unit should not be placed close to the motor in the record changer or turntable, if it is mounted underneath. There is generally sufficient room in the base of any record changer or turntable for such a small unit.

The output cable in the author's unit is about 2 feet long and is a two-conductor shielded cable. The one conductor is connected to the "hot" output terminal and the other conductor is connected to the common B— point. The shield is not connected at all to the preamplifier chassis but is grounded to the input jack where it is plugged into the amplifier. This method is advisable and tends to pick up much less hum than the usual single conductor shielded cable employed in phonographs.

The final test of any high-fidelity component is the listening test. It is not uncommon to find that a device checks to be of highest quality in the laboratory and yet does not stand up to these high standards when in normal everyday use.

The preamplifier described in this article is installed in the author's Garrard T Turntable

and is used several hours per day with both a Pickering Model D240 cartridge and a General Electric Model RPX-053A. The output of the preamplifier is fed to a Bogen Model DB110 Amplifier. The amplifier feeds several speaker systems. The main one consists of a Karlson enclosure employing a Lansing D123 12-inch speaker, and an Electro-Voice Super-Sonax T35 Tweeter. Several smaller auxiliary loudspeaker systems in different parts of the house are also used from time to time. All of them employ full range 8-inch speakers of various quality (and price).

The sound quality has been judged by several friends (who also have high-fidelity systems) to have been improved by the addition of the preamplifier. It was especially noted that the extreme high and extreme low frequency sounds are exceptionally clean and clear without any trace of harshness. This is especially true at the high end where extreme high frequency response very often results in a harsh, unnatural sound. Where it was somewhat strident with a tube preamplifier, it is now quite smooth.

Notice that type 2N34 transistors and a voltage supply of —6 volts are indicated in the schematic diagram of the preamplifier. Type 2N35 transistors can also be used in the unit but it is then necessary to reverse the power supply polarity. Thus, it would become +6 volts rather than —6 volts. If this is done, then the electrolytic coupling condenser polarity should be reversed.

Although the type 2N35 transistors are somewhat less expensive than the type 2N34, they have a slightly higher noise level. This was not found to be excessively higher in some of the units checked and was yet found to be bothersome with others. It seems that transistor quality control is not yet as high as tube quality control.

Although you may find that both the transistors you obtain have a very high noise level, it is more likely that you will find that one of the two has a higher noise level than the other. After the unit is built, it is suggested that the input be shorted, the output connected through an amplifier to a speaker and the gain control advanced to where the noise can be heard. It may also be helpful to reduce the bass control to its maximum counter-clockwise position and advance the treble control of the amplifier to its maximum clockwise position to emphasize the noise. Then, switch the transistors in the preamplifier by placing the one that was in the second stage in the first stage and the one previously in the first stage in the second stage. It is desirable to have the transistor with the lowest noise figure in the first stage. Use the position that seems to work best and adjust the bias resistors accordingly as previously described.

You may find that both transistors are excessively noisy. If this should happen, it will probably be best to return them to the wholesaler and obtain others. However, first check to be sure that all joints in the unit are securely soldered and it may also be helpful to try new resistors. If convenient, install 1-watt resistors since they tend to be less noisy than ½-watt units. However, since there is little current flow through the resistors, this increase from ½ to 1 watt is seldom helpful. In most cases, any noise from the unit will be due to the transistors.

Although the transistor preamplifier was designed specifically for magnetic phonograph cartridges, it can also be used for a microphone by shorting out the feedback condenser C4. The feedback resistor R6 should be left in the circuit since it tends to stabilize it and improve frequency response and reduce distortion. If desirable, a single-pole, single-throw switch can be installed, connected directly across condenser C4 so the preamplifier could be used for either microphone or phonograph.

The components used in the preamplifier are given in Fig. 4. Notice that all of the components are available from most radio wholesalers or mail order houses such as Allied Radio Corporation at 100 North Western Avenue, Chicago 80, Illinois. NRI cannot supply any of these components.

Remember that the electrolytic coupling condensers C1, C2 and C3 must have a voltage rating at least equal to the power supply used. Condenser C4 must also have a working voltage rating equal to or above the power supply rating. These condensers need not have a power supply rating of that above the source voltage rating, since, unlike ac power supplies, peak or surge voltages above the power supply average output cannot be obtained.

In conclusion, it seems worthwhile to improve a high-fidelity system with the addition of this preamplifier in place of the tube preamplifier. The slight investment is well worth the improved quality.

Fig. 4. Parts list of the Pre-amplifier. Two 2N34 or 2N35 Sylvania Transistors.

C1, C2, C3	5 MFD electrolytic, 6 volts or more (see text)	
R1	2.7K	
R2	100K-500K ohm (see text)	
R3	10K ohm	
R4	3.3K ohm	
R5	22 ohm	
C4	.25 MFD	Record equalizer components chosen for RIAA
R6	1.5K ohm	

Note: all resistors are ½ watt, 10%.

Boss: "What makes you so late this morning?"
Employee: "I had a blowout."
Boss: "Why, I didn't know you owned a car."
Employee: "I don't. The blowout was last night."

n r i

Many a wife has wondered after listening to her husband expound on banking and economics how anyone could know so much about money and not have any of it.

n r i

N.R.I. ALUMNI NEWS

Elmer E. Shue Elected As President of NRI A.A. For 1957

Elmer E. Shue,
of Baltimore, Md.

F. Earl Oliver of Detroit, William Fox of New York, John Babcock of Minneapolis and Joseph Stocker of Los Angeles Elected as Vice-Presidents.

Elmer E. Shue of the Baltimore Chapter will be President of the NRI Alumni Association for 1957.

It was not by any means an easy victory for Mr. Shue. Howard Smith of Springfield, Mass., gave him quite a battle. Mr. Shue should feel particularly honored that he won out over such a strong opponent.

The Vice-Presidential race was almost equally close in some instances. Our perennial Vice-President F. Earl Oliver of Detroit was elected to serve still another term. So, too, was William Fox of New York City. Probably the only reason Howard Smith of Springfield, Mass., was not also elected to another term as Vice-President was because so many members voted for him for President. We have two new Vice-Presidents: John Babcock of Minneapolis and Joseph Stocker of Los Angeles.

A word about our new President-Elect. Mr. Shue was born in 1900 in Towson, Md., where he attended grammar school and high school. Following his graduation from high school in 1918, he worked for several electrical contractors in Baltimore, then was employed by the Black & Decker Manufacturing Company. In 1931 he was promoted to chief electrician of Black & Decker's Towson plant, the position he holds to the present day.

Mr. Shue enrolled with NRI in 1943 and graduated in 1946. He became a member of the Bal-

timore Chapter in 1944 while still a student. He has held almost every important office in the Baltimore Chapter—treasurer, vice-chairman, chairman, librarian, sergeant-at-arms—and in addition has served on various committees.

Mr. Shue is married, has two children, a boy and a girl, and two grandchildren, also a boy and a girl. Having studied music for five years—piano, mandolin, violin, saxophone and clarinet—it is only natural that his hobby is music and collecting records. But he has little opportunity to indulge his hobby. He spends most of his spare time in his home work-shop or making service calls in connection with his Radio and TV servicing.

From his record it is evident that Mr. Shue deserves the honor of the office to which he has been elected—that as its National President he will serve the NRI Alumni Association as faithfully and earnestly as he has served the Baltimore Chapter for so many years.

Louis E. Grossman's term of office as President will expire on December 31, 1956. But, as everyone who is acquainted with him knows, Mr. Grossman certainly isn't going to take a back seat. He will remain a dynamic leader of the New Orleans Chapter, for whose organizing he himself was chiefly responsible.

Alumni members need no introduction to F. Earl Oliver of the Detroit Chapter. A former National President, re-elected to the Vice-Presidency more times than he probably cares to remember, he is widely known among our members. New York City Chapter members can justly feel very pleased that their William (Willy) Fox was elected to serve again as a Vice-President. John Babcock is fully entitled to the recognition given him in his election as Vice-President, in view of the excellent work he has done for the Minneapolis-St. Paul (Twin City) Chapter. Joseph Stocker of Los Angeles is not a member of a local chapter but as a representative of the West Coast we are glad to welcome him as a Vice-President for 1957.

Our congratulations to all these members upon their election to the offices for which they have been selected. We are confident that each and every one of them can be depended upon to carry out the spirit and purpose of the NRI Alumni Association.

Chapter Chatter

Minneapolis-St. Paul (Twin City) Chapter was very pleased with a talk given by Mr. Gean Foster on Bell Amplifiers. Mr. Foster is manufacturer's representative for Bell Amplifiers.

Arrangements have been made for all members in the area to get into the HI-FI field. One of the leading manufacturers has agreed to help by granting NRI men the same price consideration as distributors, thus permitting them to make a full profit. This is a real gain for NRI men and for the HI-FI industry in the area.

At another meeting, Secretary Charles K. Goodell gave a talk on the proper way to make a service call. This was not a technical talk but was devoted to the importance of dress and neatness of appearance, condition of tools and equipment, and the serviceman's manner in dealing with the customer. As Secretary Goodell pointed out, the importance of these cannot be stressed too much if the serviceman wants to maintain successful relations with his customers.

The Chapter is planning a talk on UNIVAC, which should prove mighty interesting.

Meetings are held on the second Thursday of each month at the St. Paul Midway YMCA at 8:00 P.M. The Chairman is Paul Donatell, 933 Burr Street, St. Paul. The Secretary is Charles Goodell, 19 West 38th Street, Minneapolis 9. All students and graduates in the area who are interested in attending meetings should get in touch with either the Chairman or the Secretary.

Hagerstown (Cumberland Valley) Chapter extended a cordial welcome to two visitors from National Headquarters: Thomas Carswell, NRI Consultant, and Ted Rose, Executive Secretary of the Alumni Association. Mr. Carswell gave an interesting and instructive talk on the gated beam detector. His talk was well received and brought forth a good many questions and considerable discussion.

All members of the Chapter were invited *free* to a turkey dinner "with all the trimmin's." Sounds good! Just the thing to get in training for the festive season which will soon be upon us.

The Chapter cordially invites all students and graduates in the Cumberland Valley to attend meetings as guests or potential members. The Chapter meets on the second Thursday of each month at the YMCA Building, 8:00 P.M. Interested students and graduates should get in touch with Chairman Edwin M. Kemp, 618 Sunset Avenue, or Secretary John Pearl, 13 Fairground

Avenue, Hagerstown, Maryland.

Baltimore Chapter is full of plans, chief of which is for a banquet to be held in December in honor of their successful presidential candidate, Mr. Elmer Shue. These Baltimore Chapter dinners are always pleasant and enjoyable get-togethers and this one should be particularly so since it will celebrate Mr. Shue's election to the Presidency of the Alumni Association.

The Chapter is also busy with a sale of parts and equipment. A sale of this kind was held earlier in the year. It was so successful and resulted in such a substantial increase in the Chapter's treasury that the members voted to repeat the sale. Hats off to the Baltimore Chapter for its initiative and energy.

But the Chapter announces the loss of one of its oldest and most loyal members, Mr. H. J. Rathbun, who has moved to St. Petersburg, Florida, in an attempt to provide a more favorable climate for his wife's illness. The Chairman refers to Mr. Rathbun as a "walking encyclopedia of electronic information" and adds "if Mr. Rathbun does not know the answer, it hasn't been invented yet." Mr. Rathbun is seventy-three years old but even some of the younger members are envious of his vitality and enthusiasm. Let's all hope that Mrs. Rathbun will recover her health in the near future so that she and Mr. Rathbun can return to Baltimore, whereupon he can again resume the important part he has always played in the Baltimore Chapter.

The Chapter meets on the second Tuesday of each month at 100 North Paca Street, Baltimore. Students and graduates who would like to attend the meetings should get in touch with Chairman Joseph B. Dolivka, 717 North Montford Ave., Baltimore 5, or Secretary Joseph M. Nardi, 4157 Eierman Ave., Baltimore.

Chicago Chapter wishes to extend a special invitation to all students in the Chicago area who are half-way or more through their courses, to attend meetings of the Chicago Chapter. Secretary Mead states that when such students have joined the Chapter in the past, he has always been impressed with the greater enthusiasm manifested by them as contrasted to graduates who respond to this invitation long after they have finished their courses. Therefore, Secretary Mead suggests that all students who believe they might join the Chicago Chapter, to do so now rather than wait until after they graduate.

Secretary Mead further points out that the Chicago Chapter is located in the center of a heavily populated part of the country and that there is no reason why it should not become one of the largest chapters. There are adequate parking facilities within a reasonable distance of the meeting place and CTA transportation is conveniently available for whose who do not wish to drive their automobiles.

There is much to be learned at the meetings. Members help themselves and other members by talking over their Radio-TV problems, thereby benefiting from the collective experience of the entire group.

A recent meeting featured a thorough and intensive demonstration of the best practical use of a signal generator for sound receiver servicing. This demonstration was a revelation to many and a reminder to other members that they have not been using the signal generator to the best advantage.

Members and guests are invited to ask questions related to Radio-TV service problems and they will nearly always get a helpful and practical answer.

The Chapter also holds service forums during which members have the opportunity to see and learn the proper application of service equipment to locate defects in Radio and Television receivers.

Students and graduates in the vicinity of Chicago who wish to take advantage of the Chapter's invitation to attend its meetings should write or telephone Secretary Charles C. Mead, 666 Lakeshore Drive, Room 228, Chicago 11, Illinois. The Chairman is Walter H. Nicely, 6441 South Campbell Ave., Chicago 29, Illinois. Meetings are held on the second and fourth Wednesday of each month at 666 Lakeshore Drive (West Entrance).

New York Chapter on October 18 held one of its delightful dinners at Chesapeake House, one of the better-known eating places in New York City. The dinner was attended by ten officers or past officers and members, and Ted Rose, from National Headquarters. The spirit and good fellowship of this group—indeed, of the entire New York City Chapter—is something to behold.

Following the meeting, the group repaired to the regular meeting place, 12 St. Mark's Place, St. Mark's Community Center, between 2nd and 3rd Avenues, where the Chapter holds its meeting regularly on the first and third Thursday of each month.

Ted Rose made a brief talk expressing his appreciation for the cordial welcome given him by the Chapter. This was followed with talks by speakers from among the members. These talks are in the nature of a series which are continued from meeting to meeting. James Eaddy has been addressing the members on Radio and TV tips, Chairman Tom Hull on TV problems,

Phil Spampinato on "Practical Radio Servicing." Frank Catalano also spoke on running down a very puzzling and elusive defect in a TV receiver.

It is impressive to attend a meeting of the New York City Chapter, to note how well the meetings are conducted, observe the able speakers that the Chapter has developed from among its own members, and above all how much real and practical benefit can be obtained by the members from each meeting. Students and graduates in the area who have not attended the meetings can have no idea what they are missing until they go to one.

The Chairman is Thomas Hull, 119-18 223rd Street, Cambria Heights, New York. The Secretary is Emile E. Paul, 6 Gateway, Bethpage, Long Island, New York.

Pittsburgh Chapter continues to meet at 8:00 P.M. at 134 Market Street. One of their recent meetings was devoted entirely to problems encountered in the course of Radio-TV service work. Questions were asked by the members and discussed at length, and various suggestions given for meeting the different kinds of problems.

This Chapter has one of the most attractive and best-equipped meeting places and it is always a pleasure to attend its meetings.

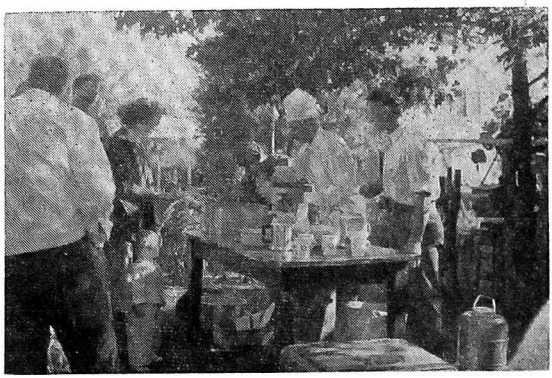
Students and graduates in the Pittsburgh area should take advantage of the Chapter's invitation to attend its meetings and to apply for membership. Get in touch with Chairman William J. Lundy, 263 Morrisey Street, or Secretary Peter Kenny, Jr., 8111 Lindisfarme Drive, Pittsburgh.

Springfield, Mass., Chapter has hit another home-run, this time with its third annual picnic which was held at the home of Chairman and Mrs. Ray Nystrom. It was an outstanding success, mainly because it was in the capable hands of Mrs. Nystrom and her sister, who worked for weeks planning, buying, worrying and cooking a chicken dinner that could have cost a great deal more but could not have possibly tasted any better. That must be the answer to why Chairman Nystrom carries around that settled, contented look.

The menu consisted of half of a very large chicken (for each guest) corn, tomatoes, potato chips, home-made cup cakes, fresh milk, coffee, soft drinks, ice cream and lollypops.

(Did only the kids get the lollypops?)

Horseshoe pitching was the main sport for the adults. The children played croquet, ring-toss, badminton, and cow-boys and Indians. The



Chairman Nystrom, presiding, and petitioners at the Springfield Chapter picnic.

wives had a long, delightful social afternoon, exchanging views and problems of the day and the future, as the ladies will, may the Lord bless 'em. Chairman Nystrom had two loudspeakers hooked up in the backyard so that everyone could enjoy the baseball games. There were thirty-two adults and seventeen children present. Quite a merry crowd! The Springfield Chapter only hopes that its future annual picnics will be as successful.

On October 19 Ted Rose visited the Springfield Chapter. He was welcomed prior to the regular Chapter meeting by being treated to an excellent dinner by the Chapter officers. (If anyone notices the Executive Secretary putting on weight as a result of these dinners, please *don't* mention it to him). Those present at the dinner then retired to the regular meeting place, the U.S. Army Headquarters Bldg., 50 East Street, Springfield, where meetings are held on the first and third Friday of each month at 7:00 P.M.

Here a surprise awaited Ted Rose, in the form of a big sheet cake (with his name on it yet!) which the Chapter had had baked especially for his visit. The regular program was dispensed

Wrecking crew in action at Springfield Chapter's picnic.

with and, after a few remarks by the genial Chairman, Ray Nystrom, and a few by Ted Rose, the members got down to the business of consuming the delicious sandwiches, coffee, and cake that had been prepared for the occasion.

There is no Chapter which ranks higher in hospitality and comradeship than the Springfield Chapter. All anyone needs to do is to attend one of its meetings to find this out for himself—in addition to furthering his practical knowledge of Radio-TV servicing through the experience and helpfulness of its outstanding members. NRI men in the vicinity of Springfield who are not members of this Chapter are missing out on a good bet. They should write Chairman Raymond Nystrom, 36 Baltimore Avenue, Springfield or Vice-Chairman Howard Smith, 53 Bangor Street, Springfield, or Secretary Marcellus Reed, 41 Westland Street, Hartford, Connecticut.

Flint (Saginaw Valley) Chapter Chairman Warrent Williamson wishes to express his appreciation to the members who have been attending the Chapter meetings, especially to those from Saginaw and Bay City. At the first meeting of this season there were five guests and six new members present.

The meeting was devoted to a discussion of color Television. A motion was made by George Hinman of Bay City to bring "dogs" to the meetings. The motion was carried.

Chairman Williamson emphasized that the business part of the meetings will be held to a minimum so that more time will be available to work on and discuss the "dogs." In this way members will get more practical benefit from the meetings.

The Chapter urges all NRI men in the area to attend the meetings. Write or telephone Chairman Warren Williamson, 1201 Allen Street, Flint, or Secretary George Rashead, 338 E. Marengo, Flint 5, Michigan.

Milwaukee Chapter, in its first meeting of the season, was addressed by Chapter member John Lasky, who gave a chalk talk on integrated circuits. Mr. Lasky dealt with vertical and horizontal troubles, their symptoms, and parts in the various circuits to suspect of being faulty. As an example, he said sync trouble only in weak stations and not in strong channels may mean leakage across the *i-f* transformer in the set. Sets mentioned were Motorola and Philco 400. Also, a drop in the AGC voltage usually accompanies this leakage and thus can be found by voltage tests and of course by the oscilloscope.

Mr. Lasky cited another example of a set condition where heads were cut off and there was a loss of height in the picture. This, he said, was caused by a shorted linearity control which had a value of 5000 ohms and calls for an exact replacement. Refreshments were served after the meeting by Mr. Philip Rinke.

At a later meeting, Vice-Chairman S. J. Petrich talked on the analysis of high voltage circuits. These lectures by Mr. Petrich are always attended with enthusiasm by the members. Being thoroughly experienced in servicing all makes of TV sets, Mr. Petrich has helped many a member to solve a problem in servicing a difficult TV job. After his talks he always welcomes questions from members. The following members also took part in the discussion: James Lasky, John P. Edgerton, Philip Rinke, Erwin E. Kapheim, Chairman Bettencourt, Gunter Opperman and others.

A good point was brought up by Mr. Petrich and discussed by others—that is, that a member should first do all he can to repair a Radio or TV receiver before bringing it to the meeting to be analyzed. He should also attach to it a written voltage report and other pertinent data.

Plans were discussed for the third anniversary banquet, which will include entertainment, moving pictures and refreshments.

The Chapter meets at the Radio-TV Store and Shop of S. J. Petrich, 5901 West Vliet St., on the third Monday of each month. The Chairman is Ernest Bettencourt, 3407A No. First St., Milwaukee 12, Wisconsin. The Secretary is Robert Krauss, 2467 No. 29th St., Milwaukee.

Detroit Chapter held its customary Fall Stag Social at the Chry-Moto Club in Windsor, Ont., Canada. Member Clarence McMaster of Ontario was in charge of arrangements and made an excellent job of it. The dinner was unusually good and consisted of fried shrimp, fish, french fried potatos, slaw, pickles, various kinds of cold cuts and sandwiches, beer, coffee, cold drinks and many other items. All members agreed that it was the best supper that the Chapter had served at any of its socials for some time. Clarence McMaster is due a hearty vote of thanks for the smooth program followed at this social and for the delicious food.

Ted Rose from National Headquarters was a guest at this social (there he was eating again) and told a few stories which added to the merriment of the evening.

The Chapter was happy to welcome a newcomer, Graduate Virgil Eberle from Pontiac, Michigan. It was his first visit to the Detroit Chapter, and he is considering becoming a member. By all means come on in and join up with us, Virgil—you will have just as much fun at

future meetings besides learning a great deal.

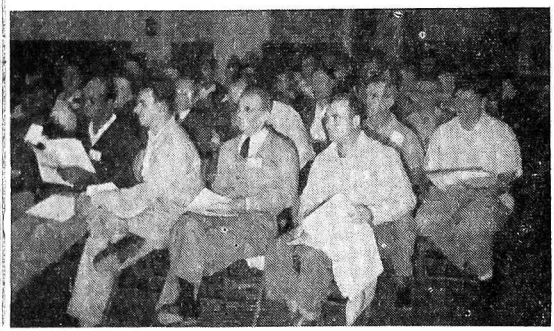
Up to the time of this social the Chapter had not yet made its plans for the winter season but we can all rest assured that it will be getting ahead with its program by the time this appears in print.

Regular meetings of the Chapter are held on the second and fourth Friday of each month at St. Andrews Hall, 431 East Congress Street, Detroit 26, Michigan. The Chairman is Edward V. Green, 9458 Knodell Avenue, Detroit 13. The Secretary is James Kelley, 1140 Livernois, Detroit, Michigan.

Philadelphia-Camden Chapter, always in there pitching to make its meetings interesting and informative (and succeeding in doing so) recently had a guest speaker in the person of Mr. Al Auerbach of the Emerson Radio and Phonograph Corporation, who spoke on the Emerson Color TV. Mr. Auerbach distributed bulletins and schematics to make it easier for the members to follow his talk.

Three members of the Motorola Corporation were guest speakers at another meeting. They were Mr. Henry Lapinski, Service Manager, Mr. Herb Telling, Field Engineer, who delivered a talk on transistors—a subject that all Radio-TV Servicemen will do well to learn all they can about—and Mr. Bill Wertz, Radio Shop Foreman, who talked on trouble-shooting in the Motorola Transistor Radio.

The Chapter is now trying to arrange for a representative of the Sylvania Corporation to attend one of its meetings as a guest speaker.



Part of the chapter listening to Al Auerbach on the Emerson Color TV.

The Chapter has admitted three more members to its membership. They are Mr. Joseph Springer, Sr., whose son is also an NRI student and member of the Chapter; Mr. Hubert Naylor, an NRI student; and Mr. Arthur Hall, Jr., an NRI Graduate. A hearty welcome to these three new members.

Left to right, Bill Wertz—Radio Shop Foreman, Herb Telling—Field Engineer, Henry Lapinski—Service Manager, holding the Motorola Transistor Car Radio.

The Chapter meets on the second and fourth Monday of each month at the Knights of Columbus Hall, Tulip and Tyson Streets, Philadelphia, Pa. NRI students and graduates in the Philadelphia-Camden area who are not now members but who would like to join or visit the Chapter as a guest, should contact Secretary Jules Cohen, 7124 Souder Street, Philadelphia 24, Pennsylvania.

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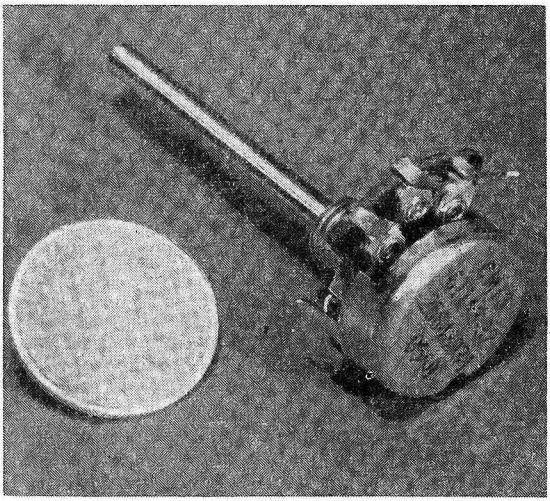

This minaturized control is actually smaller than a dime. Known as Clarostat Series 44, this control meets the space needs of transistorized assemblies such as hearing aids, pocket radios, portable radios and TV sets.

Here and There Among Alumni Members

Graduate John J. Duemler of Bakersfield, California, is playing a dual role as the Chief Engineer of station KBIS in Bakersfield and KBVM in Lancaster. KBVM was designed by Mr. Duemler. He tells us that he could use a technical assistant interested in broadcast radio.

John L. Ruthvin of Frederick, Maryland, passed his Amateur License exam on the first try. His call letters are W3DCV.

Graduate Richard K. Barnett of Massillon, Ohio, is a Field Service Engineer there. He is looking forward to an assignment in the Arctic Region. Brrrr; and best of luck, Richard.

George J. Meyer, Cincinnati, Ohio, has grossed $5,000 in spare-time Radio-TV Servicing during the past year and anticipates doing even better this year. This is in addition to raising 10 children.

Graduate E. H. Roberts of Wintergarden, Florida, now has his own shop and enough business to warrant lots of overtime. Congratulations on your success, E. H.!

Graduate Donald L. Monge, Greeley, Colorado, has obtained his second-class license. He is an engineer-announcer at station KFKA.

Carl W. Casteel is a radio parts cataloger with Convair of Fort Worth, Texas.

Redus A. Carlton, a graduate of 1939, is back with us for a "refresher" course. He is the Chief Engineer at WGPC, Albany, Georgia.

Graduate Cail E. Gibbs, Walnut Ridge, Arkansas, is an Airways Operation Specialist with the CAA.

LaValle E. Raver has been in business for himself for 3 years and is doing very well. He operates "LaValle's Radio & TV Service of Denver, Colorado." We wish him continued success.

George W. Barber now has his own business as a radio and TV parts wholesaler. It is known as Middlesex Electronics and located at 1513 Eastern Boulevard, Baltimore, Maryland. Students and graduates in that area interested in purchasing parts and supplies from another NRI man should contact Mr. Barber.

Graduate Charles F. Almony of Towson, Maryland, divides his spare time between radio servicing and collecting antique radios. His oldest radio dating back quite a few years, is known as the "breadboard Atwater-Kent." An interesting hobby!

Robert C. Harvey of N.B. Canada, is a TV technician with the Sussex Radio Centre there. He reports they are doing over 90% of the servicing in that area.

Graduate Robert C. Schorb, Norfolk, Virginia, with the Navy, recently passed the exam for CPO. He has also passed the half-way mark in his hitch and is looking forward to retirement in 1965.

Wayne J. Kaiser of South Mountain, Pa. informs us that he has a "booming" part-time shop. Now handles complete Zenith line.

John J. Oskay of New Brunswick, New Jersey, sent us a photo of his "ham" station K2BUW. He has a good setup and so far has contacted all continents, 65 countries and 46 states.

Graduate Carrol P. Johnson, Lawton, Oklahoma, puts in long hours on his regular job as an electrical contractor but finds that his part-time TV business continues to grow.

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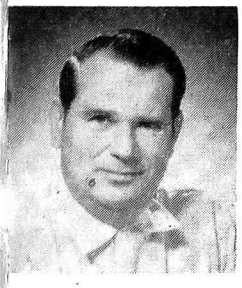
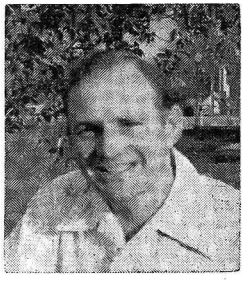
NRI Training Leads to "Extra" Cash And New Employment Opportunities



West Coast Field Engineer



Now Drawing Top Wages

"Your training has given me the position I now have. I am Field Engineer for the Elox Corp. of Michigan. I handle installation and repairs on all of their Electronic Machines for the entire West Coast, Mexico, Alaska and Hawaiian Islands. I wish to thank you for past help and cooperation."

Thomas D. McMullen
1002 W. 187th Place
Gardena, Calif.

"I am the TV-Benchman for one of the leading TV and Radio Sales and Service organizations in Sacramento, Calif. I am drawing top wages for this area, $125 plus overtime. I went into TV and Radio servicing 18 months after starting your Radio TV course. I also followed through with the Communications course and I know it has helped me very much in my field. I can honestly say I owe my success to NRI."

Richard Hery
2807 Del Paso Blvd.
No. Sacramento, Calif.

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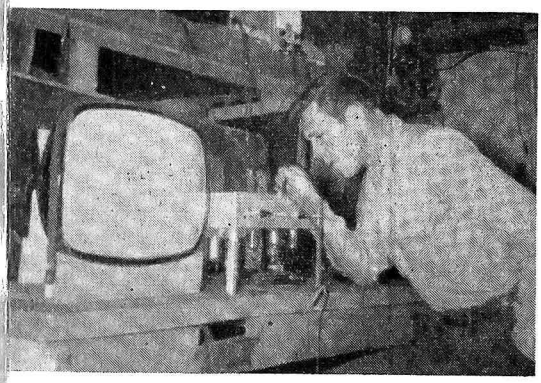
A Good Part-Time Business, Better Outlook on Future



"I am very pleased to be able to write you on your Professional Television Servicing course. I have a much better outlook on the future thanks to you and your staff. I think your course is so thorough that anyone interested in the challenge of servicing shouldn't miss the opportunity of receiving this know how. I can find my way around in a TV chassis as easy as I can my own home as the result of your course. I have a nice shop in my basement where I do part time servicing. I get from two to three sets a week."

Clare R. Dority
11517 College View Dr.
Silver Spring, Md.

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s 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 nd letters of this kind are always greatly appreciated by us. We feel we should pass them on o our readers for the inspiration to be gained from a reading of them.

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