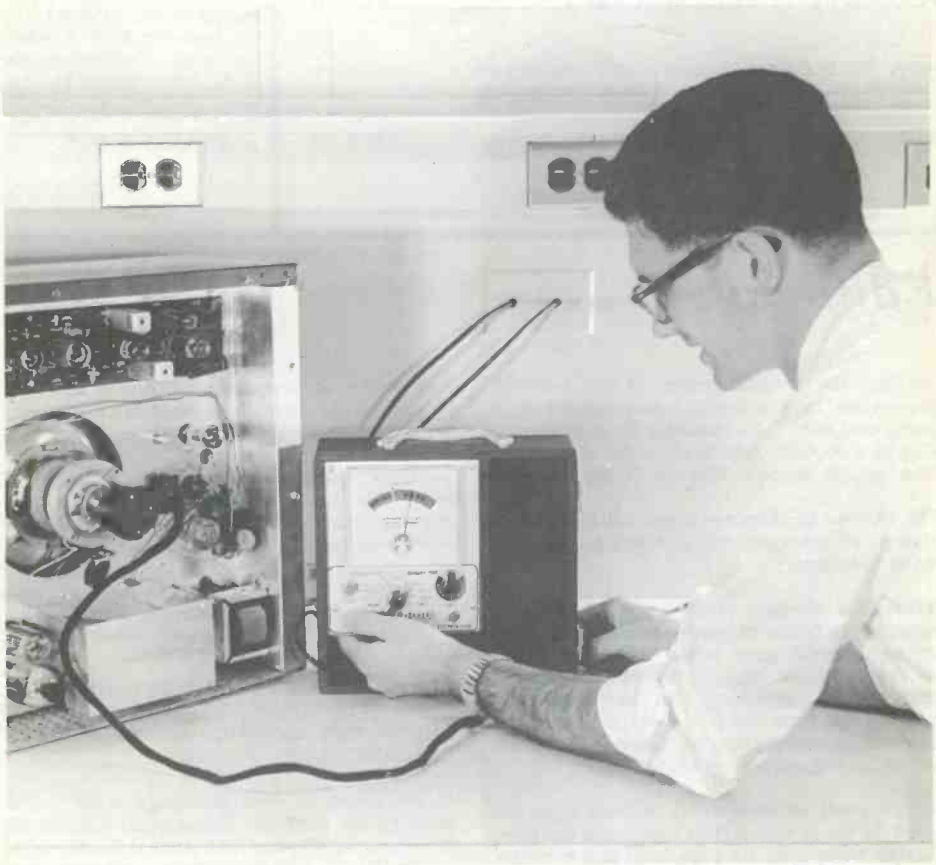
# NRI news

*August/September 1962*



CHECKING THE QUALITY OF A CATHODE RAY PICTURE TUBE WITH THE REACTO-TESTER

ALSO IN THIS ISSUE

# NRI NEWS

VOL. 20, NO. 3

AUGUST/SEPTEMBER 1962

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Published every other month by the National Radio Institute, 3939 Wisconsin Ave., Washington 16, D. C. Subscription $1.00 a year. Printed in U.S.A. Second class postage paid at Washington, D. C.

## *Editorial:* TEAMWORK

Reading the sports section of our favorite newspaper is a universal pastime for both young and old. Take baseball as an example. Why is a certain team on top in the standings? Who got it there? Why is it the leader?

The answer is simple - talent and teamwork, plus good management. It takes all three to make a winner.

Baseball's all-time pitching greats have devoted many hours of voluntary help to rookies trying to make good in the "big time." This is also true of other players and batting champs. Management, too, has converted many good infielders to even greater outfielders by recognizing certain qualifications and by taking advantage of them.

In business, as in sports, success does not come to those who fail to recognize the particular talents of its personnel and to cultivate and use these talents to the fullest.

The Electronics industry has, to a great degree, been built from small groups of men who started modest laboratories, service shops and retail establishments. By pooling their particular talents they have developed successful business teams and have prospered.

And many of our large radio-TV service organizations have been born through sheer teamwork and with good solid management.

Amateur radio is an excellent example of what can be achieved by teamwork (the pioneer hams) and good management (the ARRL) to reach their objective.

No matter what we do in business or with a hobby -- we can do it better with teamwork.

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PRESIDENT KENNEDY'S TELEGRAM TO NHSC PRESIDENT, JOHN C. BUCKBEE, DURING THE 36TH ANNUAL CONFERENCE IN MIAMI BEACH, FLORIDA:

"I am happy to send greetings to the members of the National Home Study Council on the occasion of your 36th Annual Conference. Accredited correspondence schools are meeting a real need in providing educational opportunity for those who find it inconvenient or impossible to attend resident classes. The importance of continuing education for adults must be recognized if the highest potentials for all are to be achieved. Best wishes for your continued success.

John F. Kennedy"

# Servicing With The CRT Tester-Rejuvenator

By
Art Widmann

***Technical Editor***

Art Widmann

The CRT Tester and Rejuvenator is a special piece of equipment for testing and repairing television picture tubes. The tester will detect shorts, opens, low emission, and gas in a cathode ray picture tube. After locating a fault in a picture tube, you can use the rejuvenator features of the instrument to correct the faults. Since the picture tube is the most expensive single item in a TV set, a special instrument is justified. You don't have to repair very many picture tubes to recover the cost of a tester-rejuvenator.

Most specialized test instruments are optional equipment for the average serviceman. This is not so with the CRT Tester-Rejuvenator. No practical substitute exists for dealing with faulty picture tube service problems. For one thing, when you have to tell a customer that his expensive picture tube is bad, it is nice to be able to back it up with a test instrument. You will find that the tester-rejuvenator has as many uses in dealing with customers as it has as an electronic tool. Before examining the principles of operation of a typical tester-rejuvenator, let's see what it can do for customer relations.

## CUSTOMER SATISFACTION

The Radio-TV shop sells service, and the prolonged life of the customer's picture tube is another service that can be sold profitably. A customer is ill-equipped to judge the technical problems of a faulty picture tube. Therefore, the service technician must explain carefully and even use a little showmanship when selling this type of service. If the customer's picture tube develops a defect, you have to convince the customer of the defect and find some way to get adequately paid for repairing the defect. Also, you must protect yourself against the possibility that an attempt at rejuvenating the picture tube may result in a completely dead picture tube. For example, suppose a shorted control grid causes the picture to loose detail. Before attempting to clear the short, the customer must be made to understand that, if unsuccessful, he will have to have a new picture tube. Otherwise, he may accuse you of ruining his tube. Likewise, you should have an understanding about the price he is to pay for this service before you rejuvenate the tube.

One shop that I know uses the following successful technique when the customer has a faulty picture tube. First, the service technician puts the tester on the picture tube and shows the customer the instrument indication of the picture tube fault. The technician explains the nature of the fault, the chance of correcting it, the probable length of service, and quality of picture to be expected, etc. The customer is then given several choices. He may elect to buy a new picture tube and no attempt is made to rejuvenate the tube. The second choice is to attempt to correct the fault in the tube. If successful, there will be a charge of $7.50, which includes the price of a CRT booster. If the tube fails within 90 days, the $7.50 charge will be credited toward the purchase of a new picture tube and the shop takes back the booster.

This is a reasonable offer to the customer and the technician is adequately paid for his efforts. If the tube fails within the 90-day period, the shop is assured of the profitable

sale of a picture tube. Chances are the picture tube will give six months to a year or more service. In that case, the customer will still call your shop. He appreciates the added length of service from his old tube and is well disposed toward you.

In some cases the customer might be better off with a new tube instead of rejuvenating the old one. Usually, the new tube will give a better quality picture. However, other reasons may make the customer want his tube rejuvenated. It may be an inconvenient time financially for the customer to buy a new tube. If you rejuvenate the tube and tide him over until he can better afford it, he will appreciate it a great deal. I've seen customers call up six months after rejuvenating their tube and tell the shop to come and put in a new picture tube. When you ask how the set is acting, they say it works perfectly but they know their tube is about gone and they would like to get the new one now. This may sound illogical to you and me, but remember, you are dealing with people, not an electronic circuit. Also, this kind of customer confidence cannot be bought -- it can be earned only by giving service that always seems reasonable to the customer.

Replacing the tube means a trip to the shop and the tube installation time. Your rate of profit for time spent will probably be greater for the rejuvenator-booster job. The real payoff is customer good-will. As the customer sees it, he paid only about $12 to have his set repaired, instead of $30 to $60 for a new picture tube. Also, the customer usually has a distorted idea of the profit you make on a large bill for installing a picture tube. You and I know you earn every dime of it. When you rejuvenate his tube, he feels that you passed up the profit on the picture tube sale to give him reasonable-cost service. You'd be surprised how many new customers you get from this kind of customer satisfaction.

## SHOP USES OF TESTER-REJUVENATORS

On a service call, the CRT Tester-Rejuvenator will help to isolate trouble quickly by eliminating the CRT as a possible cause of trouble. Also you have seen how useful it is for dealing with the customer when his set has a picture tube fault. In the shop, the instrument has even more uses. When figuring an estimate on a repair job, it pays to test the CRT if the set defect is such that you haven't seen a picture on the tube. This enables you to give a more accurate repair bill estimate and prevents customer disappointment if you have to tell him later that his tube is bad.

> Josh Billings: "The happiest time in any man's life is when he is in red-hot pursuit of a dollar with a reasonable prospect of overtaking it."

If you attempt to service without a tester-rejuvenator, you stand a chance of losing customers. Suppose you service a set in which the CRT filament is open. It still pays to put the tester on the tube and show the customer the results of the test, and mention that sometimes the tube can be rejuvenated. If you don't do this, he may talk to a neighbor who had picture tube trouble a year ago and "his serviceman rejuvenated his tube and it's still giving service." The technical difference between the tube faults will probably not be apparent to the customers. Your customer will say that you tried a rejuvenator, but the tube was too far gone. However, if you made no attempt, he may feel that he "got took" and will call someone else next time he has TV trouble.

The customer has a right to expect the serviceman to attempt to rejuvenate his picture tube. I've seen many picture tubes give two years of service after being rejuvenated and equipped with a CRT booster. You might think it would be more profitable to sell the customer a new picture tube but, in the long run, it's not necessarily so. Consider first the time spent. Rejuvenating the tube and installing the booster takes only a few minutes.

The CRT Tester-Rejuvenator is a "must" if you fix up and sell second-hand sets. It enables you to pick out useful picture tubes from the duds that come into the shop. By repairing the defects, these tubes can be used in second-hand sets.

The Tester-Rejuvenator can prevent you from losing money on certain type repair jobs. Suppose you estimate a repair job and the customer says "Well, if it's going to come to more than $30, don't do the job." You perform the repair and while the set is running for its final checkout, the picture tube develops a short. You are in a bad spot. You have already reached the limit of what the customer will pay. You stand to lose all your work on the set and the customer will be unhappy. Most shops will use a tester-rejuvenator to remove the short and not mention it to the customer. True, the tube may fail again shortly and you didn't get paid for rejuvenating the tube. However, you have been paid an honest price for the other work you did.

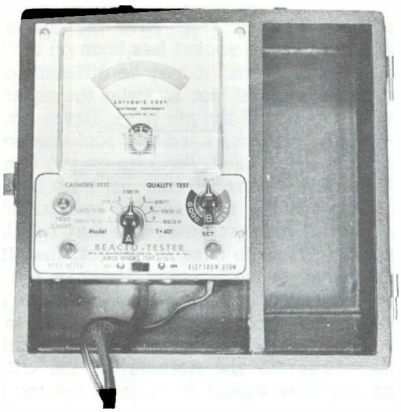


FIG. 1. A typical CRT Tester Rejuvenator, Model T-401 Reacto-Tester.

Many customers are reluctant to pay, but in the long run if the customers don't pay fair prices, you won't be in the service business. If you can prevent losses on this type of situation, you are able to give better service at more reasonable prices on regular service jobs.

## HOW THE TESTER-REJUVENATOR WORKS

The Reacto-Tester shown in Fig. 1 is a typical CRT Tester-Rejuvenator. The unit shown is made by Anchor Products Company and is sold by the CONAR Division of the National Radio Institute. The instrument is housed in a wooden case with sturdy red leatherette covering. Enough space is provided inside the case to store the line cord, cable to the picture tube socket, and the adapters that fit all types of picture tube bases. The instrument panel is brushed aluminum with red and blue lettering. A sensitive galvanometer type meter is used to indicate the emission of the tube being tested. The meter scale is simply marked "reject" or "good" -- a reading easily interpreted by the customer. A neon lamp serves to indicate shorts, leakage, and opens. The conveniently placed controls are labeled for easy operation. The control settings for various tests and repair procedures are almost self-explanatory from the labeling on the controls. However, a card with step-by-step test procedures is attached to the inside top of the case for quick reference. Also a manual of repair procedures comes with the instrument. This includes all the in-

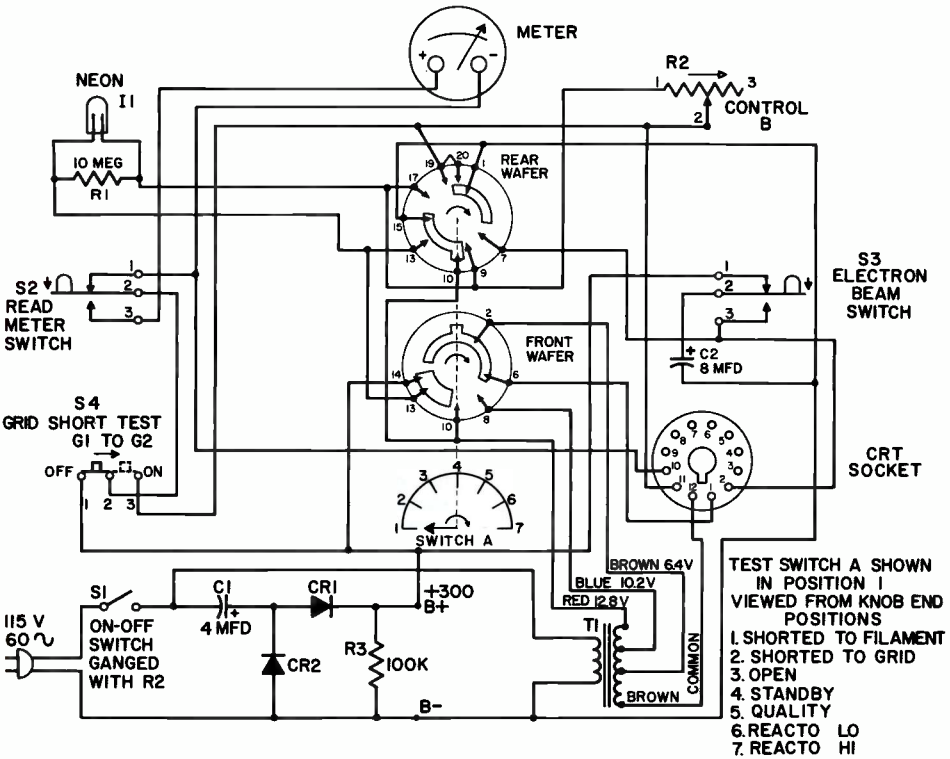



FIG. 2. Schematic diagram of the Model T-401 Reacto-Tester.

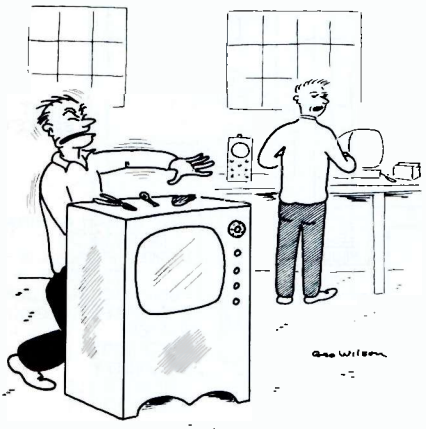
formation one needs to operate the instrument.

A complete schematic diagram of the instrument is shown in Fig. 2. The voltage doubler circuit made up of C1, CR1 and CR2, rectifies the line voltage and produces +300 volts dc. The line voltage is also supplied to the primary of filament transformer, T1. The secondary of this transformer produces various filament voltages for the tube being tested. The 2-section function switch in the center of the diagram, marked switch A, selects the type of test or repair to be performed. R2 is a 50K potentiometer that is used to limit the current through the meter. This control is ganged with switch S1 which turns the instrument on and off. Switch S2 is a push-button switch that you depress when you want to read the meter. Switch S3, labeled electron beam switch, is also a push-button switch. When depressed, this switch completes a path to discharge capacitor C1 to terminal 2 of the CRT socket. Switch S3 is used in certain repair procedures.

The test procedures for the Reacto-Tester call for testing the CRT for shorted elements before the quality of the tube is checked. This prevents damaging the meter due to excessive current caused by a short. The only precaution is that you perform all the short tests before pushing the meter switch. If the tube shows a short, do not read the meter until the short has been cleared. Let's go through the test procedure for using the Reacto-Tester.

## TEST AND REPAIR PROCEDURE

To put the Reacto-Tester in operation, plug the line cord into a 110-volt ac receptacle. Remove the socket from the neck of the picture tube that is to be tested. If the tube is installed in a set, be sure the set is de-energized. If the socket has been on the tube for several years, it may be difficult to remove. Be careful not to twist the socket or you may twist off the pin base. Grasp the pin base firmly in one hand and rock the socket with the other hand. Sometimes you can use a thin-bladed screwdriver or tube lifter to pry between the base and the socket. Do not use too much pressure or you may break the plastic part of the base or socket. Install the CRT socket of the Reacto-Tester on the picture tube base. Turn selector switch A to "standby" and rotate switch B to "set" mark. Put grid short test switch in "off" position. Allow time for the filament of the CRT to heat up. You should be able to see the filament glow in the neck of the tube. If the filament does not light up, it indicates an open filament.



"You ever find that short?"

Whenever you test a picture tube, never overlook the possibility that an open element is caused by faulty soldering at the picture tube pins. Examine the ends of the pins for poor solder connections. Reheat the pin with a soldering iron and apply more solder, if necessary. It is sometimes difficult to get solder to stick to the wires inside the pins. The connections between the pin and the wire can be made by crimping the pin down on the wire. Take care that you don't flatten the pin so much that it won't go into the socket.

Cathode-to-filament short. The first test to perform is the cathode-to-filament short test. Put selector switch A in position 1 and observe the neon lamp. If the lamp lights, the elements are shorted. A momentary flash of the neon lamp when the switch is operated should be disregarded. Also, a very faint glow of the lamp is normal in this position and does not indicate a short. Gently tap the neck of the tube with the plastic handle of a screwdriver to uncover intermittent shorts. To perform this test for a short, the Reacto-Tester places 300 volts dc between the filament and the cathode of the tube. If a short or leakage exists, current flows and lights the neon bulb. Since selector switch A is shown in position 1 in the schematic (Fig. 2), let's trace the circuit for the filament-cathode short test. The +300-volt line from the power supply is connected to terminal 14 on the front wafer of switch A. Trace from terminal 14 through the switch contacts to terminal 13, front wafer, and to one side of the neon lamp I1. Trace through the neon lamp or the 10 meg resistor, R1 in parallel with the lamp to terminal 1 of R2 (control B). Trace through a portion of R2 to terminal 2 of R2 and from terminal 2 of R2 to pin 11 of the CRT socket. Pin 11 of the CRT is the cathode so we have +300 volts on the cathode of the CRT.

Now let's trace the circuit to see how the filament is returned to B-. The filament pin connections are 1 and 12 of the CRT socket. Trace terminal 12 of the CRT socket to the secondary of T1, through the secondary of T1 to the 12.8-volt terminal of T1 to terminal 10 of the rear wafer of switch A. Trace through the contacts of switch A (rear wafer) to terminal 15, rear wafer, and to be B- side of the power supply. In this way, 300 volts potential is placed across the space between the cathode and the filament. If the space is shorted, the circuit is completed and current flows through the circuit causing the neon lamp to light.

The best way to correct a cathode-to-filament short is by using a filament isolation transformer. As shown in Fig. 3, the dc isolation provided by the filament transformer in the booster separates the filament circuit of the TV set from the cathode. The short from cathode-to-filament is still present but no dc connection exists from the cathode to the filament circuit of the TV set.

When selecting a CRT booster for this purpose be sure it is not the auto-transformer type. In some boosters, the primary and secondary are connected internally. If you are in doubt, check the booster with an ohmmeter to make sure that the secondary is isolated from the primary.

Short-to-grid. The next test to perform is the short-to-grid test which is position 2 of the selector switch A. In case you installed an isolation transformer booster because of the shorted filament-to-cathode, leave the booster connected to the picture tube, then connect the Reacto-Tester to the booster. The tester will indicate no short on position 1 and you are ready to make further checks with the switch in position 2. If the neon lamp lights in position 2, it indicates that a short or leakage exists between the control grid and the cathode of the picture tube. Test for intermittent shorts by tapping the tube neck. In position 2 the control grid of the tube (pin connection 2) is connected to B- through the closed contacts (terminal 7 to terminal 1) of the rear wafer of Switch A. At the same time the cathode (CRT pin connection 11) has +300 volts on it. This arrangement places 300 volts across the space between the grid and cathode. If a short or leakage exists, current will flow and light the neon lamp.

To repair a short from control grid to cathode, you use switch A in the Reacto-lo position and the electron beam switch. Turn the selector switch A to position 6 which is the Reacto-lo position. Wait 15 seconds and press the electron beam switch, S3, momentarily. Wait 15 seconds and press the beam switch again. Do not leave the selector switch A in position 6 for more than 60 seconds. Return selector switch A to position 2 and repeat the short test. If the short is still present, repeat the Reacto-lo repair procedure a few more times. Recheck for shorts in position 2.

The Reacto-Tester repairs shorts by placing a high positive voltage on the grid of the CRT which accelerates the electron beam. The circuit, with switch A in position 6, is shown in simplified form in Fig. 4. With S3 in the normal position, shown by dotted lines, capacitor C2 is charged to +300 volts through the 1-2 terminals of S3. When S3 is pressed, as shown by the solid line, terminals 2 and 3 of S3 connect the positive side of capacitor C2 to the grid (pin 2 of the CRT). The cathode (pin 11 of the CRT) is connected to the negative plate of capacitor C2 through closed contacts switch A. Therefore, the control grid of the CRT is 300 volts positive in respect to the cathode. This high positive voltage on the grid accelerates the electron beam. Since the grid is very close to the

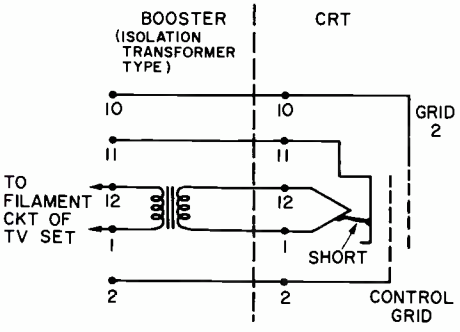



FIG. 3. An isolation transformer type booster can be used to correct a short between the filament and cathode.

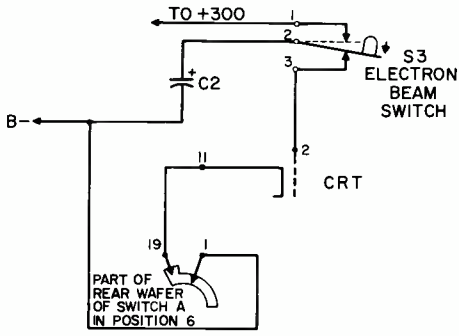



FIG. 4. Simplified circuit of portion of tester when switch A is set to position 6, Reacto-lo.

cathode, the potential is sufficient to physically break up and pull off particles from the cathode. If you watch the gun of the CRT when you depress S3, you may see little sparks of material flake off. Flakes of cathode material in the space between the grid and cathode usually cause grid-to-cathode shorts. When these flakes have burned clear, the grid will no longer be shorted. Notice in Fig. 4 that depressing S3 disconnects C2 from the +300-volt supply. This assures that the +300 volt charge on C2 will be applied only momentarily to the control grid. Each time S3 is released, the capacitor recharges. If the +300 volts were applied to the control grid for any length of time, it could ruin the tube.

After testing for a shorted control grid, you leave switch A in position 2 and test for a short on grid 2. To check for a short on grid 2, you move switch S4, labeled Grid Short Test G1 to G2, to the "on" position. If grid 2 (terminal 10 of the CRT socket) is shorted, the neon lamp lights indicating the short. From the schematic in Fig. 2, you can trace terminal 10 of the CRT through normally closed contacts 1 and 2 of switch S2, from contact 2 of S2 to contact 2 of S4. When S4 is in the "off" position, grid 2 (pin 10 of the CRT) is supplied 300 volts. Switching S4 to the "on" position disconnects the 300 volts and connects grid 2 (pin 10) to the cathode (pin 11 of the CRT) through contacts 2 and 3 of switch S4. Now the cathode and grid 2 are connected through the neon lamp to +300 volts. Grid 1 (pin 2 of the CRT) is connected to B- through the closed contacts from terminal 7 to terminal 1 of the rear wafer of switch A. If a short or leakage exists between grid 2 and grid 1, the circuit is completed causing the lamp to light.

A short between G1 and G2 is repaired by accelerating the electrons with switch S4 in the "on" position. Rotate switch A to position 6. This connects the cathode (pin 11) and grid 2 (pin 10) to B-. At the same time grid 1 (pin 2) is disconnected from B-. When the electron beam switch, S3, is depressed, capacitor C2 is discharged onto grid 1 (pin 2). This accelerates the electron beam and burns out any short between grid 2 and grid 1. Return S4 to the off position.

Open cathode. The cathode of the CRT is tested for an open condition by placing switch A in position 3. The neon test lamp should light. If the lamp remains off or is intermittently off while tapping the neck of the tube, the cathode is open. The circuit for testing the cathode is shown in simplified form in Fig. 5. Grid 2 (pin 10) of the CRT is supplied +300 volts through the closed contacts of S4 and S2. Grid 2 is the focusing anode of the CRT gun and in this circuit it acts as the plate of the vacuum tube. The control grid (pin 2) is connected through a portion of switch A to B-. The cathode (pin 11) is connected through part of R2, through R1 with the neon lamp in parallel and through a portion of switch A to B-. The current through the tube will produce enough voltage across R1 to light the neon lamp and indicate that the cathode is not open.

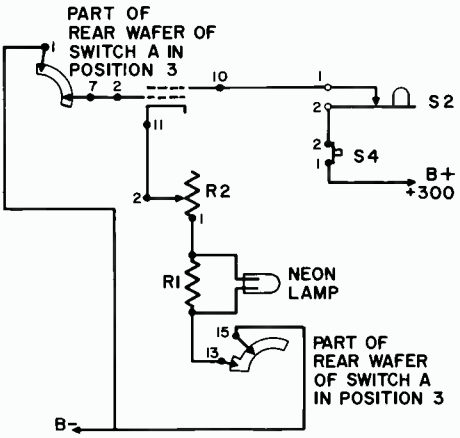



FIG. 5. Simplified circuit for testing for an open cathode.

To repair an open cathode, rotate switch A to position 6. Wait 15 seconds, then while tapping the neck of the picture tube with the plastic handle of the screwdriver, press the electron beam switch S3 every 15 seconds for a period of about one minute. To repair an open element in the picture tube, the electron beam or the current from the tester must weld the broken wires together. Thus, when you tap the neck of the picture tube, you change the position of the broken wires. If the space at the break is not too great, the current from the tester will produce an arc and weld the wires together. After making this type repair, you must check for the open when the tube cools off. The contraction and expansion of the wires due to cooling and heating may break the weld again.

Emission Test. The emission or quality test of the CRT is made by turning selector switch A to position 5 and pressing the "read meter" switch, S2. Control B should be in the "set" position. Be sure to test for shorts with switch A in positions 1, 2 and 3, before you press the "read meter" switch. Otherwise, it is possible to damage the meter if a short exists in the tube. Fig. 6 shows a simplified schematic of the emission test. Apply +300 volts through the meter to grid 2 (pin 10) of the CRT. The control grid (pin 2) is connected to B-. Cathode (pin 11) is connected through a portion

of R2 (control B) to B-. Thus the amount of tube current determines the amount of deflection of the meter and indicates the quality of the tube.

Gassy Tube. A check for gas in the tube is made by observing the meter when the "read meter" switch is depressed. If the meter needle rises at a slow rate, the tube is probably gassy. A similar indication is sometimes noted when only a small area of the emitting surface is left on the cathode of the tube. In either case, if the condition persists, after rejuvenating the tube, you will probably be unable to get a satisfactory picture at some settings of brightness and contrast.

Reactivation. To reactivate low emission tubes, place selector switch A in position 6, Reacto-lo, and allow the tube to heat for 60 seconds. At 15 second intervals, intermittently press electron beam switch S3. With switch A in position 6, a higher than normal filament voltage is supplied to the tube filament. This higher filament voltage combined with the action of the electron beam removes worn-out material from the cathode, exposing active emitting material. Return switch A to standby position and allow a minute or so for the tube to cool off. Now repeat the emission test. If the meter does not read up into the good part of the scale, repeat the reactivating procedure. If several attempts do not produce a good "reading", you might consider using the Reacto-Hi position which is position 7. This places an even higher voltage on the filament and might burn out the filament. Reacto-Hi is used only as a last resort when the tube would be totally unusable anyway. A tube that has been reactivated for low emission will not usually hold up unless you place a booster on the tube. The booster supplies the filament with a slightly higher than normal filament and enables the worn cathode to emit enough electrons for normal picture tube operation.

## CONCLUSION

The CRT Tester-rejuvenator is a "must" for the TV service technician. No other piece of equipment can quickly test and repair a picture tube. The instrument is particularly useful on service calls where it can be used to build good customer relations. Reactivating customer picture tubes provides added service income and satisfied customers. Testing picture tubes with the Reacto-Tester takes the guesswork out of determining the condition of the picture tube.

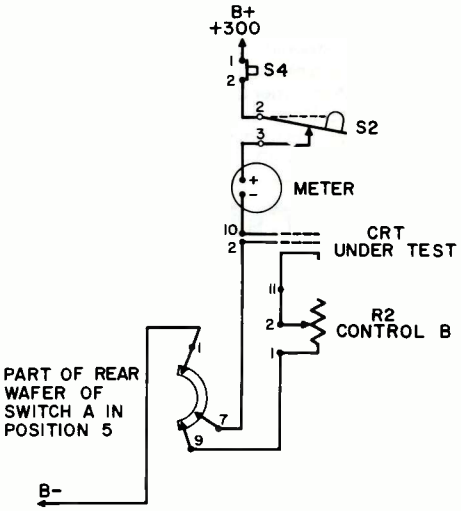



FIG. 6. Simplified circuit showing the tester set up for reading the emission or quality of CRT.

## HOME REMEDY

So you think that you have troubles with the TV set that just won't adjust properly? An Englishman came up with a solution to one such problem - whack the light pole with a crowbar.

The following is an excerpt that appeared in a recent issue of the Manchester (England) "Guardian" telling of his remedy for a TV set that would not operate properly.

"Practically every night we get tremendous flashes on the screen. You would think the set was going to blow up. The picture parts and rolls over, cutting people's heads in two.

"The whole neighborhood is complaining about it. Engineers can find no fault with my set. It must be the street light or the electric wires which are on top of the same pole. I once read about a person hitting a street lamp pole to bring on the light. So I kicked the pole outside my house to relieve my feelings. It brought my TV picture back perfectly for a short while.

"We have three at home in the family and now we take turns to hit the pole with a crowbar."

1st Idiot - Did you hear about the engineer who was going to throw his log book into the fire?
2nd Idiot - No, what fire?
1st Idiot - Why the amplifier of course!

## IMPORTANT ANNOUNCEMENT

The NRI Alumni Association has local chapters in a number of the larger cities. NRIAA Executive Secretary Ted Rose visits most of these chapters about once a year.

On his visits this year he will be accompanied by Mr. J. B. Straughn, NRI Chief of Consultation Service. Mr. Straughn will conduct a service forum during which he will discuss and demonstrate the test equipment used in Radio-TV service work and will answer questions about test equipment and service problems. He will also answer questions on the latest developments in color Television.

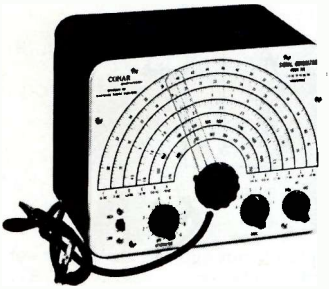
All NRI students and graduates in each chapter's area are cordially invited to attend these meetings as guests of the chapters. Here is a rare opportunity to meet Mr. Straughn and to see him demonstrate Radio-TV test equipment and techniques, -- hear his answers to questions on current service problems.

The visits are scheduled as follows (see "Directory of Local Chapters" on Page 28 for information on place and time:

| Chapter | Date |
|---|---|
| Southeastern Mass. | September 26 |
| Flint (Saginaw Valley) | October 10 |
| Detroit | October 12 |
| New York City | November 1 |
| Springfield, Mass. | November 2 |
| Hagerstown (Cumberland Valley) | November 8 |
| Philadelphia-Camden | November 12 |
| Pittsburgh | December 6 |
| New Orleans | January 8 |
| San Antonio | January 10 |
| Minneapolis-St. Paul | April 11 |

Any changes will be indicated in later announcements which will appear in subsequent issues of the NRI News.

# CONAR Signal Generator



**For AM-FM-TV alignment and troubleshooting**
**Fundamental Frequency coverage 170 kc to 60mc**
**Harmonic Frequency coverage over 200 mc**
**Average accuracy better than ±1% on all bands after easy calibration**

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Easy-to-Build, Money-Saving Kit

**Just $21.50** (Stock No. 280UK)

or

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**$29.50** (Stock No. 280WT)

Designed for rapid, accurate alignment of receivers. High output simplifies signal injection. Aligns weak receivers without difficulty.

Wide frequency coverage for simple AC-DC sets, complex all-wave receivers, transistor portables or hybrid automobile radios. Also covers intermediate i-f frequencies of FM and TV on fundamentals.

Ideal for troubleshooting. Quickly isolates defective stages by the "signal injection" method.

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SPECIFICATIONS

Frequency Coverage - 170kc to 60mc on six bands. 60mc to over 200mc on harmonics. Tubes: 6BE6 and 12AU7. Solid state power supply. Planetary Drive tuning capacitor with 6:1 ratio eliminates black-lash. Tuned rf coils with highly stable mica trimmers on low bands and ceramic trimmers on high bands. Three types of signal available: Unmodulated rf, Amplitude Modulated rf and 400 cycle af. Coarse and Fine Attenuation. Heavy gauge aluminum panel with black lettering. Cadmium plated steel chassis. Steel cabinet with durable black-wrinkle finish. Actual Weight: 7 lbs. Shipping Weight: 8 lbs. Size: 9-7/8" × 7-1/2" × 6-1/2".

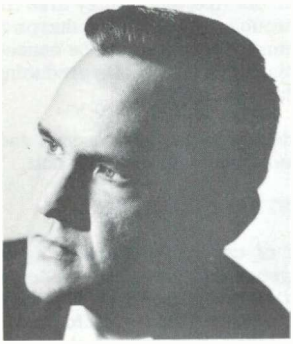


**USE ORDER BLANK ON PAGE 17**

# Understanding Series

# And Shunt Peaking

# In TV Video Amplifiers



Ed Beach

By
Ed Beach

***Technical Editor***

Ever hear of a hi-fi amplifier with a frequency response flat from 30 cps to over 4 mc? Everyone who owns a TV set has one. The video amplifier section of TV receivers has this enviable distinction -- or, at least, it should have.

To what does the video amplifier owe its extremely wide bandwidth? Well, as any hi-fi enthusiast can tell you, it is fairly easy to get good low-frequency response from RC coupled amplifiers; it is simply a matter of using large enough coupling capacitors, resistors and adequate bypass capacitors. High-frequency response, however, is not quite so easy to come by. All the things that are called for to bring about good low-frequency response detract from high-frequency response. Parts placement becomes critical and lead dress all-important when designing for the high frequencies. A compromise is usually arrived at by sacrificing some gain in favor of an extended range.

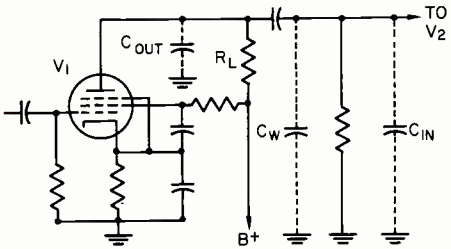



FIG. 1. Simple RC coupled amplifier showing input, output, and wiring capacity.

Fig. 1 shows a typical RC coupled amplifier. Notice the three capacities to ground marked $C_{in}$, $C_W$, and $C_{out}$. These are the input capacity of $V_2$, the stray wiring capacity, and the output capacity of $V_1$. All together they may total 30 mmf or 40 mmf. Not so much, you say, but look at this: At a frequency of 4 mc, a capacity of 40 mmf has a reactance of about 1000 ohms, and this is right across $R_L$! What happens as a result of this shunt capacity? **The gain of $V_1$ falls off drastically.**

Anything that can be done to reduce the shunting effects of these three capacities will help the detail producing high frequencies get through to the picture tube. As shown in Fig. 2, a small inductance (if properly chosen) in series with $R_L$ will become parallel resonant with the shunt capacity at a frequency near 4 mc.

Fig. 3 shows the results of adding this SHUNT PEAKING COIL. The thick solid curve shows the normal amplifier response; the dotted curve shows the resonance curve of the shunt peaking coil; and, the thin solid curve shows the resultant response.

A second way of increasing high frequency response is to separate the various capacities as much as possible. This is accomplished by adding a SERIES PEAKING COIL, as shown in Fig. 4. Now at high frequencies $C_{out}$ and $C_{in}$ are separated by the high reactance of this coil and $R_L$ is shunted only by $C_{in}$ and part of $C_W$.

The third method is a combination of series

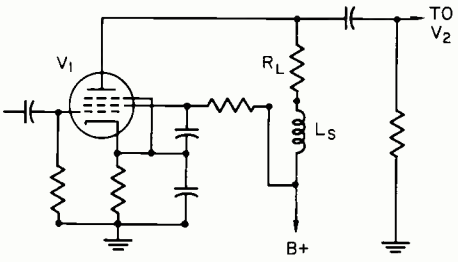



FIG. 2. Simple RC coupled amplifier with shunt peaking added.

and shunt peaking and is called SERIES-SHUNT or COMBINATION PEAKING. This is the method most commonly used since it produces provides maximum gain and bandwidth.

Fig. 5 shows the video amplifier of a typical modern TV receiver. Notice that it uses combination peaking. $L_{112}$ and $L_{113}$ are both shunt peaking coils and $L_{111}$ is the series peaking coil. Two shunt peaking coils are used here because in this particular receiver the $R_L$ load ($R_{113}$) is separated physically quite a distance from $V_6$. Note that the video detector employs high frequency peaking also. Just because it is a diode does not mean it is immune to the effects of shunt capacity! Diode load $R_{110}$ is just as susceptible to shunt capacity as plate load $R_{113}$. $L_{108}$ and $L_{109}$ are the detector shunt and series peaking coils respectively. $L_{105}$, $L_{106}$, and $L_{107}$ are NOT peaking coils, however. They are part of a low pass filter to remove I-F variations from the detected video signal. $L_{107}$ is the output coil of the filter and isolates the last shunt capacity of the filter, $C_{116}$, from the detector load resistor. For this reason it could be considered as a series peaking coil, although it is much smaller than the usual series peaking coil.

## PICTURE DEFECTS CAUSED BY PEAKING COILS

The most obvious fault produced by inadequate high frequency response is the picture that lacks definition and detail such as Fig. 6. Don't go rushing out to buy new peaking coils

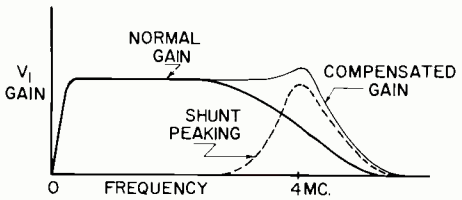



FIG. 3. Effects on amplifier gain using shunt peaking coil.

right away, however. First, check to make sure the picture is in focus. A poorly focused raster will also obscure detail. (A dirty picture tube or faceplate can reduce apparent detail as well as brightness.)

A picture that has ghosts or shadows that cannot be removed by antenna orientation or adjustment of the fine tuning may also mean peaking coil trouble. Fuzziness of sharp edges and large picture elements may be caused by improperly placed peaking coils producing an oscillating video amplifier.

An obvious defect would be no sound and no picture caused by an open peaking coil.

## TESTING PROCEDURES

If, like most of us, you don't have a costly video sweep generator, a really excellent way of checking video amplifier response is with received test pattern signals. Unfortunately, few stations today transmit test patterns.

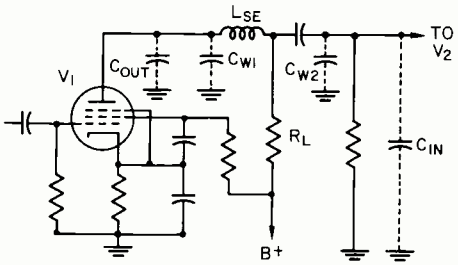



FIG. 4. Simple RC coupled amplifier with series peaking added.

Those that do transmit, do so for only for a short time early in the morning or late at night. A suitable substitute is the B and K Analyst Model 1076 which produces its own test pattern complete with bandwidth indications up to 4 mc. If the alternate black and white lines in the vertical wedge of Fig. 6 are clearly visible all the way down to the center, frequency response is adequate.

A method of checking amplifier response for anyone having a good wideband oscilloscope is inspection of the horizontal blanking and sync pulses. Fig. 7 shows horizontal sync pulses with poor, normal, and excessive high frequency response. If the amplifier produced a waveform like the one shown in Fig. 7A at the cathode of the crt, one or more of the peaking coils may have developed a shorted turn, opened up, or been moved drastically from its factory positioned location. It is easy in the course of routine servicing for one or more of the peaking coils to get pushed aside.

If you have a square wave generator, you may

use it also to test frequency response. Set to some frequency higher than 15,750 cps and connected to the video detector load, a series of well defined alternate black and white vertical bars should be seen on the picture tube. Soft edges or trailing ghosts indicate trouble.

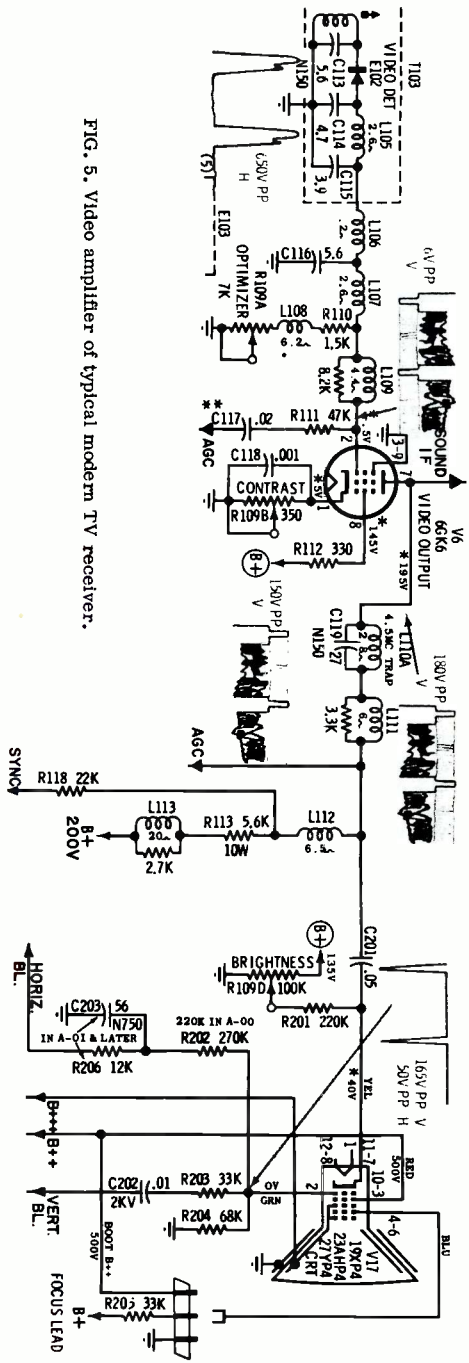



FIG. 5. Video amplifier of typical modern TV receiver.

## REPAIRS

You have seen some of the results of faulty peaking coils and some of the test procedures for checking video amplifier response. Now let's see exactly what you can do about these troubles.

There are normally four things that can happen to peaking coils:

(1) damping resistor open
(2) peaking coil open
(3) shorted turns
(4) improperly positioned coils

(1) will usually produce the characteristic ringing or ghosts shown in Fig. 7C. This is a result of excessively high Q of the peaking coil, producing a sharp resonant peak. Shunting a 1K-ohm resistor across $L_{109}$, $L_{111}$, and $L_{113}$ in turn while observing either a test pattern on the picture tube or horizontal sync pulses at the cathode of the crt will locate the open resistor. The damped oscillations shown in Fig. 7C will be reduced in amplitude when the open resistor is shunted by a 1K-ohm resistor.

Depending upon which coil is open, (2) may produce one of two symptoms: no sound and no picture, or the poor detail signal shown in Fig. 7A. If $L_{109}$ (not likely) or $L_{112}$ opens up, it's no sound no picture. If any of the other coils open, the picture detail will suffer. Either a resistance check can be made or you can check the voltage drop across each coil. More than one volt difference across the coil means the coil is open. The open coil will have to be replaced with an exact substitute for best results.


FIG. 6. Loss of fine detail due to loss of high frequencies.

(3) will sometimes develop when these sealed coils are placed too near a heat-producing tube or power resistor. The effects are similar to those produced by open coils in that there is no longer proper compensation. The lowered inductance will resonate at a higher frequency than desired so that response falls off just as if the amplifier were not compensated. An excellent article by NRI's J. B. Straughn appearing in the April, 1962 issue of Electronics World magazine gives an easy method of checking all kinds of coils, including peaking coils for shorted turns and opens. A shorted coil can also be found with resistance checks against the manufacturer's specifications.

If the change in inductance is not too great, a small trimmer capacitor (3-30 mmf) can be placed across the shorted coil and adjusted to re-peak the amplifier response. By adjusting the trimmer as you observe horizontal sync pulses, the response can usually be restored to the condition of Fig. 7B. If you cannot achieve the correct compensation with the trimmer, the defective coil will have to be replaced.

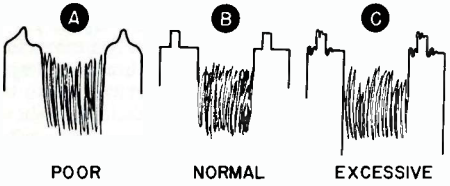



FIG. 7. Horizontal waveforms at cathode of CRT indicating poor, normal, and excessive high frequency response.

(4) may produce one of two faults: poor definition or oscillation. If a random hash type signal is present at the crt cathode when the receiver is switched off channel, there is a strong likelihood the video amplifier is oscillating. Feeding a sine wave into the suspected amplifier will show the presence of oscillation. If the sine wave is distorted or shows spurious "birdies" at the amplifier output, the stage is probably oscillating. This would be caused by magnetic coupling between $L_{111}$ and $L_{109}$. It at all possible, they should be positioned as far from one another as possible and mutually at right angles to minimize coupling. If they are placed too near a grounded object, they can increase the stray wiring capacity above that which they were designed to compensate. Repositioning should help this situation.

IN CONCLUSION

Peaking coils are simple things. They are usually overlooked by technicians but go about their business quietly and unthought of for years. However, when they do act up, it is well for you to be familiar with their warning signs and know what to do to correct their ills quickly, efficiently and economically.

## THESE TEN COMMANDMENTS SPELL SAFETY FOR YOU

1. Do not handle a radio or any other electrical device while in the bathtub or shower.
2. Do not put a small radio where it may accidentally fall into the bathtub.
3. When placing a radio in the bathroom or kitchen, locate it where no one will be able to reach it and touch a water faucet or electrical stove at the same time.
4. Do not remove a plug from a receptacle by pulling on the cord alone.
5. Inspect the cord occasionally to see that it is in good condition.
6. Do not force the line cord and antenna wire into the rear of the set when it is not in use.
7. Do not hold onto the bare end of an antenna wire in order to improve reception. Increasing the length of the antenna will give the same results.
8. Do not use low hanging, make-shift antennas, such as a wire clothesline.
9. Do not attempt to add a ground wire to any radio unless it has a specifically marked ground terminal.
10. Do not use a radio whose cabinet has been broken or discarded.

Courtesy of Radio-Electronics.

## IT'S HOW YOU SAY IT

How we say things -- not what we say -- will quickly show whether we are a courteous or discourteous person. And, we want to say right here and now, courtesy is something you acquire through personal discipline and training -- it very seldom "just comes naturally."

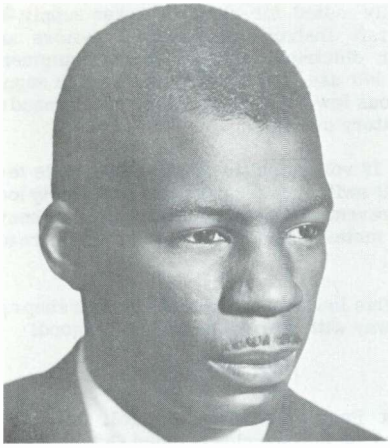
At some time or other -- in one version or another -- most of us have heard the following:

"Oh, she's too sensitive. I didn't mean it the way it sounded." Or, "He takes everything the wrong way. I didn't mean it like that."

Sure, we'll agree, there are a lot of oversensitive people. And, there are folks who tend to twist our innocently said words around to their own interpretations. But, they are the way they are and very few of them are going to change.

So, before you say something that might be taken the wrong way -- that might set off somebody's temper -- stop and think first how it sounds. Remember, it's not what you say, but how you say it that adds up to courtesy.

# How To Solve Square Root Problems



Harry Taylor

By
Harry Taylor

***Technical Editor***

Many basic calculations in electronic circuits involve finding the square root of some number. A few examples of problems in which you would need to take the square root of a number are: finding the impedance of a circuit which has both resistance and reactance, the resonant frequency of a tuned circuit, and finding the turns ratio of a transformer when the impedance ratio is known.

Somehow, the method for finding the square root of a number is easily forgetten. We learn it when we need to find a square foot and soon forget it. It is possible to remember the square roots of a few numbers. However, it is much easier to work a problem if we master all the processes required to find the solution. There are minor variations in methods for extracting the square root. However, the principles are the same.

In quick review, the square root of a number is that number which, when multiplied by itself, is equal to the given number. For example, 4 is the square root of 16 ($4 \times 4 = 16$), 10 is the square root of 100 ($10 \times 10 = 100$), and 33 is the square root of 1089 ($33 \times 33 = 1089$). In each case, the square root multiplied by itself is equal to the given number.

The radical sign ($\sqrt{\ }$) is the symbol we use to indicate that we want to find the square root of a number. The number placed under the radical ($\sqrt{16}$) is the square or the number of which the square root is to be taken. The square root of that number is placed above the radical

$$(\sqrt{\overset{4}{16}}).$$

When speaking of this relationship, we would say "the square root of 16 is 4."

In working square root problems, you must understand the relationship between the square and the square root. The square is equal to the square root multiplied by itself. This may be written mathematically as $4^2 = 16$. The 4 is called the base. The 2 to the right and above the four is the exponent. The 2 indicates that the base (4) is multiplied by itself or squared, and 4 squared is 16.

The numbers 1, 4, 9, 16, 25, 36, 49, 64, and 81 are the squares of 1, 2, 3, 4, 5, 6, 7, 8, and 9. The first series of numbers are called perfect squares of the second group because when the numbers 1 through 9 are squared, they will equal one of the perfect squares.

Extracting or finding the square root of a number involves three basic operations. They are: (1) separating the number into groups of two digits each; (2) finding the largest square in the first group of digits, and (3) dividing a trial divisor into the remainder.

To separate the numbers in groups of two digits each, start at the decimal point. If there is no decimal point, assume that there is one at the right of the number. Place the digits in groups of two digits each, counting from the decimal point to the left. Grouping is illustrated below.

$\widehat{39}\widehat{69}. = 39\ 69$

$\widehat{90}\widehat{25}. = 90\ 25$

$\widehat{1}\widehat{71}\widehat{61}. = 1\ 71\ 61$

Notice that in the third example, the last group, counting from the decimal point to the left, consists of only one digit. This will be true whenever the number from which the

(continued on page 18)

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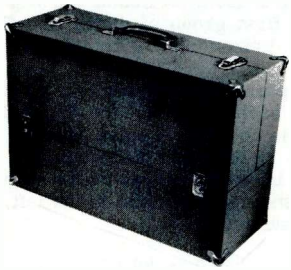

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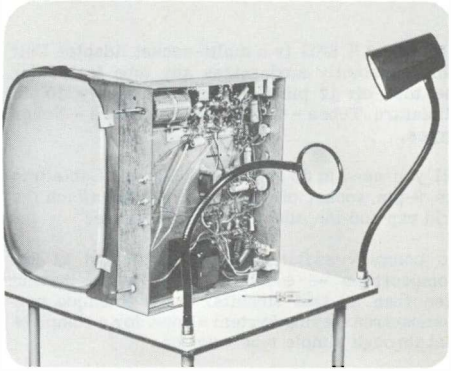

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**SQUARE ROOT**

(continued from page 13)

square root is to be taken has an odd number of digits to the left of the decimal point.

Once the digits are properly grouped, they are placed under the radical.

Step 1:

$$\sqrt{39\ 69}$$

Take the last group to the left, 39, and find what number multiplied by itself will give 39. There is no number that will do this. Six multiplied by 6 equals 36 and is too small. Seven multiplied by 7 is 49 and is too large. We take the one that is smaller, that is, 6, and place the 6 above the radical over the first group of digits.

Step 2:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \end{array}$$

Next place the square of 6 (36) under the 39.

Step 3:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \end{array}$$

Step 4:
Subtracting,

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \\ 3 \end{array}$$

The next step is to bring down both digits in the next group.

Step 5:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \\ 3\ 69 \end{array}$$

We are now concerned with the three digit number 369 as we try to find the second digit of the square root.

To find the second digit of the square root (number above the radical), double the number already placed above the radical ($2 \times 6 = 12$) and place it in position to divide into 369.

Step 6:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \\ 12\overline{)3\ 69} \end{array}$$

Temporarily disregard the last digit of the difference (369) in the preceding calculation.

Step 7a:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \\ 12\overline{)3\ 6\not{9}} \end{array}$$

Divide 12 ($2 \times 6$) into the number (36) which you obtained in Step 7a.

Step 7b:

$$\begin{array}{r} 6 \\ \sqrt{39\ 69} \\ \underline{36} \\ 12\overline{)3\ 6\not{9}\ (3} \end{array}$$

36 divided by 12 is 3. Place the digit 3 next to the 12. This becomes 123 and is your trial divisor. Also place the 3 above the radical. The trial divisor when multiplied by its last digit (3) should equal or be less than the number found in Step 5 (369)

$$\begin{array}{r} 6\ 3 \\ \sqrt{39\ 69} \\ \underline{36} \\ 123\overline{)3\ 69} \\ \underline{3\ 69} \end{array}$$

$123 \times 3$ equals 369. Therefore, 3 is the second digit of the square root.

63 is the square root of 3969. To prove this, square 63: $63 \times 63 = 3969$.

Let's try another problem. Find the square root of 9025. First, group the digits and place them under the radical

$$\sqrt{90\ 25}$$

Find the largest square root in the first group.

$$\begin{array}{r} 9 \\ \sqrt{90\ 25} \end{array}$$

Place the square of the root under the first group. Subtract and bring down the second group.

$$\begin{array}{r} 9 \\ \sqrt{90\ 25} \\ \underline{81} \\ 9\ 25 \end{array}$$

Double the root ($2 \times 9$) and divide the product (18) into the 92 (925 with the 5 ignored)

$$\begin{array}{r} 9 \\ \sqrt{90\ 25} \\ \underline{81} \\ 18\overline{)9\ 2\not{5}\ (5} \end{array}$$

18 will go into 92 five times. Therefore, place the 5 over the radical and also to the right of 18.

185 (18 and 5) is your trial divisor.

$$\begin{array}{r} 9\ 5 \\ \sqrt{90\ 25} \\ \underline{81} \\ 185\overline{)9\ 2\not{5}\ (5} \end{array}$$

Multiply the trial divisor by its last digit

$$185 \times 5 = 925$$

This product is equal to the dividend 925. Therefore, the answer or square root of 9025 is 95.

$$\begin{array}{r} 9\ 5 \\ \sqrt{90\ 25} \\ 81 \\ \hline 185)\ 9\ 25 \\ 9\ 25 \\ \hline \end{array}$$

To check, square 95. $95 \times 95 = 9025$.

In both examples, the root came out even. Thus, 3969 and 9025 are both perfect squares: The root when squared is equal to the number under the radical.

Frequently, however, the number is not a perfect square. Let's find the square root of 4760. Group the digits, place them under the radical and find the first digit of the square root.

$$\begin{array}{r} 6 \\ \sqrt{47\ 60} \end{array}$$

Subtract and bring the second group down to obtain the difference.

$$\begin{array}{r} 6 \\ \sqrt{47\ 60} \\ 36 \\ \hline 11\ 60 \end{array}$$

Divide twice the first digit of the root into the first three digits of the difference.

$$\begin{array}{r} 6 \\ \sqrt{47\ 60} \\ 36 \\ \hline 12)\ 11\ 60\ (9 \end{array}$$

12 divided into 116 equals 9 and 8 left over. Add 9 to the right of 12, making 129 the trial divisor, and also over the radical. Multiply 129 by 9

$$129 \times 9 = 1161$$

Since the product of 129 and 9 is greater than the dividend 1160, we must try adding the next lower number (8) to the right of 12 (making 128 instead of 129) and try the new trial divisor. Also put the 8 (instead of the 9) over the radical. Multiply the trial divisor by its last digit which in this case is 8.

$$128 \times 8 = 1024$$

Since 1024 is less than 1160, place 1024 below 1160 and subtract.

> Voltaire: "A long dispute means that both parties are wrong."

$$\begin{array}{r} 6\ 8 \\ \sqrt{47\ 60} \\ 36 \\ \hline 128)\ 11\ 60\ (8 \\ 10\ 24 \\ \hline 1\ 36 \end{array}$$

68 is the largest whole number square root in 4760. This leaves a remainder of 136.

In most practical applications a square root of 68 with a remainder of 136 is not sufficiently accurate. Therefore, we add two zeros to the right of the decimal point to form a new group of digits and continue:

Bring down the next group (two zeros) to the right of the remainder, 136.

$$\begin{array}{r} 6\ 8 \\ \sqrt{47\ 60.00} \\ 36 \\ \hline 128)\ 11\ 60\ (8 \\ 10\ 24 \\ \hline 1\ 36\ 00 \end{array}$$

Double the number above the radical ($2 \times 68 = 136$) and divide it into 1360.

$$\begin{array}{r} 6\ 8 \\ \sqrt{47\ 60.00} \\ 36 \\ \hline 128)\ 11\ 60 \\ 10\ 24 \\ \hline 136)\ 1\ 36\ 0\emptyset\ (9 \end{array}$$

136 will go into 1360 ten times. However, the largest number which may be placed above the radical is 9. Therefore, we try a 9 as the last digit in the trial divisor. Add 9 to the right of 136 ($2 \times 68$) to form the trial divisor, 1369. Also, place 9 above the radical. Multiply the trial divisor by its last digit.

$$1369 \times 9 = 12321$$

Place this product below the 13600 and subtract

$$\begin{array}{r} 6\ 8\ .9 \\ \sqrt{47\ 60.00} \\ 36 \\ \hline 128)\ 11\ 60 \\ 10\ 24 \\ \hline 1369)\ 1\ 36\ 00 \\ 1\ 23\ 21 \\ \hline 12\ 79 \end{array}$$

At this point you may choose to round off the square root of 68.9 to 69, or you may go through the same procedure and find more decimal places.

To find the next decimal place, add another group of two zeros to the right of the decimal point. Bring this group down with the remainder of 1279 to form 127900.

```
    6 8 . 9
√47 60.00 00
   36
128)11 60
    10 24
1369) 1 36 00
      1 23 21
        12 79 00
```

Double the number above the radical ignoring the decimal point.

$$2 \times 689 = 1378$$

Divide 1378 into 12790 to find the last digit of the trial divisor.

```
    6 8 . 9
√47 60.00 00
   36
128)11 60
    10 24
1369) 1 36 00
      1 23 21
 1378) 12 79 0Ø (9
```

1378 will go into 12790 nine times. Thus, we place 9 to the right of 1378 to form the trial divisor 13789 and also place the 9 over the radical. Multiply 13789 by 9 and subtract the product (124101) from 127900.

```
    6 8 .9  9
√47 60.00 00
   36
128)11 60
    10 24
1369) 1 36 00
      1 23 21
13789)12 79 00(9
      12 41 01
         38 00
```

For all practical purposes, 68.99 is close enough to be used as the square root of 4760. $68.99^2$ (68.99 × 68.99) is equal to 4759.2201.

Notice that when we added zeros to the right of the decimal point, they were added in groups of two each, starting from the decimal point. The grouping always starts at the decimal point. Whole numbers are grouped on the left and decimals on the right.

41721.5283, for example, would be grouped thus:

$$\overline{4}\ \overline{17}\ \overline{21}.\ \overline{52}\ \overline{83}$$

When solving a problem, be sure to place the decimal point in the answer (quotient) directly above the decimal point under the radical.

Let's find the square root of a number smaller than 1. Find the square root of .00325.

First, group the number. Start at the decimal point and group toward the right.

$$.00\ 32\ 50$$

Whenever the last group has only one digit, add a zero to complete the group as we have done.

Place the numbers under the radical and find the largest square in the first group.

```
   .0
√.00 32 50
```

There is no square root of 00, so place a zero over the first group and proceed to the second group. The largest square root in 32 is 5. Place 5 above the second group:

```
   .0  5
√.00 32 50
```

From this point, the procedure is the same as it was in the foregoing examples:

```
   .0  5
√.00 32 50
     25
      7 50
```

Double the number above the radical: 2 × .05 = .10. Disregard the decimal point and divide 10 into 75 (ignoring the last digit.) Place the 7, which you obtain from this step, above the radical and also to the right of 10 to get a trial divisor of 107:

```
   .0  5  7
√.00 32 50
     25
107) 7 5Ø (7
```

107 multiplied by 7 is 749. Place this product below the 750 and subtract

```
   .0  5  7
√.00 32 50
     25
107 ) 7 50
      7 49
         1
```

The square root of .00325, then, is slightly more than .057

$$.057^2 = .003249$$

Another problem which you may encounter is finding the square root of a fraction. If both the numerator and denominator are perfect squares, simply take the square root of both:

$\sqrt{\frac{25}{49}} = \frac{5}{7}$ $\sqrt{\frac{9}{36}} = \frac{3}{6}$ or $\frac{1}{2}$ or .5

If the numerator and denominator are not perfect squares, such as

$$\frac{5}{12}$$

change the fraction to a decimal by dividing the denominator (12) into the numerator (5):

$$\begin{array}{r} .4166 \\ 12\overline{)5.000} \\ 4\,8 \\ \hline 20 \\ 12 \\ \hline 80 \\ 72 \\ \hline 8 \end{array}$$

and find the square root of the decimal:

$$\sqrt{\frac{5}{12}} = \sqrt{\begin{array}{r} .6\ \ 4\ \ 3 \\ .41\ 66\ 00 \end{array}}$$

The square root of $\frac{5}{12}$ is .643.

When you have to find the square root of a number whether it is a whole number, mixed number, decimal or fraction, you will find it easier if you learn the processes we used in these examples and apply them to the problems you are trying to solve.

Finding the square root of a number by this method does take time. Often, a technician's time means money. For this reason, many technicians use a slide rule when they have to make calculations. With a slide rule, you can find the square root of a number within the accuracy required in just a few seconds. Complete instructions come with slide rules explaining how they are used.

## VISITS TO NRI

If you are ever in Washington, please come and see us. You will be given a conducted tour of our entire building and you'll see where your records are kept, the way we pack your demonstration kits, our Printing Section, how your lessons are sorted and graded, our laboratories and the Consultants in the Instruction Department answering students' and graduates' requests for help. If you want to chat with any member of our staff, you'll find him delighted to meet you and to answer any questions. Whether we meet you over the phone, by a letter, or at our Reception Desk, you are a very important person to every employee at NRI, and our aim is to see you successful in your chosen field.

## Nomination Ballot

T. E. ROSE, *Executive Secretary*
NRI Alumni Association,
3939 Wisconsin Ave.,
Washington 16, D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1963.

*(Polls close August 25, 1962)*

MY CHOICE FOR PRESIDENT IS

.....

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

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. .....

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

2. .....

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

3. .....

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

4. .....

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

Your Signature .....

Address .....

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

Student Number .....

## SPECIFICATIONS

Accurately measures **RESISTANCE, CAPACITY, LEAKAGE, POWER FACTOR, OPENS, SHORTS, ELECTROLYTICS.** 4 overlapping capacity ranges: **.00001 mfd. to 1500 mfd.** 4 overlapping resistance ranges: **one ohm to 150 megohms. Continuously Variable DC** working voltage up to 450 V. 0 to 60% direct reading power factor scale. **Bridge Type Circuit** with tuning eye null indicator. 1% precision resistors. 5% capacitors. 6X4 and 6E5 tubes. **Special "5-way" Binding Posts.** Black wrinkle finish cabinet with brushed aluminum panel. **All American Made Parts. Size:** 9⅞" x 7½" x 6½". Actual Weight 6 lbs. Shipping Weight 8 lbs. 90-day EIA warranty.


# Resistor-Capacitor Tester

- **Uses lab-type bridge circuit**
- **Wide resistance-capacity ranges**
- **Fully variable DC working voltage to 450 V**
- **"Floating chassis" design reduces shock hazard**
- **A basic test instrument—won't become obsolete**

**Kit Stock #311UK** (8 lbs. parcel post)..... **$21.95**

**Assembled Stock #311 WT** (8 lbs. parcel post)....**$29.95**

Every Radio-TV service shop needs a reliable resistor-capacitor tester. It's a must for identifying and matching resistors-capacitors used in critical circuits. By eliminating guesswork, it saves costly callbacks and increases profits. Builds customer goodwill and gives you added confidence too.

Check the specifications and note this Conar instrument has all the features of most "in-circuit" testers. In many applications, it can be used for in-circuit tests. But when other circuits are parallel to a resistor or capacitor, one lead must be unsoldered for an *accurate* test. This instrument available as Conar easy-to-build kit or fully wired complete with comprehensive instructions.

# Replacement Parts Kits for Radio-TV Servicing


**A $60.00 value for only $29.95! More than 250 commonly needed replacement parts — all fresh stock — first-quality—U. S. made. Not surplus. Fast-moving parts for any service shop—selected by men who know—to save you time and money. Standard Kit includes:**

- 6 volume controls
- 4 "add-on" switches
- 8 control shafts
- 2 universal selenium rectifiers
- 100 fixed resistor assortment
- 25 tubular capacitor assortment
- 8 most needed electrolytics
- 10 pilot lamp assortment
- 2 universal oscillator coils
- 2 456kc i.f. transformers
- 1 dial repair kit with assortment of cords, springs & fasteners
- 2 quality line cords
- 1 universal AC-DC output transformer
- 1 tube bakelite cement
- 1 tube speaker cement
- 1 bottle service solvent
- 1 universal loopstick antenna
- 1 12BA6 tube, (1) 12BE6 tube, (3) 35W4 tubes, (1) 12AT6 tube, (1) 50C5 tube

AND—included FREE—steel tool box with lift-out tray, full-length piano type hinge, carrying handle and snap-lock latch. A *$4.50* value.

**Economy Kit**—includes all parts listed above except for volume control-switch assortment, tubes and rectifiers. Retail value approximately $39.00.

**Stock #25UK** (11 lbs. shipped express collect)

only **$19.95**

**Standard Kit**—includes all parts listed above—retail value approximately $60.00.

**Stock #24UK** (12 lbs. shipped express collect)

Yours for **$29.95**

**USE ORDER BLANK ON PAGE 17**

## It Speaks For Itself....

We received the following letter from NRI student George A. Sirek who purchased a Model 311 Resistor-Capacitor Tester. You can read about it on page 22.

August 29, ____
Golf Moor Court
Malvern Rd.
Hot Springs, Ark.
B248-K77

National Radio Institute
Washington, D. C.

Dear Mr. Rose:

In looking over your changes of the new and improved Resistor-Capacitor Tester, which you have outlined in your letter of August 22nd, I am very much pleased that you are taking interest in my welfare in trying to save me a few dollars.

I have gone through several catalogs to compare the different testers, but in the comparison of the different makes, the NRI Tester seems to have more and finer features than any of the rest of them.

I am hereby sending you the filled out order blank, for the new Model 311 in Kit form. I do enjoy assembling any of your kits as they are easy to assemble from your detailed instructions and it is a valuable experience in the right direction.

Thank you for your interest,
I remain, Yours sincerely.

/S/ George A. Sirek

George A. Sirek
B248-K77

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### *HOPE IS A WORD TO LIVE BY*

HOPE is something within us that makes us strive and reach for something higher. There may be failure, but there is always HOPE to start again, with HOPE directing our way.
HOPE longs for a desired goal.
HOPE keeps us with a song in our heart.
HOPE is like a shot in the arm; it brings new thoughts or desires to build on.
HOPE is a booster for the discouraged.
HOPE is a stepping stone to the depressed and needy; it renews their will to find a brighter day.
HOPE is truly a word to live by.

### *HOW TO SUCCEED*

1. Never disparage or minimize your strength, power, or judgment.
2. Never need praise, approval, or sympathy.
3. Do not give or receive communication unless you yourself desire it.
4. Be true to your own goals.
5. Be your own advisor, keep your own counsel and select your own decisions.
6. Never fear to hurt another in a just cause.
7. Never regret yesterday. Life is in you today and you make your tomorrow.

L. Ron Hubbard

# NRI ALUMNI NEWS



## NOMINATIONS FOR 1963

It is generally recognized that politics is a fascinating and rugged game with many ramifications. We hear of compromises and "trades" or "deals", of candidates jockeying for position, of tactics, strategy, and the other elements which characterize an election campaign.

Well, members of the NRI Alumni Association are now called upon to participate in an election campaign, to choose their officers for 1963. But that is all it will be -- a simple, straightforward choosing of the officers, with no deals or trades or the other trappings of political campaigns.

The campaign begins with the nomination of candidates. The nominees for our President will be the two members receiving the largest number of votes for that office. The nominees for Vice Presidents will be the eight members for whom the greatest number of votes are cast for a Vice Presidency.

August 25 is the deadline for nominations. To make your vote count, you must mail your ballot in time to reach Washington by then. National Headquarters will count the votes and the names of the nominees will appear in the October-November issue of the NRI News. Members will then cast their votes for the President and four Vice Presidents by means of ballots that will be printed in the October-November issue.

Frank Skolnik, President of the Association this year, will relinquish his office on December 31, 1962, to be succeeded by the winning candidate for the office for 1963.

The name of John Berka of the Minneapolis-St. Paul Chapter has cropped up in the last two elections. In 1960, although he was not successful, he was nevertheless a heavily favored runner-up for a Vice Presidency. Last year he was a candidate for the Presidency but of course lost out to Frank Skolnik. Maybe he'll make it this year.

Another member who has come to the fore in the last few years is J. Arthur Ragsdale of the San Francisco Chapter. He was twice elected to a Vice Presidency for two consecutive years, 1961 and 1962.

Members would do well to bear both of these men in mind in casting their ballots. All of the present Vice Presidents -- Walter Berbee of Minneapolis-St. Paul, James Kelley of Detroit, J. Arthur Ragsdale of San Francisco, and David Spitzer of New York City -- are eligible as candidates for either re-election as Vice Presidents or for election to the Presidency. Names of other suggested candidates, selected geographically, appear under "Nomination Suggestions." Nominees may be selected from this list or you may nominate any other member of the NRIAA.

### NOMINATION SUGGESTIONS
(Use Ballot on Page 21.)

C. B. Taylor, Birmingham, Ala.
Floyd B. Parks, Mobile, Ala.
N. R. Lee, Phoenix, Ariz.
F. Milton Sema, Winslow, Ariz.
Roy V. Barger, Nashville, Ark.
Sidney C. Timmerman, Little Rock, Ark.
Eugene DeCaussin, Hollywood, Calif.
Fred Tevis, Los Angeles, Calif.
William G. Edwards, Los Angeles, Calif.
Anderson P. Royal, San Francisco, Calif.
Peter P. Salvotti, San Francisco, Calif.
A. W. Blake, Denver, Colo.
William J. Fertal, Pueblo, Colo.
Joseph C. Allard, New Britain, Conn.
Arthur E. Acorn, Hartford, Conn.
Robert A. Williams, Wilmington, Del.
George A. Clark, Smyrna, Del.
Roger W. Powell, Washington, D. C.
Henry Lee Bradley, Washington, D. C.
Fred B. Wadley, Tampa, Fla.
Robert B. Moore, Jr., St. Petersburg, Fla.
J. W. Bentley, Columbus, Ga.
Walter Rozenbeck, Jr., Savannah, Ga.
Francis W. Magnelli, Idaho Falls, Idaho
A. Stanley Brown, Twin Falls, Idaho
Lester Wolfe, Kingston, Ill.
Charles Fraunberg, Sycamore, Ill.
Henry March, Goodwine, Ill.
William Greer, Chicago, Ill.
Joseph Ciancanelli, Joliet, Ill.
H. W. Johnson, Galesburg, Ill.
R. W. Tyler, Fort Wayne, Ind.

Charles Booker, Indianapolis, Ind.
Bernard McSorley, Council Bluffs, Iowa
Norma E. Wood, Sioux City, Iowa
Clark Frazier, Wichita, Kans.
Leonard J. Sager, Scott City, Kans.
Vincent T. Roberts, Owensboro, Ky.
Oscar L. Burney, Louisville, Ky.
John M. Conrad, New Orleans, La.
Ronald J. Reed, New Orleans, La.
Lloyd S. Hodgdon, Bangor, Maine
Archie J. Bobryk, Portland, Maine
John P. Chase, Baltimore, Md.
Charles Metzger, Annapolis, Md.
Sam Infantino, Fitchburg, Mass.
Edward Bednarz, Fall River, Mass.
Arnold Wilder, Agawam, Mass.
William Wade, Jr., New Bedford, Mass.
Paul Donatell, St. Paul, Minn.
Henry Hubbard, Grand Blanc, Mich.
Clyde B. Morrissett, Flint, Mich.
James J. Kelley, Detroit, Mich.
George Povlich, Ecorse, Mich.
Ray Hughes, Jr., Gulfport, Miss.
W. S. Tatum, Hattiesburg, Miss.
Willis F. Reynolds, St. Louis, Mo.
F. C. Kelly, Kansas City, Mo.
Wayne C. Smith, Missoula, Mont.
Victor Spinler, Havre, Mont.
H. R. Luehl, Lincoln, Nebr.
Angelo Gilliotti, S. Omaha, Nebr.
L. R. Carey, Elko, Nev.
Phillip T. Hubel, Henderson, Nev.
Charles R. Waters, Dover, N. H.
Everett R. Hardy, Manchester, N. H.
Paul H. Prince, Orange, N. J.
Alex Bunn, Englewood, N. J.
Paul E. Gammill, Albuquerque, N. Mex.
Luther M. Goldman, Roswell, N. Mex.
James Eaddy, Brooklyn, N. Y.
Frank Castalano, New York, N. Y.
Alvah B. Bonham, Bronx, N. Y.
Frank Zimmer, Long Island City, N. Y.
Harry Gerdts, Jackson Heights, N. Y.
Ralph Pincus, Arverne, N. Y.
Jake L. Reddick, Wilson, N. C.
Robert E. De Main, Raleigh, N. C.
Willard F. Velline, Fargo, N. Dak.
Homer Grove, Bordulac, N. Dak.
Dayton Brown, Cleveland, Ohio
Gerald Gribble, Canton, Ohio
Ralph W. Smith, Oklahoma City, Okla.
Robert O. Nutt, Tulsa, Okla.
John Place, Portland, Oreg.
Harold W. Smith, Eugene, Oreg.
Harvey Morris, Philadelphia, Pa.
Charles Fehn, Philadelphia, Pa.
John Pirrung, Philadelphia, Pa.
Harold J. Rosenberger, Waynesboro, Pa.
Howard Tate, Pittsburgh, Pa.
James Wheeler, Verona, Pa.
Lawrence Whittaker, Barrington, R. I.
Frank S. Mendes, Providence, R. I.
William Stone, Greer, S. C.
James B. Winchester, Columbus, S. C.
William M. Weidner, Fairfax, S. Dak.
Arthur Richardson, Beresford, S. Dak.
James T. Reed, Memphis, Tenn.
Rank Wallace, Nashville, Tenn.
John J. Chiles, Houston, Tex.
James A. McKillop, Fort Worth, Tex.
George L. Houtz, Salt Lake City, Utah
Herbert C. Dyer, Ogden, Utah
R. C. Wintermeyer, Norfolk, Va.
Bert Keyser, Lynchburg, Va.
Raymond J. Hebert, Williamstown, Vt.
B. C. Bryant, Alburg, Vt.
Alfred Stanley, Spokane, Wash.
Arnold Layton, Colfax, Wash.
Spencer R. Roberts, Fairmont, W. Va.
Gilbert Lee Johnson, Stirrat, W. Va.
Joseph Peterson, La Crosse, Wisc.
Ambrose McNall, Janesville, Wisc.
John Johnson, Cheyenne, Wyo.
Eugene Matthews, Torrington, Wyo.
Thomas Crotty, St. John's, Nfld., Can.
Valerie A. Landry, St. Joseph, N.B., Can.
Herbert Blakemore, New Glasgow, N.S. Can.
Victor Graham, Kingston, Ont., Can.
Donald Marquis, Granby, P. Q., Can.
Nick Knebel, Sask., Can.
Howard R. Rietze, Winkler, Man., Can.
Wesley Kay, Vancouver, B. C., Can.
Ernest E. Oxereok, Wales, Alaska
D. S. Chang, Honolulu, T. H.

# Chapter Chatter

DETROIT CHAPTER has been giving demonstrations on the various sections of a Television receiver. Many of the members have been participating in these demonstrations and all are gaining more knowledge of the functions and principles of Television.

A fine demonstration was given by Leo Blevins on the power supplies of Radio and Television receivers.

Recent additions to the membership of the Chapter are George Mastaler, Steve Bubel, Johnson Lowe, and Thomas LePere. It's a pleasure to number you among the members, gentlemen.

The Chapter's Annual Stage Party was scheduled to be held in the last week in June, the meetings then to be suspended for July and August. The first meeting of the 1962-1963 meeting will take place on September 15.

FLINT (SAGINAW VALLEY) CHAPTER has come up with a new and original creation which the members call "Handy Andy."

It is a TV demonstration board with switches that permit all types of trouble to be simulated. By finding the defects which cause the type of trouble, a clue is obtained which speeds

service work in other receivers. The maintenance of a log of symptoms and of the defects which produce them makes valuable service information easily available.

This is an ingenious idea which should be of real value to the Chapter and its members. The device is essentially a troubleshooting computer but the members' pet name for it, "Handy Andy", is a highly appropriate one.

Meetings have been suspended for the summer, the first one for the 1962-1963 season to be held on September 27. The Chapter has some ambitious programs planned for early fall: Westinghouse on their new receivers and automatic tuning; Mr. Carenaham of Bell Telephone will conduct a program on "NORAD" (North American Radio Defense Communications); and the Chapter will be host to the Civil Air Patrol, the Amateur Radio Club and also to engineers from General Motors. These all add up to some mighty interesting meetings.


A few of the Flint-Saginaw Valley Chapter members and families: Andrew Jobaggy, Richard Jobaggy, Bill Jones, Robert Poli, George Martin, Raymond Kitt, Leroy Cockrell, Miss Wotring, Charles Wotring, Jr., Mr. and Mrs. Ray Duncan, Mr. and Mrs. Charles Wotring, and Mr. and Mrs. William Duncan. The occasion was a visit to WJRT channel 12 transmitter in April.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER Secretary Harold Rosenberger at one meeting lead a discussion in which he dealt with Ohm's Law. He also talked at length on voltage laws, current laws and power laws and formulas pertaining to each law.

This year the chapter marked the end of the season with a family style picnic held in the latter part of June at Water Works Park, Williamsport, Md. Like many other Chapters, no meetings were scheduled for July and August but will be resumed in September.

LOS ANGELES CHAPTER admitted two new members, Floyd Cox and Louis Roth, both of Los Angeles. Our congratulations, gentlemen!

Floyd Cox immediately demonstrated his value as a new member by delivering a talk on servicing color TV. He also discussed the color TV class sponsored by the Electronic Trade Association.

The Chapter has purchased the new Custom 70 Television Kit from the CONAR Division of the National Radio Institute, the assembly of which is now a major project. It was decided to assemble the kit on alternate Saturday nights, which are not regular meeting nights.

It was mentioned in the June-July issue of the NRI News that the Chapter had arranged with the telephone company for the loan of films to be shown at meetings. These films, especially the ones on Electronics have become very popular with the members. That is the reason that assembly of the TV Kit was assigned to alternate Saturday nights so that the members would not miss any of the films on Electronics which are shown at the regular meetings. This is a good indication of just how interesting the films are and how enthusiastic the members are about them.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER held its last meeting of the past season in June. At this meeting John Berka gave a comprehensive talk on transistors and transistorized Radio receivers. This talk was so well received that plans have been made for John to continue with his discussions and demonstrations of transistors at the beginning of the 1962-1963 season.

John Berka happened to win the $20 door prize at the June meeting. Fortunately for the Chapter, he planned to buy transistor test equipment with it and thus make his talks and demonstrations on transistors that much more interesting and informative.

No meeting was held in July because so many members are on vacation in that month, but the meetings will be resumed in August.

NEW YORK CITY CHAPTER, like the Pittsburgh Chapter, is another local Chapter that has shown a renewed spirit this year.

It is the result of the efforts and industry of some of its leaders such as Chairman Dave Spitzer, Tom Hull, Frank Zimmer, James Eaddy, and Joseph Bradley, Jr. The first three named delivered many fine lectures and demonstrations on TV and Radio; James Eaddy and Joseph Bradley gave many equally fine lectures and demonstrations on transistors. All these lectures met with enthusiasm on the part of the members.

Hardly a month has gone by that new members have not been admitted to the Chapter. The latest reported are John Medzie, Rafaed Ibanez, Charles Pearson, Joseph Bradley,

Jr., and Robinson Vorgas. A warm welcome to you gentlemen!

The final meeting of the 1961-1962 season was the "Open House" to which the members had long looked forward with a great deal of anticipation. It was well attended. The meetings were suspended until Sept.

PHILADELPHIA-CAMDEN CHAPTER celebrated its 28th Anniversary with a stag party at its regular meeting place. It was well attended. The chief entertainment was the showing of several 16mm sound films, one on the new Philco portable TV receivers and the others on Bugs Bunny cartoons. Next came a buffet supper, and when the 70 members present dug into the food and beverages as they always do, there couldn't be much left except a few napkins and plastic spoons. These fellows' appetites being what they are, probably somebody sooner or later will figure out a way to make even the napkins and plastic spoons edible!

A group of members visited the A T and T Company at Wayne, Penna. Of greatest interest was the company's process of microwave transmission and cross-country automatic dialing. The tour was arranged through Mr. John Eby, Staff Supervisor, who appointed Messrs. Robert Mosakowski, Robert Burns, and Sheldon Forsythe as guides. These gentlemen were very thorough and knew their business, made the tour quite an impressive and thoroughly enjoyable experience.

Someday a report from the Philadelphia-Camden Chapter is going to come in that does not mention any new members and it probably will not be believed. At this time the newest members to be admitted are Joseph Winczoski, Matthew Tompkowics, James Blanchard, Milton Belkin, all of Philadelphia, and Thomas Baker, of Trenton. Our congratulations to these new members!

Chris Urback delivered a talk about "hams" which so impressed the members that they wanted to get in on it. Result: Chris is now conducting a school for hams for the Chapter at which the members learn to send and receive messages in code. The Chapter also has a CB club for citizens' band enthusiasts. Secretary Jules Cohen says that the Chapter now has such a variety of activities that the only thing missing is a group which would devote itself to space and satellites.

Instead of a picnic this summer, Chapter members decided to have a fishing trip at Atlantic City, tentatively set for the last Saturday in August. Those interested in attending should check with Secretary Jules Cohen for a more definite date later on.

In keeping with its usual custom, the Chapter will hold only one meeting each in July and August. These will be service meetings held on the second Monday each month.

PITTSBURGH CHAPTER welcomed two guest speakers. Mr. Statley of Blonder Tongue spoke on antenna systems, how to set them up and what to expect of them. His talk was well received not only by members who were interested in antenna work but even by those who do not undertake such work.

At another meeting, Mr. Stan Prentis, representing Paco and Precision Instruments conducted a program dealing with the use of test equipment. He could be at the meeting for only a very limited time. He began with the use of minor instruments and worked up to the major instruments employed in repairing Radio and Television receivers. He also gave the members helpful tips on color Television work. Mr. Prentis promised to come back again later for another meeting. All the members liked his talk and hope he returns soon.

Meetings featuring guest speakers and representatives of Admiral, Sylvania and the House of Audio have been scheduled. The chapter hopes to get representatives of still other manufacturers to present talks at its meetings.

SAN FRANCISCO CHAPTER'S Chairman Ed Persau has continued his intensified membership campaign by appointing several committees to specialize in checking on delinquent members and welcoming new members, and committees for various social functions. Ed further requested that all members give earnest consideration to inviting more guest speakers to give lectures on various Electronic subjects. The Chapter has had such speakers in the past but the chairman and the membership feel that more of them would be desirable. All the members promised to contact at least one prospective speaker in the ensuing months.

In place of a regular program, a "welcome home party" was given for Secretary Art Ragsdale upon his return from a visit to NRI. This was a complete surprise to Art. The hall was decorated with streamers, and a special cake, ice cream and other refreshments were served. The members listened with much interest to Art's description of NRI, his cordial reception by Executive Secretary Ted Rose, his meeting with Mr. J. E. Smith, founder of NRI, and his tour of the building, during which he met various members of the staff.

While at NRI Art purchased a CONAR Model 250 Oscilloscope, which he brought to the

meeting and exhibited to the members. They examined it with considerable interest.

SOUTHEASTERN MASSACHUSETTS CHAPTER member Manuel Figueiredo, one of the newer members of the Chapter, gave an absorbing talk on color Television. In this talk he covered mostly the workings of the matrix section of a color TV receiver. The members had a few well done diagrams to refer to during this talk, for which they were indebted to Ernest Grimes.

The series of programs on color transistor circuits will be followed by the next topic of popular demand. The Chapter always has a question-and-answer period at most of its meetings to cover any subject that the members present may want to discuss.

The newest member to be admitted is Horace Cox of Central Falls, R. I. Our congratulations to you, Horace!

SPRINGFIELD (MASS.) CHAPTER was due to elect its officers for the 1962-1963 season at its last meeting in June. Up to the deadline for the material to appear in this issue of the NRI News, no report had been received on the results of the election.

In keeping with past practice, meetings were suspended for July and August and will be resumed in September.

## Directory of Local Chapters

*Local chapters of the NRI Alumni Association cordially welcome visits from all NRI students and graduates as guests or prospective members. For more information contact the Chairman of the chapter you would like to visit or consider joining.*

CHICAGO CHAPTER meets 8:00 P. M., 2nd and 4th Wednesday of each month, 666 Lake Shore Dr., West Entrance, 33rd Floor, Chicago. Chairman: Frank Dominski, 2646 W. Potomac, Chicago, Ill.

DETROIT CHAPTER meets 8:00 P. M., 2nd and 4th Friday of each month, St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich., VI-1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month at Chairman Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint Mich., OW 46773.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month, at homes or shops of its members. Chairman: George Fulks, Boonsboro, Md., GE2-8349.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, 5938 Sunset Blvd., L. A. Chairman: Eugene DeCaussin, 5870 Franklin Ave., Apt. 203, Hollywood, Calif., HO 5-2356.

MILWAUKEE CHAPTER meets 8:00 P. M., 3rd Tuesday of each month. at home of Treasurer Louis Sponer, 617 N. 60th St., Wauwatosa, SP4-3289. Chairman: Philip Rinke, RFD 3, Box 356, Pewaukee, Wis.

MINNEAPOLIS-ST. PAUL (TWIN CITIES) CHAPTER meets 8:00 P. M., 2nd Thursday of each month, Walt Berbee's Radio-TV Shop, 915 St. Clair St., St. Paul. Chairman: Paul Donatell, 1645 Sherwood Ave., St. Paul, Minn., PR 4-6495.

NEW ORLEANS CHAPTER meets 8:00 P. M., 2nd Tuesday of each month, home of Louis Grossman, 2229 Napoleon Ave., New Orleans. Chairman: Herman Blackford, 5301 Tchoupitoulas St., New Orleans, La.

NEW YORK CITY CHAPTER meets 8:30 P.M., 1st and 3rd Thursday of each month, St. Marks Community Center, 12 St. Marks Pl., New York City. Chairman: David Spitzer, 2052 81st St., Brooklyn, N. Y., CL 6-6564.

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P. M., 2nd and 4th Monday of each month, K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: John Pirrung, 2923 Longshore Ave., Philadelphia, Pa.

PITTSBURGH CHAPTER meets 8:00 P. M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: Howard Tate, 615 Caryl Dr., Pittsburgh, Pa., PE-1-8327.

SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 2nd Thursday of each month, National Cash Register Co., 436 S. Main Ave., San Antonio. Chairman: Thomas DuBose, 127 Harcourt, San Antonio.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: E. J. Persau, 1224 Wayland St., San Francisco, Calif., JU 4-6861.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month, home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: James Donnelly, 30 Lyon St., Fall River, Mass. OS 2-5371.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P. M., 1st Friday of each month, U. S. Army Hdqts. Building, 50 East St., Springfield, and on Saturday following 3rd Friday of each month at a member's shop. Chairman: Norman Charest, 43 Granville St., Springfield, Mass.

# Stan Cor's Corner

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Mr. Bennett Cook, Adv. Mgr.

## SERVICE SHOP SHORT CUTS

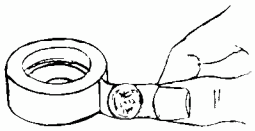
The various ideas, gadgets, and service hints listed here are designed to help you save time.

### A SMALL THIRD HAND

Have you ever felt the need of a third hand to hold parts while they are being soldered? Try plugging the center of your spool of solder with a cork to which you have screw-fastened an alligator clip. The clip provides that often needed third hand and can be transferred from one spool to another as solder spools are emptied.

### FINDING THE END OF A TAPE

Do you ever have trouble finding the loose end of your roll of electricians' tape? Instead



of picking and fumbling, just tape a penny at the end, and it will always be easy to find.

### DRILLING THIN METAL

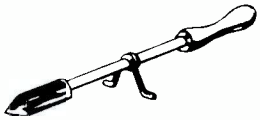
When you are drilling thin metal you can brace it so it won't bend by using a soldering iron to stick on a blob of solder at the site of the center punch mark. The diameter of the solder should be slightly smaller than the drill used and it should be 1/16" thick. The solder readily gives way to the drill and holds it there until the hole is started. You can drill even more accurately if you flatten the top of the solder blob and make a new center punch mark.

### COLD WEATHER TAPE TIP

Before you go outdoors in cold weather, to splice TV lead-in, warm up a roll of electricians' plastic tape by keeping it in an inside pocket. You'll find that warm tape sticks better than cold, and that a warm roll goes farther because it has more stretch.

### SOLDERING IRON REST

It is not a very good idea to burn your customer's carpet with your soldering iron -- and you can prevent this accident from occurring by attaching a soldering iron rest directly to the iron.



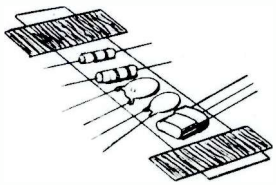
An easy way to do this is to cut a length of heavy wire from a clothes hanger. Bend it to shape around your iron's barrel and bend out the ends. If it fits too loosely, pinch the coiled section lightly with pliers.

### MODELING CLAY IS A USEFUL TOOL

If you keep some children's modeling clay on your work bench, you'll find many uses for it. It can serve as a third hand in holding small parts for soldering. It can also be used to hold extremely small screws or bolts in place in spots in the chassis where there isn't room for your fingers. You'll find it speeds up dial cord restringing if you use it to hold the cord in place on the pulleys.

### KEEPING TRACK OF SMALL PARTS

It is easy to keep track of small components and hardware and have them ready for easy



selection by laying them out in an orderly manner on a strip of masking tape, sticky side up. This comes in particularly handy when building electronic devices from kits.

NRI NEWS
3939 Wisconsin Ave.
Washington, D. C.

Second-class
postage paid
at Washington, D. C.

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H19-C239

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