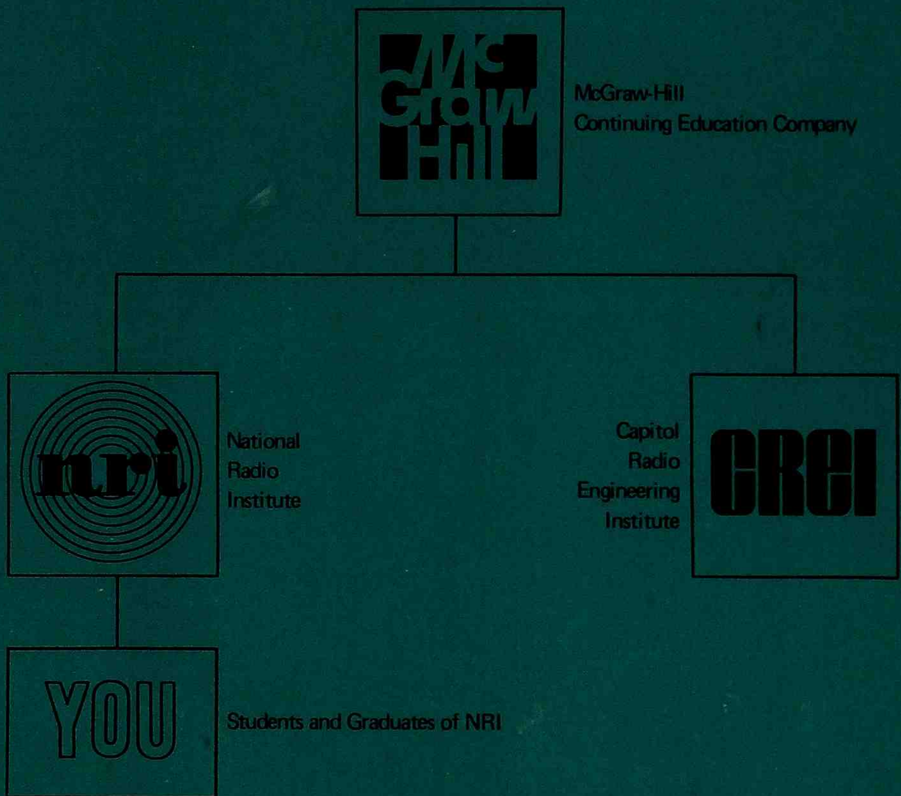
nri journal

March/April 1972



Important News for You

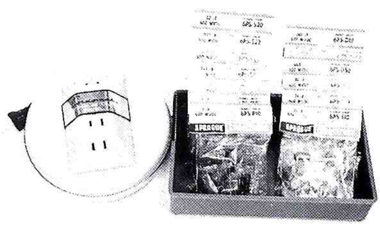
Introducing the CONAR Model 214

Further Adventures of a Part-Time Serviceman

Here's a "Reel" Deal—and a "Hot" Deal

(a \$37.95 Value) Only \$15.40 each (a \$39.70 Value)

(POSTAGE PAID)



THE REEL DEAL #21AC

Here's what the "reel" deal includes:

- **65 Orange Drop Capacitors**

Best of the dipped tubulars and a must for applications where only an exact replacement will fit. "Orange Drops" are the perfect replacements for dipped capacitors now used by makers of the leading television receivers.

- **130 Kwickette Soldering Aids**

Answer to a serviceman's prayers. Saves you hours and hours of work. Makes parts replacement a snap. Practically lets you do "in-circuit" component testing.

- **Handy Work Tray**

Use it for storage, for spare parts, for keeping track of odds and ends from jobs in progress. One end has a file card slot for easy identification.

- **Cordomatic Portable Extension Reel**

Contains 15 feet of 16-gauge, 10-amp cord. Hang it anywhere or set it on the floor, it's the modern safe way to end cord clutter. Built for lifetime use, the CORDOMATIC case has three outlets. Use it in your shop, at home, and on service calls.

YOUR CHOICE ONLY \$15.40

Here's what the "hot" deal includes:

- **20 Transiolytic electrolytic capacitors**

Utilize a special low-leakage current construction and meet the very special needs of transistorized circuits. Excellent resistance to high humidity because of plastic case with thermo-setting resin end-seals. Each unit stamped with rating and polarity.

- **25 Pacer Film Capacitors**

Feature metal end caps over extended foil sections. Assures best possible non-inductive capacitors. End caps also effective moisture barriers. Protected by epoxy coating—rugged and durable.

- **90 Kwickette Soldering**

An answer to a serviceman's prayer. These are the soldering aids that are saving technicians hours and hours of work. For quick parts replacement. Practically lets you do "in-circuit" component testing.

- **Kidde Pocket Butane Torch Kit**

Great for all kinds of soft soldering and even for hard soldering on small work. Its 3500 degree (F) pinpoint flame lets you get into tight places. Comes complete with torch, soldering iron attachment, solder, and five ½ hour butane chargers.

THE HOT DEAL #28AC

nri journal

March/April 1972
Volume 29, No. 2

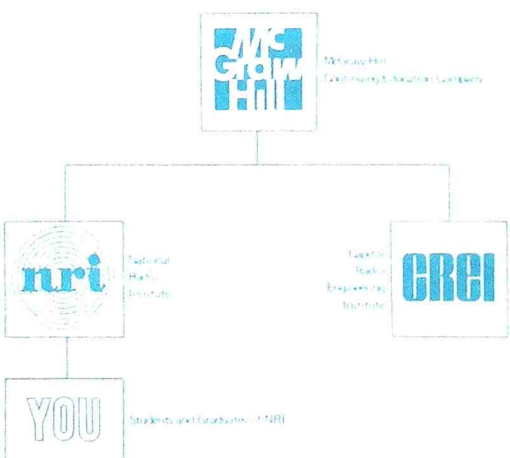
The NRI Journal is published bimonthly by the National Radio Institute, 3939 Wisconsin Avenue, Washington, D.C.20016. Subscription price is two dollars yearly or 35 cents per single copy. Second-class postage paid at Washington, D.C.

Editor and Publisher
w. f. dunn
Managing Editor
a. j. magann
Associate Editor
h. b. bennett
Technical Editor
e. b. beach
Staff Artists
e. blaine
a. susser

CONTENTS

ON OUR COVER

Wondering what it's all about? Turn the page for an announcement of some exciting and important news that affects YOU.



Now We Are McGraw-Hill CEC, We Can Do A Lot More For You

by Louis E. Frenzel, Assistant Director of Education

Back in the latter part of 1968, your school, National Radio Institute, became a part of the McGraw-Hill Book Company. Located in New York City, McGraw-Hill is one of the oldest, largest and most respected book publishers in the world. It publishes tens of thousands of texts on all subjects and at all levels for elementary and secondary schools, junior colleges, technical schools and universities, as well as fiction and nonfiction books for all interests.

Under the McGraw-Hill affiliation, NRI has continued to operate as always, giving you the same excellent electronic training and service you expect. Now, NRI has become part of the new Washington, D. C. based McGraw-Hill Continuing Education Company (CEC). Also part of this new Continuing Education Company is another leading home study school, Capitol Radio Engineering Institute (CREI). CREI also teaches electronics, and its training emphasizes the theoretical, mathematical and design aspects of electronics, going beyond NRI's practical hands-on approach. With both NRI and CREI, CEC provides the broadest, most complete and finest home study electronics training available.

So what does this mean to you?

So what does all of this mean to you? How do these changes affect you as a student or graduate of NRI? First of all, you are still an "NRI man." No change there. You will still get the same training with the same materials, and the identical service and personal help from the same staff. But with some new changes in the organization, you can look for improved service.

Second, with the financial backing and publishing expertise of a company like McGraw-Hill, National Radio Institute will continue to grow and improve at an accelerated rate. It will offer you a wider range of courses and ensure that you will always receive the best, most up-to-date training materials available anywhere. NRI will draw upon McGraw-Hill's experience and resources to serve you better.

And third, through CREI, we offer you graduates of NRI the chance to continue your education in electronics at a more advanced level.

That's the NRI – CREI – McGraw-Hill CEC story and we're proud to include you as a mighty important part of it! □

Yes, Dear Readers, There IS A CONAR Transistor Tester!

"Why doesn't Conar make a transistor tester? I know that transistors can usually be tested with an ohmmeter, but there are always tricky servicing situations that demand something more. And what about field-effect transistors? It's not so easy to test them with an ohmmeter."

by Harold J. Turner, Technical Editor

These are the types of question that NRI students and graduates have been asking me and other members of the NRI staff for some time now. At last we are very happy to report that a high-quality transistor tester is now available from the Conar Instruments Division of National Radio Institute. As you can see from the sketch, the new instrument is built into the same cabinet that has proved itself in its use as a housing for the Conar Model 212 transistorized volt-ohmmeter (tvom), which was introduced last year. The large 6″ meter and layout of the front panel make it extremely easy to operate. With the Model 214, you can completely test any transistor in just a few seconds.

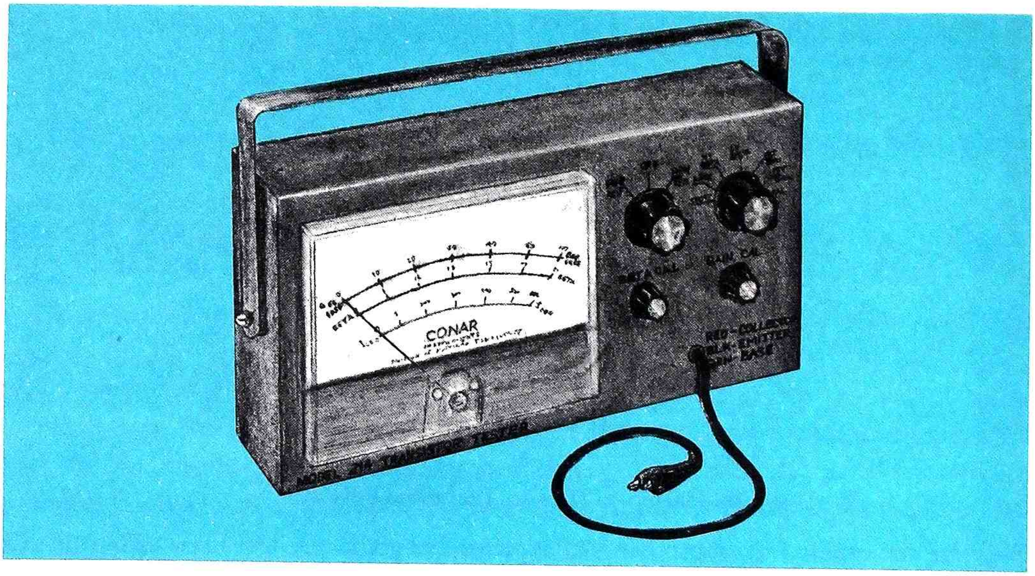
Besides being able to make complete tests of ordinary (bipolar) transistors, the Model 214 can tell you just about everything you'll ever need to know about the condition of any field-effect transistor (FET). In fact, the Model 214 is the only instrument we know of, priced under $75, that will test FETs at all.

WHAT THE MODEL 214 CAN DO

The new Conar transistor tester checks bipolar transistors for beta (current gain) and leakage. Beta measurements can be made either in-circuit or out-of-circuit. This means that it is no longer necessary to remove a transistor from a piece of equipment before testing it. Leakage tests, because of their very nature, must always be made out-of-circuit. In many cases, however, a beta check will suffice to tell you whether or not the transistor is capable of working in a circuit. This means that much of your testing can now be done without unsoldering transistors from the circuit.

The Model 214 checks FETs in four ways: for gate leakage, for drain saturation current, for mutual conductance (gain), and for the ability of the gate to control drain current.

In a good field-effect transistor, no current ever flows between the gate and the channel (source or drain). The leakage test measures the current that flows between the drain and gate terminals in the device under test. If any current is indicated, the transistor is faulty. All good FETs will show a zero indication in this test.



CONAR MODEL 214 TRANSISTOR TESTER SPECIFICATIONS

Bipolar Transistors:	Leakage (I_{CBO}) 0 - 200 μA; DC Beta 0 - 50, 0 - 500.
Field-Effect Transistors:	Leakage (I_{DGO}) 0 - 200 μA; Drain Current (I_{DSS}) 0 - 20 mA; Gain (Gm) 0 - 50,000 μmhos; Gate Control (Relative).

Testing Mode:	DC Beta test "in" or "out" of circuit. All other tests "out" of circuit.
Accuracy:	±10% of full scale, or better.
Power:	Built-in battery supply — two 9-volt transistor batteries (furnished).
Meter:	200 μA D'Arsonval, diode protected against overload. Burnout proof.
Size:	5-3/4" H × 10-3/4" W × 2-3/4" D.
Weight:	3 lb. actual, 5 lb. shipping.
Price:	Kit 214 UK $39.95, Wired 214 WT $49.95

READER'S EXCHANGE

WANTED

A color bar generator equivalent to Conar 680 in working condition.

CONTACT

Richard Mullins
3716 2nd Ave. South
Great Falls, Mont. 59405

WANTED: "ARC" Model 601 battery-operated radio receiver. Made by Arc Radio Corp. in 1947. Must be complete and in good, restorable condition.

Write: David Murphy
Box 105
Prattsville, N.Y. 12468

The test for channel saturation current (I_{DSS}) is an important one, since it is this characteristic of FETs that affects their performance in a circuit more than any other variable. Because of this, the I_{DSS} test is very useful in selecting matched pairs of FETs.

The mutual conductance of a field-effect transistor is an indication of how much voltage gain it can provide. The Model 214 reads Gm directly, in thousands of micromhos. The fourth test, for gate effectiveness, applies a small reverse voltage to the gate. If the transistor is good, the Gm reading will decrease. A transistor with an open gate will cause no difference in the reading when this reverse voltage is applied, so you will instantly know that the transistor is defective.

HOW DOES IT WORK?

Now, let's examine the individual circuits used in the Model 214, and see just how they work. Since the beta measuring circuit is probably the most frequently used, we'll discuss it first.

A simplified diagram of the beta measuring circuit is shown in Fig. 1. The transistor shown is the transistor being tested. There are no transistors or other amplifying devices inside the Model 214. The switch shown is a portion of the 7-position function switch. Only that portion of the function switch that involves beta testing is shown in Fig. 1. Note that this switch has two positions: "CAL." and "BETA". In the "CAL." position, the meter is used to measure the collector current of the transistor under test. The meter movement itself has a basic sensitivity of 200 microamps for full scale deflection, but in the "CAL" position of the function switch, a shunt resistor is used to decrease the sensitivity of the meter. With the 100-ohm shunt, the sensitivity becomes 2 milliamps for full scale deflection.

While the collector current is being monitored by the meter, base current is adjusted with the 2.5 megohm variable resistor (the Beta Cal-control) to bring the needle up to full scale deflection. In other words, the variable resistor adjusts the base current to the value

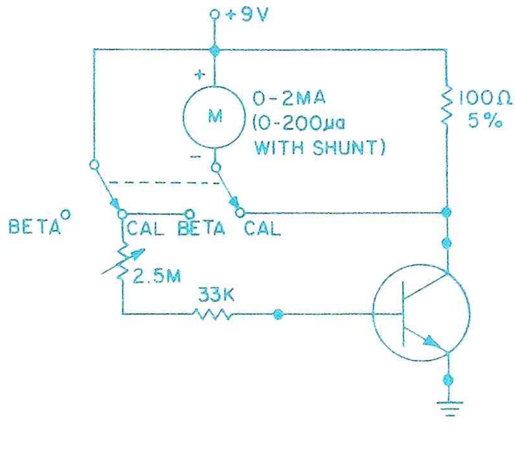


Fig. 1. Simplified diagram of beta measuring circuit.

needed to produce 2 milliamperes of collector current. Since beta is defined as the ratio of collector current to base current, all we need to do to calculate beta is to measure the base current. This is what happens when the function switch is changed from "CAL" to "BETA". The 100-ohm resistor still allows the same collector current to flow, but the base current must now pass through the meter, so it can be read. However, the scale is not calibrated to read the base current directly in microamperes. Instead, since the collector current is known, and the base current is being measured, the scale is calibrated directly in terms of beta, so no complicated calculations are necessary.

If a low-beta transistor is being measured, or (as sometimes happens in in-circuit testing), the circuit resistances are very low, the 2.5 megohm control is adjusted to produce only 1/10 full scale deflection. Then the switch is thrown to read the beta of the device. In this case, the beta scale is read just as it is calibrated. When the meter is set to full scale in the "CAL" position, the scale markings must be mentally multiplied by 10 to yield the correct beta reading. The result is that two beta scales are derived from a single switch position. This considerably simplifies the operation of the instrument.

Incidentally, notice that the transistor shown in Fig. 1 is an NPN device, and that the supply voltage and meter polarities are selected to match this type of transistor. For PNP transistor testing, the supply voltage and meter polarities are reversed by the combination on/off and polarity reversal switch. As you read this article, keep in mind that all the checks described can be made on transistors of either sex, provided that this switch is thrown to the proper position. The same is true of field-effect transistors, so the Model 214 can test either N-channel or P-channel FETs.

The simplest test of all the tests performed by the Model 214 is the leakage test, shown in simplified form in Fig. 2. As you can see, a reverse bias is applied to the base-collector junction of the transistor under test, and any current that flows is measured on the sensitive meter. Germanium transistors will show a slight indication, but all silicon transistors (good ones, that is) will show zero current when tested in this mode.

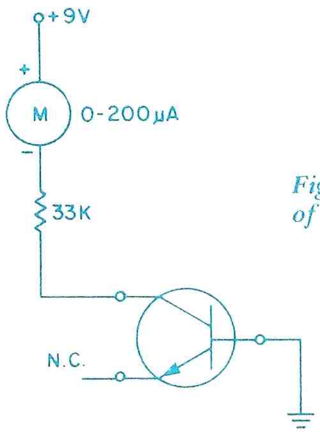


Fig. 2. Simplified diagram of leakage measuring circuit.

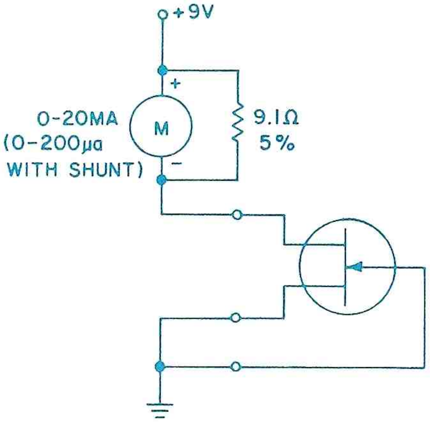


Fig. 3. Simplified diagram of I_{DSS} measuring circuit.

For testing gate leakage of FETs, exactly the same circuit configuration is used; however, the leakage is measured from drain to gate. The connections and indications remain exactly the same, and even the same setting of the function switch is used. Since all FETs are silicon devices, all good ones will show zero leakage.

Fig. 3 shows the circuit used for measuring FET saturation current. Channel saturation current, called I_{DSS}, is defined as the current that flows through the channel when the bias between gate and source is zero volts. In other words, we measure the current through the channel with the gate and source shorted together.

The I_{DSS} of most FETs is on the order of 1 to 10 milliamps, with some older types being slightly higher. A 9.1 ohm resistor is used as shunt for the 200 microamp meter movement, allowing the meter to measure I_{DSS} from 0 to 20 milliamps. Practically all available types can be tested in regard to this critical parameter. If a circuit application arises that calls for matched pairs of FETs, simply measure the ones that you have on hand until you find two with very close I_{DSS} readings. As long as these devices are both of the same type, the closeness of the I_{DSS} readings practically guarantees their success in a circuit requiring matched transistors.

The remaining two field-effect transistor tests are performed by the circuit shown in Fig. 4. Basically, this circuit is used to measure the mutual conductance (Gm) by measuring the resistance of the channel (resistance from source to drain, with no bias voltage applied) at a very low drain voltage. So what we have here is a simple ohmmeter circuit. With the switch set to the "Gm ZERO" position, only the meter, series resistor, and 25k-ohm control (Gm zero control) are connected to the positive supply. The control is then adjusted for full scale deflection of the meter. When the switch is set to its center position (to read mutual conductance) the channel is connected in parallel with the meter movement, and the resistance of the channel will cause the meter reading to decrease. The lower the resistance of the channel, the more the reading will decrease.

At this point you may be asking, "What does the channel resistance have to do with the

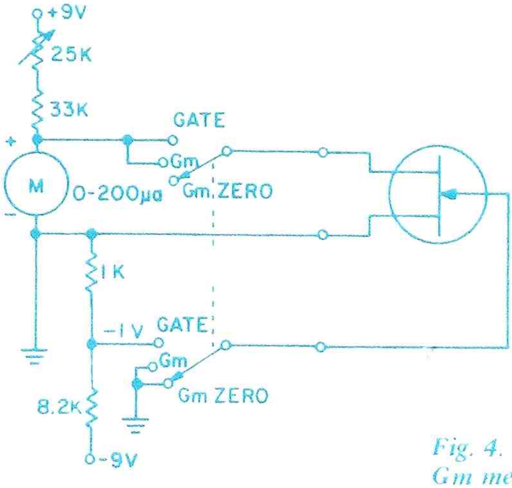


Fig. 4. Simplified diagram of Gm measuring circuit.

mutual conductance?" Well, it can be shown mathematically that Gm is the reciprocal of channel resistance. That is,

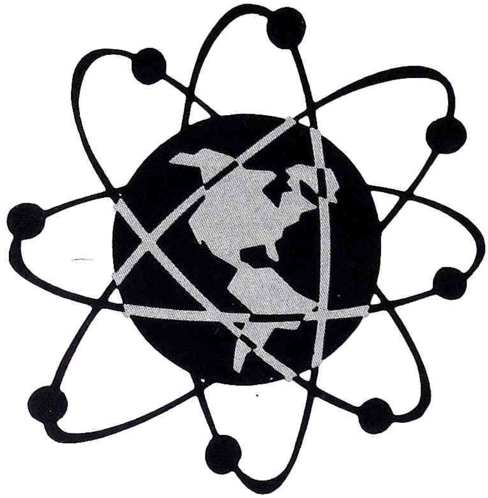
$$\text{Gm} = \frac{1}{R_{DS}}$$

where R_{DS} is the resistance from drain to source. As with the beta scale, no calculations are necessary here. The meter scale is calibrated directly in thousands of micromhos.

So far in this discussion of FET testing we have checked for leakage between channel and gate, channel saturation current, and mutual conductance. However, a transistor with an open gate, but otherwise in good condition, could easily pass these three tests. For this reason, a fourth test is included, so that you can tell for sure that the gate is doing its job. This fourth test is accomplished by setting the switch shown in Fig. 4 to the "gate" position. Here, the channel is still connected to the ohmmeter circuit, but a small reverse bias voltage is applied to the gate. If the gate is in good condition, this will cause the channel resistance to increase, so the Gm reading should decrease. If setting the switch to this position makes no difference, the gate is open.

As mentioned before, all the checks described in this article, for bipolar as well as field-effect transistors, can be made on transistors of either sex; that is, on PNP and P-channel as well as NPN and N-channel transistors. In addition, the front-to-back ratio of diodes can readily be determined. Specific information on transistor and diode testing is given in the Model 214 Manual, but, while very simple to understand and follow, will not be presented here, because of space limitations.

The all-new Conar Model 214 transistor tester is now available from Conar Instruments at the reasonable price of $39.95 in kit form, or $49.95 wired. We here at NRI are convinced that it is a fine instrument and a great buy. □



HAM NEWS

By Ted Beach, K4MKX

Well, I guess I'll have to confess that I haven't really done my homework for the column this time. I fully expected to devote almost the entire column to a witty (but scholarly!) discussion of different ways to make cheap, good looking QSL cards. But somehow there just hasn't been the time available to get together just what I wanted, so you lose this time.

As I did mention in the last Journal, my firm belief is that perhaps the easiest way to start out is by the silk screen route. Most art stores have very inexpensive starter kits that you can buy to try out this method. These kits have complete instructions for making what is called "knife-cut" stencils with the materials supplied in the kit. However, unless you happen to be somewhat talented (artistic, that is), your results will probably not be very professional looking since you have to cut out each letter or picture with a sharp knife.

There is another way to make the stencil, which can produce very good results the very first time. This is the photographic stencil, mentioned also in the last Journal. The basic kits do not have the supplies to make these stencils; however you can buy the things you need at the grocery store and your local photo shop. All you need is a package of plain gelatin (grocery store) and some Potassium Dichromate (about $1 for a pound at the photo shop). One package of gelatin and one pound of Potassium Dichromate should last indefinitely.

One other item you might get at the grocery is some food coloring. This added to the gelatin will make it a little easier to see the results of your efforts. I prefer a nice bright green, but pick your own color.

Dissolve the package of gelatin in half a cup of warm water. Stir the solution as you slowly pour the powdered gelatin into the water, letting a little dissolve at a time. When the whole package has dissolved, put a few drops of food coloring into the liquid.

Now get a quart of warm water and the Potassium Dichromate. You will need only one ounce of this orange chemical. A good way to measure out one ounce is to use a postal scale. If you don't have one, maybe you can sneak down to the post office and use theirs when the postmaster is not looking. Put a piece of paper on the scale and pour the chemical onto the paper. BE CAREFUL NOT TO GET THIS CHEMICAL IN YOUR EYES OR MOUTH AS IT IS POISONOUS AND AN IRRITANT!

With your one ounce of Potassium Dichromate measured out, slowly stir it into the quart of warm water. Let it all dissolve. You can keep this solution indefinitely if you store it in a brown bottle (covered) or in a dark plate. It will deteriorate if left exposed either to air or light.

MAKING THE SILK SCREEN

Now, you are all ready to make the photosensitive silk screen. Take the screen (from your kit) and brush on the gelatin. Cover an area only as large or slightly larger than you will be printing. I like to use government postcards for my QSLs, and cover an area on the screen about 8″ X 5″. Let the gelatin dry, and then using a soft brush sensitize the gelatin by brushing on the Pottasium Dichromate solution. Cover the gelatin area with brush strokes in both directions, up and down and crossways. Do not use too much solution. You'll need to dip the brush only once or twice for the postcard size area.

After you have coated the screen, put it in a dark place to dry. The gelatin is now light-sensitive just like photographic film. It must be thoroughly dry before you can use it. This will be a while anyway, because so far you haven't made the "negative" you will use for your card!

Actually what you will need is a "positive" transparency of exactly what you want to appear on your card. It doesn't have to be a real "transparency"; I usually make mine on very thin tracing paper (onionskin) which is translucent rather than transparent.

You can sketch in what you want with a blue pencil (which won't be "seen" by the photosensitive screen) and then use a pen and India ink to fill in the letters and/or pictures you want. The transfer type rub-on letters also make a neat looking job. Let your imagination run wild; after all, it's YOUR QSL card and should reflect your own individuality.

With your positive original ready and the screen dry, you are ready to make your photo-stencil. In a dark room place the screen face down on a clean, smooth surface. Place the positive transparency on the gelatin area (you can use very subdued lighting like a 15 watt lamp to see by) and cover it carefully with a piece of glass.

Expose the screen by holding a 100 watt lamp about a foot above the glass for at least 3 minutes. The light will harden the gelatin which is unprotected by the India ink and/or lettering. Remove the glass and original positive transparency and then gently wash the screen with warm (no hotter than 100°F) water You should soon see the gelatin dissolve and form a perfect image of your QSL. When it looks like the screen is clear in all areas, rinse it gently with cold water to "set" the undissolved gelatin.

And that's it. Dry the screen, set it up and start cranking out cards using the squeegee and inks supplied with your kit. The inks are usually quite slow drying, so you will have to spread the cards out to dry overnight.

As I mentioned in the last column, the photosensitive silk screen can also be used for making printed circuit boards. Use the foil pattern you need as the original positive transparency to make the screen, and then use a regular enamel paint as the "ink" for the circuit board. The enamel is a good etch resist (although there are special inks available for this process).

If any of you guys try this method out, I would like to see your results. We might even print a copy of your card here in your column.

Now let's see who the Hams are in our Course for Amateur Licenses this time:

Fred	WA3HQZ	C	New Castle, PA
Richard	WN3RNJ	N	Washington, DC
Charles	WN3RSU	N	Derry, PA
Ron	K4LWZ	T	Edenton, NC
Rick	WB4SGT*	G	Ft. Myers, FL
Tom	WB4UMU*	A	Odessa, FL
Doc	WN4WVG	N	Lake Park, FL
B.J.	WN4YEU	N	Dandridge, TN
Richard	WN5FRO	N	Kingsville, TX
Gil	WN6NOR	N	La Mesa, CA
Joe	WA6UKA*	A	Sherman Oaks, CA
Tom	WA7OIJ	G	Pasco, WA
Jim	W7TYL	C	Meas, AZ
John	WN8JMS	N	Lima, OH
Norm	WN8KCF	N	North Olmsted, OH
Paul	W8OP	E	Trenton, OH
Bill	WN9HZI	N	Peoria, IL
Elmer	WNØEIN	N	Aurora, CO
Steven	WNØGAR	N	Ottawa, KS
Cecil	WBØGGR	G	St. Charles, MO

*Just upgraded; congratulations!

Thanks only to the excellent memory of my secretary did WB4UMU get his "upgrade" listed this time. We received a photostat of an Advanced Class license bearing the call WB4UMU and also Tom's name and address. We sent this down to our filing section to get a Student number or Graduate number but it was returned to us with a notation "can't locate". Ouch. Anyway the good old secretary said the call somehow sounded very familiar so we ranged back through past issues of the Journal, and sure enough came across WN4UMU in Odessa, Florida (July/August, 1971).

Ron, K4LWZ, professes to be an active vhf man, but we wonder how much activity he can expect in the future if he sells all that gear he has in this month's Ham Ad? Actually, future activity may be on the HF bands as Ron is going for his General real soon, the very reason he is enrolled in our course. Good for you, Ron.

One call that does not appear in the list above is WN6CAI. It belonged to Art Chapman until March of last year when it expired. Now Art is on the way back up with his NRI course.

WA7OIJ was WN7OIJ when he enrolled in our course back in July of last year. Tom traded the N in for an A in November. Again, as a result (we hope) of his Amateur studies with NRI.

How about having a two letter call listed in the list above? Wow! Maybe we'll have to start looking for the OLDEST ham in the Course for Amateur Licenses. Actually, Paul is a graduate and was first licensed over 50 years ago as 9AYS. W8OP has held the calls WB8HWM and W9EAU also in all those years. At present the call is an Extra Class, one to be proud of. Paul is an inveterate home-brewer and after lo these many years is still rock-bound on 40 meters. His present project is to build a vfo rig he saw in QST to get away from those crystals. Congratulations, Paul, and the best of success.

WN0GAR is practically a brand new Novice, but his station equipment reads like a real oldtimer: Heath HW-16, DX-60, SB-610, SB-600, line voltage monitor and vtvm (seems to like Heath equipment). Steven says he would also like to latch onto one of the Heath linear amplifiers. After you get to General, we hope!

I would really like to reprint all of the letter we received from Cecil, WB0GGR, but there just isn't room. At the very least I think that I will frame it and hang it on my office wall. Cecil wrote one of the very nicest letters I believe I have ever seen, thanking the staff at NRI for the course which he took which led to his General call. We thank you, Cecil, and keep at it until you get Extra.

Now on to some of the "other" rogues we've heard from recently.

Ed	K1BKD	—	Burlington, VT
Gerry	WA1FIR	—	New Haven, CT
Charles	W2BXD	—	Tuckahoe, NY
George	K3MYK	—	Hatboro, PA
John	WA3QFG	G	New Castle, PA
Bill	WN4VZL	N	Erin, TN
Everett	W4WJJ	—	Myrtle Beach, SC
Paul	WB6GFV	T	Sonora, CA
Ken	WN8GB?	N	Clarksburg, WV
Lee	WB8KIS	G	Edgerton, OH
Robert	WA8OFU/4	A	Jacksonville, FL
Dick	WA9LJZ	—	Savanna, IL
Charles	WA0ENV*	G	Keytesville, MO
Johnny	WN0GED	N	Duluth, MN
Wayne	KA2WM	—	APO San Francisco, CA
Bob	KL7HGK	G	Anchorage, AK
Kerry	KR6AC	C	APO San Francisco, CA

*Just upgraded; congratulations!

After writing several paragraphs in the last column about Bob, KH6AD, our first Hawaii QSL, you can imagine my surprise the other day when he walked into the office! Seems as how Bob hops around all over the place and was in town on business for a day or two and just thought he would "stop in". We had a nice chat, but I had to shoo him back to Hawaii so he could set up skeds for all the people who are going to write asking for one as a result of his writeup last time.

WA8OFU/4 is a Chief Petty Officer stationed in Mayport at present. Bob likes to help new and prospective hams to get their licenses and says he would be more than willing to help anyone in the Jacksonville area. He is active on 20, 40 and 80 meter phone and cw and is currently on pins and needles awaiting the results of the tests he recently took for a First Class Radiotelephone license. We'll keep our fingers crossed, Bob. For anyone who needs the help offered he can be reached at the following address:

Robert J. Kerr – WA8OFU/4
751-B Everglades St.
Naval Station, Mayport
Jacksonville FL, 32227

The WN8GB? call came about because I could not read my secretary's handwriting. After the list was made up we misplaced the card from Ken and hence the "?". Sorry about that, Ken. (For those of you who haven't followed the column for long, please understand that I am my own secretary!)

I got several other nice letters from the Group listed above, but unfortunately I rambled on too much about the silk screen bit and I don't think we will have room to comment on all of them. I will say, however, that I got about five requests for the two AN/ARR-7 manuals I said had been sent me. Sorry guys, they are long gone now.

BCNU – Vy 73 – Ted K4MKX

HAM ADS

SELL 6 meter gear, all mint: Polycomm 6, $125; Lafayette HA460, $90; Allied TR106, $80. Ron Hines – K4LWZ Rt. 1 Box 179-B Edenton, SC

SELL: Hallicrafters HT-40 transmitter. 75 watt AM and CW with manual, $45. Dick Kline – WA9LZJ 726 No. 4th St. Savanna, IL, 61074

SELL: Conar 500 receiver, $20; AMECO transmitter, $15. Will take best offer for either item. Steven Couch – WNØGAR Princeton Road, Ottawa KS, 66067

SELL: DX60B in mint condition. First $50 takes it, postpaid. R. Miller – KP4BPH Coll. Sta. Mayaguez PR, 00708

Getting the TV Chassis Out of the Cabinet: It's Not Always As Simple As It Sounds

FURTHER ADVENTURES OF A PART-TIME SERVICEMAN

by J.B. Straughn

Most servicing jobs are run of the mill stuff, and I don't want to get too much of that in these articles. However, we will mention once more those cases where line voltage surges, caused by lightning, result in lack of B supply voltages. When this happens the tubes will light up, but the set will be dead. There will be no sound from the speaker, not even a hum, and the raster will not be present. All this is a pretty good indication that a fusible surge resistor, in series with the low voltage rectifier, has opened up.

Most but not all of these resistors are flat and thin, with a rough brown or white coat. Most are 3/4" high, 3/16" wide, and about 2" long. They may terminate in removable pins for easy plug-in installation. In the majority of cases, if the back of the set is removed, the resistor can easily be identified by its physical characteristics. However, there are some sets in which this resistor is mounted near the front of the chassis, which must be pulled to get at the resistor.

For the benefit of the beginner in servicing, let's run through getting the average portable out of the cabinet. The first thing is to remove the cover. Sound easy? It is if you remember certain things. First, get a small box or envelope to hold the set's screws, bolts, knobs, etc. This is an absolute necessity; it is very likely you will start on another receiver before this one is put back together. If you leave the hardware loose on your workbench, chances are it will disappear, and the right hardware is the one thing it is sometimes impossible to get.

First check to see how rear cover is attached

Check to see how the rear cover is attached to decide if the leads must be removed from the antenna binding posts. If the binding posts are on a chassis-mounted block separate from the rear cover, the answer is yes. Remove all screws or bolts or any control knobs if the rear cover comes far enough around to contain them. Don't try to yank the rear cover off. In many cases the antenna leads from the vhf and uhf tuners are attached to lugs of the antenna terminal strips inside the rear cover. In that case, ease the cover back so the leads can be slipped off. Sometimes the leads are soldered to the cover lugs, but can be slipped off the tuner terminals. If they are soldered at both points they must either be unsoldered, or cut as a last resort. In the latter case the cut leads will have to be stripped and trimmed for reassembly. Do this now, and take the cover off, putting it in a safe place where it will not be stepped on.

Usually a careful examination of the rear and bottom of the set will show what few bolts and screws must be removed to pull the chassis out of the cabinet. Some connections also will need to be removed to get the chassis out, and some parts, such as the picture tube, will stay in the cabinet. However, usually the picture tube socket will have to be taken off. Try not to wiggle the base of the picture tube too much. It is easy to break off the centering key on the tube base of old sets, as the base material may become brittle with heat and age. If the key breaks off, it will fit back only in one position to get the socket back on correctly.

There could be difficulty if you ever have to service the set again, so it is best to glue the key back on the base right away. Be sure to let it dry thoroughly before you put the socket back on the base. I like a clear "dope" for this purpose, and always turn the set so the picture tube is face down on the bench and so no glue will get on the tube pins. Another point to remember is to be sure there is something soft, a bath towel or whatever, between the face of the tube and the top of the bench. If you don't do this, the face of the tube might get scratched.

Now work the yoke plug out of the socket

The yoke plug if present should be worked out of its socket. If the yoke leads are soldered in place, the yoke must be slipped off and put on top of the chassis. To do this, loosen the screw holding the yoke clamp. Sometimes the plastic flaps on the yoke cover may stick to the neck of the picture tube. Break them free by lifting gently with your fingernail or the blade of a small screwdriver, so the yoke can be slipped off the picture tube neck.

Discharge residual voltage stored in glass envelope

The high voltage lead to the picture tube anode must then be removed from the cavity in the side of the tube. There probably is no voltage stored, but don't take a chance. If a charge is present it can give a nasty shock. For this purpose I use a long screwdriver with an insulated plastic handle. Clip a lead to the shank of the screwdriver and the other end of the clip lead to the case of the high voltage cage containing the high voltage rectifier and flyback transformer. Always discharge the picture tube to this point. Then work the tip of the screwdriver blade under the rubber anode cap attached to the side of the picture tube.

When the grounded screwdriver blade tip touches the anode, the picture tube will discharge the voltage stored between the inner and outer coatings of the picture tube glass envelope. Do this several times at about 15-second intervals to remove any residual charge. It is then safe to work the rubber anode cap around so the prongs of the lead will slip out of the anode cavity and can be removed. If necessary you can turn back the rubber to expose the two connector clips and use a pair of needlenose pliers to get the first clip out. Then the next will be easy to remove. Pull off any remaining knobs and store with the rest of the hardware.

Now the chassis can be worked out of the cabinet. If the loudspeaker leads are not long enough they can be removed by slipping their lugs off the terminals of the speaker or output transformer as the case may be. In only a few cases must the leads be unsoldered or cut.

When you have located the surge resistor, unplug it or cut it loose and install the replacement. The exact value for black and white sets is generally of no importance. A surge resistor between 4 and 6 ohms, rated at around 7 watts, will do nicely. However, don't stop here. Check the low voltage diode rectifier with the 10k range of your ohmmeter to see if it is shorted. Connect the ohmmeter leads across the two leads of the diode rectifier. Note the reading and then reverse the ohmmeter leads. With a good diode, one connection should give a low resistance reading and the other a much higher rating.

If both readings are about the same, disconnect one lead of the diode and recheck. If the readings do not change the rectifier is shorted. To be on the safe side, also check the filter capacitor for a short, as this could have been the cause of the failure. Clip the negative lead of your ohmmeter to the chassis and touch the probe to the circuit point where the cathode of the diode was connected. The resistance reading should gradually build up as the capacitors charge.

A reading of more than 10,000 ohms indicates the capacitors did not draw enough current to short the rectifier or burn out the surge resistor. The replacement diode should then be installed. Be sure to buy the right replacement; for instance, you should ask for a silicon diode for the low voltage in a TV set. Also, be sure you have the correct polarity; otherwise the voltage applied to the filter capacitors will be reversed and could ruin them. The rectifier will be marked with this symbol: 

The arrow represents the anode connection and the flat plate the cathode. Sometimes only the cathode is identified, by a band printed on one end. As with a tube rectifier, the cathode goes to the B+ circuit and the anode lead to the connection that eventually goes to one side of the power line. This symbol can be confusing if you don't remember that electrons flow from the flat symbol into the arrow point.

When the defective parts have been replaced and the set put back together, the job should be completed. I generally charge about $15 (cash and carry). When I can get the diode and surge resistor out of a junk receiver it is all labor return for less than an hour's work! Now let's look at some typical repair jobs.

PHILCO CHASSIS 15G20

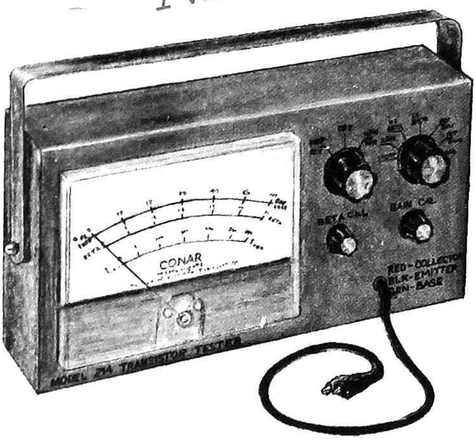
Was called out early on a Sunday morning to look at a neighbor's Magnavox which was completely out of sync, both vertically and horizontally. Found both husband and wife out of sync, too; suffering from a party the night before. They had adjusted everything in sight! Got the sync straightened out in time for the program they "just had to see". In lieu of payment they gave me this Philco which they said was just fine and almost new (it was 10 years old).

CONAR PRESENTS

THE CONAR MODEL 214

TRANSISTOR TESTER

NEW



Conar Guarantees It

Unconditionally

Only Transistor Tester we know of for less than $75 that tests FETs!

For some time there has been a need for a good transistor tester kit. Conar has filled this need with its' own Model 214. Special attention has been given in the development of the Model 214 to ease of construction, accuracy in test results, and usefulness in day-to-day servicing work.

For instance, the Model 214 test both PNP and NPN bipolar transistors by measuring leakage (I_{CBO}) and DC Beta (h_{FE}). A leakage range of 0-200 microamperes and Beta ranges of 0-50 and 0-500 are provided. It detects shorts, open, leakage, low gain and other common transistor defects.

Its usefulness is expanded by its ability to test Field-Effect Transistors. FET's are more widely used than ever before and their use will increase. Don't buy any transistor tester that does not have this important feature. With the 214, you can measure I_{DSS} and Gm (transconductance) of any N or P channel FET. Ranges of 0-20 ma I_{DSS} and 0-50,000 micromhos Gm are provided.

A precision, burnout proof 200 microampere D'Arsonval meter is used in the 214. For ease of construction, all of the circuitry is on a single printed circuit board. If you prefer, the 214 is available as a factory assembled unit.

	Catalog Price	Student Discount Price
KIT Stock # 214UK	$39.95	$35.45
WIRED Stock # 214WT	$49.95	$44.35

SPECIFICATIONS

Tests: Standard (Bipolar) Transistors —
Leakage — 0-200μA;
DC Current Gain (Beta)—Two Ranges: 0-50, 0-500

Field Effect Transistors (FETs) —
Bias Point — I_{DSS} — 0-20 MA
Transconductance — Gm — 0-50,000 μmho

Accuracy: ±10%

Power Requirements: Built in battery supply — two 9-volt standard transistor batteries (NEDA 1604) supplied.

Meter Movement: 200μA D'Arsonval, fully protected . . . burnout proof.

Method of Connection to Transistor under test: Color-Coded Alligator Clips.

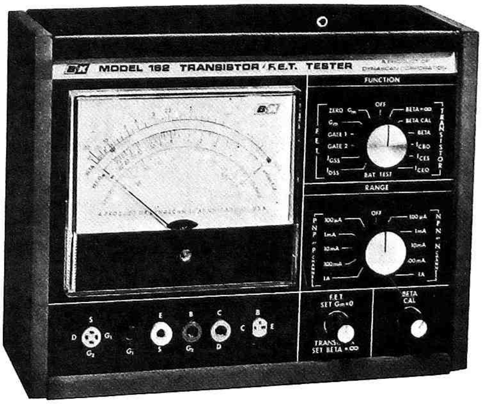
Physical Construction: Identical to 212 TVOM. All parts but batteries mounted on printed circuit board for easy assembly.

Size: 5¾" H x 10¾" W x 2¾" D.

Weight: 3 lbs.

Shipping Weight: 5 lbs. P.P.I.

BRAND NEW . . . B&K TRANSISTOR/FET TESTER



EIGHT EXCLUSIVE FEATURES:

- **SPECIAL BALANCING CIRCUIT:** Permits balancing-out as low as 6 ohms circuit impedance for in-circuit BETA test.
- **HIGHER CURRENT CAPABILITIES:** Up to 1 ampere. You need this for testing power transistors and power FETs.
- **THREE TRANSISTOR LEAKAGE TESTS:** Icbo-Iceo-Ices. Finds failures missed by other transistor testers. Especially avalanched mode breakdown failures, common in horizontal output or other power stages.
- **TESTS EVERYTHING:** Diodes. Bipolars. FETs. Unijunctions. SCR's and Triacs.
- **CORRECT BETA READING:** from 1-5000.
- **FRONT PANEL SOCKETS:** For conventional (bipolar) and FET transistors. Especially useful for FET test. Minimizes damage due to static charges.
- **SEPARATE CHECKS:** Checks Gate 1 and Gate 2 of dual gate FETs separately.
- **PROGRAMMED INSTRUCTION GUIDE:** Provides instruction on Go-no-Go conditions for Beta and Leakage. Eliminates need for bulky transistor reference manuals.

Stock Number 162WT
Shipped Express Collect

$99.95

- The 162 offers the fastest and most simplified method of testing transistors in-circuit and out-of-circuit using same basic procedure!
- Easy-to-read scale on 4¾" high sensitivity meter.
- Simple to operate.
- Instruction manual fits neatly into the back of the 162.
- Battery operated for portability.
- Five selective current ranges.
- Tests are made under circuit conditions to give more valid readings.
- Unique DC injection provides more accurate in-circuit tests in low impedance circuits.

FREE OF EXTRA COST WHEN YOU BUY THE MODEL 162!

Adjustable 3-Point Probe

- Instantly provides connection to 3 printed wiring board terminations.
- Automatically adjusts to any spacing 1/32" to ⅝".
- Each probe point can be rotated in full 360° circle.
- Points individually spring loaded for proper contact.
- Eliminates unsoldering while making in-circuit tests.
- Designed specifically for use with in-circuit transistor testers, VTVM's, VOM's, and TVOM's.
- Probe available separately for $12.95. Stock #33PB.

B&K MODEL 176 SOLID STATE F.E.T. VOM

176 WT
Express Collect

$99.95

the ideal VOM for shop, field and laboratory testing

All the "ease in use" of the old standby VOM — Stable accuracy, "Instant-on" operation, high-impedance input and long-term stability — are yours with this new B & K Model 176 F.E.T. VOM. Extremely low current drain—Field Effect Transistors insure minimum loading. Exclusive complementary symmetry circuit provides balanced temperature compensation for protection of F.E.T.'s from over-voltage transients and for drift-free accuracy. Also makes calibration of plus and minus voltages identical. Unique voltage regulation circuit assures precision measurements by providing constant voltage for life of the batteries.

- Total solid-state with F.E.T.'s for complete stability
- Battery operated, compact, for complete portability
- DC Volts: 8 ranges, accuracy ±2% full scale, input impedance 11 megohms
- AC Volts: 8 ranges, RMS and peak-to-peak on same scale, accuracy 3% full scale, input impedance 10 megohms
- Ohm Meter: 7 ranges, accuracy ±3° scale arc
- DC Current: 6 selective ranges, accuracy ±2% full scale
- Measures audio level at any impedance from −10 db to +66 db
- Fuse and diode protected against accidental overloads
- 4½" high sensitivity meter with convenient center zero scale for special applications
- BNC Connector
- Insulated case eliminates shock hazard
- Easy to use. Clear and complete step-by-step instruction manual eliminates guesswork

ORDER BLANK

CONAR

DIVISION OF NATIONAL RADIO INSTITUTE
3939 WISCONSIN AVENUE • WASHINGTON, D.C. 20016

CHECK ONE:
- ☐ Cash Order
- ☐ C.O.D. (20% deposit required)
- ☐ Select-A-Plan Order

CHECK ONE:
- ☐ New CONAR Account
- ☐ Add-on CONAR Account
- ☐ Re-open CONAR Account

PLEASE PRINT

NRI Student or Graduate No.

Name

Address

City State Zip Code

Moved since last order?

Previous Address City State

Ship to another address? Give Directions here

Name

Address

City State Zip Code

1. NAME OF ITEM	2. STOCK #	3. HOW MANY?	4. PRICE EACH	5. TOTAL	WEIGHT

IMPORTANT

To speed handling, any correspondence should be on separate paper.

All prices are net F.O.B., Wash., D.C.

Please include postage for weight shown and insurance on Parcel Post orders.

Express Orders should not include shipping charges.

A 20% deposit is required on C.O.D. orders. SELECT-A-PLAN ORDERS: Please complete and sign reverse side.

Thank you for your order.

Prices in the CONAR catalog and Select-A-Plan time payment privileges apply only to residents of the United States and Canada. Residents of other countries and territories may obtain CONAR products, through SIGMA INTERNATIONAL CORPORATION, our Export Representatives. Address inquires and send orders to: Sigma International Corporation, 13 East 40th Street, New York, N.Y. 10016.

6. Total Cash Price For Merchandise		
(Do not remit for items shipped Express Collect) 7. Parcel Post and Insurance		
8. 10% Cash Down Payment and Parcel Post Costs Required on New CONAR Accounts		
9. Unpaid Balance of Cash Price (Items 6 & 7 less item 8)		
10. Sales Tax (Washington, D.C. Residents Only)		
11. Unpaid Balance (Amount to be financed) (Item 9 plus item 10)		
12. Finance Charge (See schedule on back)		
13. Total of Payments (Item 11 plus item 12)		
14. Deferred Payment Price (Items 6, 10 and 12)		

Please do not write in this space

RETAIL INSTALLMENT CONTRACT & SECURITY AGREEMENT

CONAR SELECT-A-PLAN

SELECT YOUR TERMS TO FIT YOUR BUDGET

CONAR FINANCIAL RATES:

STANDARD PLAN—The ANNUAL PERCENTAGE RATE is 17.75%

EXTENDED PLAN—The ANNUAL PERCENTAGE RATE is 15.50%

TO SPEED SHIPMENT

1. Complete other side of this sheet.
2. Use Select-A-Plan Schedule on the right to find your Finance Charge and your Monthly Payment.
3. Insert amount of down payment (at least 10% of total order) and other information in Payment Agreement below.
4. Sign Payment Agreement and fill in Credit Application.

IMPORTANT: When you have made three monthly payments, you can "add-on" purchases with no down payment. If you are under 21, please have the Payment Agreement and credit application filled out and signed by a person over 21. He can make the purchase for you and will be responsible for payment. If you have a CONAR account open or recently paid-in-full, just sign the Payment Agreement.

NOTICE TO THE BUYER: (1.) Do not sign this agreement before you read it or if it contains any blank space. (2.) You are entitled to a copy of this signed agreement. (3.) The Finance Charge will be waived if the unpaid balance is paid within 30 days. If paid within 60 days, the Finance Charge will be reduced by ⅔; if paid within 90 days, the Finance Charge will be reduced by ⅓. Accounts extending beyond 30 days will pay up to $3 in Credit Service Charges before the above reductions are made.

SELECT-A-PLAN SCHEDULE

PLEASE CHECK ONE: ☐ STANDARD PLAN ☐ EXTENDED PLAN

IF UNPAID BALANCE IS	STANDARD PLAN Finan-cial Charge	STANDARD PLAN Monthly Pay-ments	EXTENDED PLAN Finan-cial Charge	EXTENDED PLAN Monthly Pay-ments
20.01- 25.00	1.05	3.50		
25.01- 30.00	1.50	4.00		
30.01- 35.00	2.05	4.50		
35.01- 40.00	2.65	4.75		
40.01- 50.00	3.00	5.00		
50.01- 60.00	4.15	5.50		
60.01- 70.00	5.50	6.00	6.40	4.50
70.01- 80.00	7.00	6.50	8.00	5.00
80.01- 90.00	8.00	7.75	10.10	5.00
90.01-100.00	9.00	8.75	12.60	5.25
100.01-110.00	10.00	9.75	14.80	5.50
110.01-120.00	11.00	10.75	16.20	6.00
120.01-130.00	12.00	11.75	17.60	6.50
130.01-140.00	13.00	12.75	19.40	7.00
140.01-150.00	14.00	13.75	21.60	7.50
150.01-160.00	15.00	14.75	23.20	8.00
160.01-170.00	16.00	15.75	24.80	8.50
170.01-180.00	17.00	16.75	26.20	9.00
180.01-200.00	18.00	17.00	27.90	10.00
200.01-220.00	20.00	18.50	29.80	11.00
220.01-240.00	22.00	20.00	32.40	12.00
240.01-260.00	24.00	22.00	35.20	13.00
260.01-280.00	26.00	24.00	38.20	14.50
280.01-300.00	30.00	24.50	41.20	15.50
300.01-320.00	32.00	25.50	44.20	17.00
320.01-340.00	35.00	27.00	47.80	18.00
340.01-370.00	38.00	28.00	52.40	18.50
370.01-400.00	42.00	29.50	57.20	20.00
400.01-430.00	46.00	31.50	62.20	21.00
430.01-460.00	49.50	34.00	69.00	22.00

ON ORDERS OVER $460.00 THE FINANCIAL CHARGE ON THE EXTENDED PLAN WILL BE 15% AND PAYMENTS WILL BE IN PROPORTION TO AMOUNTS SHOWN ON ABOVE SCHEDULE.

HOW TO DETERMINE THE NUMBER AND AMOUNT OF MONTHLY PAYMENTS TO REPAY THE "TOTAL OF PAYMENTS"

Use the Select-A-Plan Schedule to find out what your monthly payment is. Then divide your monthly payment into your "Total of Payments" to find out how many monthly payments you must make. The amount which is left over is your final payment. FOR EXAMPLE, if your unpaid balance is $95, then your monthly payment is $8.75 (using the Standard Plan). If your "Total of Payments" is $104, then your monthly payment of $8.75 divides into that number 11 times with $7.75 left over. This means you make 11 payments of $8.75 each, plus a final payment of $7.75.

PAYMENT AGREEMENT

Enclosed is a down payment of $.................... on the merchandise I have listed on the reverse side. Beginning 30 days from date of shipment, I will pay CONAR $.................... each month for .... months, plus a final monthly payment of $.................... Title to and right of possession of the merchandise shall remain in you until all payments have been made. If I do not make the payments as agreed, you may declare the entire balance immediately due and payable. In satisfaction of the balance, you may at your option, take back the merchandise, which I agree to return at your request. I understand that a 1% accounting charge will be added to my unpaid balance if my payments become 60 days or more in arrears. I agree that the above conditions shall apply to any add-on purchases to my Select-A-Plan account. The statements below are true and are made for the purpose of receiving credit.

DATE .... BUYER SIGN HERE ....

IT'S AS EASY AS A - B - C TO OPEN A CONAR ACCOUNT

PLEASE ALLOW ADEQUATE TIME FOR NORMAL ROUTINE CREDIT CHECK. ONCE YOUR CREDIT IS ESTABLISHED, ONLY YOUR SIGNATURE IS NEEDED TO ADD ON PURCHASES

A → WHERE DO YOU LIVE?

PRINT FULL NAME .... Age ....

HOME ADDRESS .... CITY .... STATE .... ZIP CODE ....

HOME PHONE ....

HOW LONG AT THIS ADDRESS ....

( ) OWN HOME ( ) RENT

RENT OR MORTGAGE PAYMENTS $.................. PER. MO.

WIFE'S NAME ....

MARITAL STATUS ( ) MARRIED ( ) SINGLE

NUMBER OF DEPENDENT CHILDREN ....

PREVIOUS ADDRESS .... HOW LONG? ....

B → WHERE DO YOU WORK?

YOUR EMPLOYER .... POSITION ....

MONTHLY INCOME $..........

EMPLOYER'S ADDRESS ....
Street City State

HOW MANY YEARS ON PRESENT JOB? ....

PREVIOUS EMPLOYER ....
Name Address

HOW LONG? ....

WIFE'S EMPLOYER ....
Name Address

MONTHLY INCOME $..........

C → WHERE DO YOU TRADE?

BANK ACCOUNT WITH ....
Street City State

( ) CHECKING

( ) SAVINGS

CREDIT ACCOUNT WITH ....
Street City State

( ) LOAN

CREDIT ACCOUNT WITH ....
Street City State

TOTAL OF ALL MONTHLY PAYMENTS INCLUDING CAR $..........

When I got it back home there was sound but no raster. Then I proceeded to outsmart myself. In a previous article I told how a neon bulb on the end of an insulated stick could be used to detect the presence of horizontal sweep signals around the horizontal output tube envelope, its top cap, the damper envelope, the yoke, and the high voltage rectifier tube. So --- I got out my neon bulb outfit and went to work. There was a normal glow when the bulb was placed against the top cap of the horizontal output tube, the damper tube envelope, the yoke horizontal winding, and the top cap and envelope of the high voltage rectifier tube. This indicated the possibility of a defective high voltage rectifier tube, but a new tube made no difference.

The rectifier filament was not lighting up, but why?

Then checked the picture tube and found it be be all right. Checked the grid-to-cathode voltage of the picture tube to make sure that the tube was not overbiased to cutoff. Everything was normal. Next I got out my high voltage probe and checked for anode voltage on the picture tube. There was practically no voltage, and this of course was the reason for no raster. There is a series-limiting resistor between the filament of the high voltage rectifier and the anode of the picture tube, but this checked out as well. Then checked the continuity of the new rectifier tube filament with the tube out of the socket. It was okay. The glow of the neon bulb all around the rectifier envelope was as bright as I had ever seen in a black and white set, indicating plenty of voltage waiting to be rectified. Guessed the rectifier filament was not lighting up, but why?

While thinking things over, messed around with all service controls on the back of the set, and once saw a faint raster, compressed and wider at the bottom than at the top. This of course pointed to a yoke defect, but the trace was just that, barely visible. It disappeared almost at once and could not be brought back. Was still all shook up about the apparent lack of filament voltage on the high voltage rectifier tube. Managed to unhitch everything and got the rectifier tube with its socket out of the high voltage compartment and positioned it so I could see inside the tube envelope. Sure enough, the filament showed no glow.

Suspect an intermittent open in the filament circuit

Then I did a dangerous thing. Hooked an ac voltmeter (plastic encased multimeter, not a vtvm) to the high voltage filament lugs on the tube socket and turned on the set, being careful to keep away from the meter. From the way the meter needle acted, showing zero volts and then jumping to three volts and then back again to zero, it was clear that voltage was not being applied long enough for the filament to heat up to the point where electrons would be emitted. Resisted the impulse to connect a 1.5 volt D cell across the rectifier filament leads, which would have worked but helped nothing. Instead suspected an intermittent open in the filament circuit. So connected the ohmmeter--tube removed--to the filament socket leads, which are around the core of the flyback transformer. In this set they are neatly held in a plastic ring of some kind (unusual).

While I succeeded in breaking the ring (not on purpose), everything tested normal. Had a feeling that things were not going so well, so gave up this line of search and put the

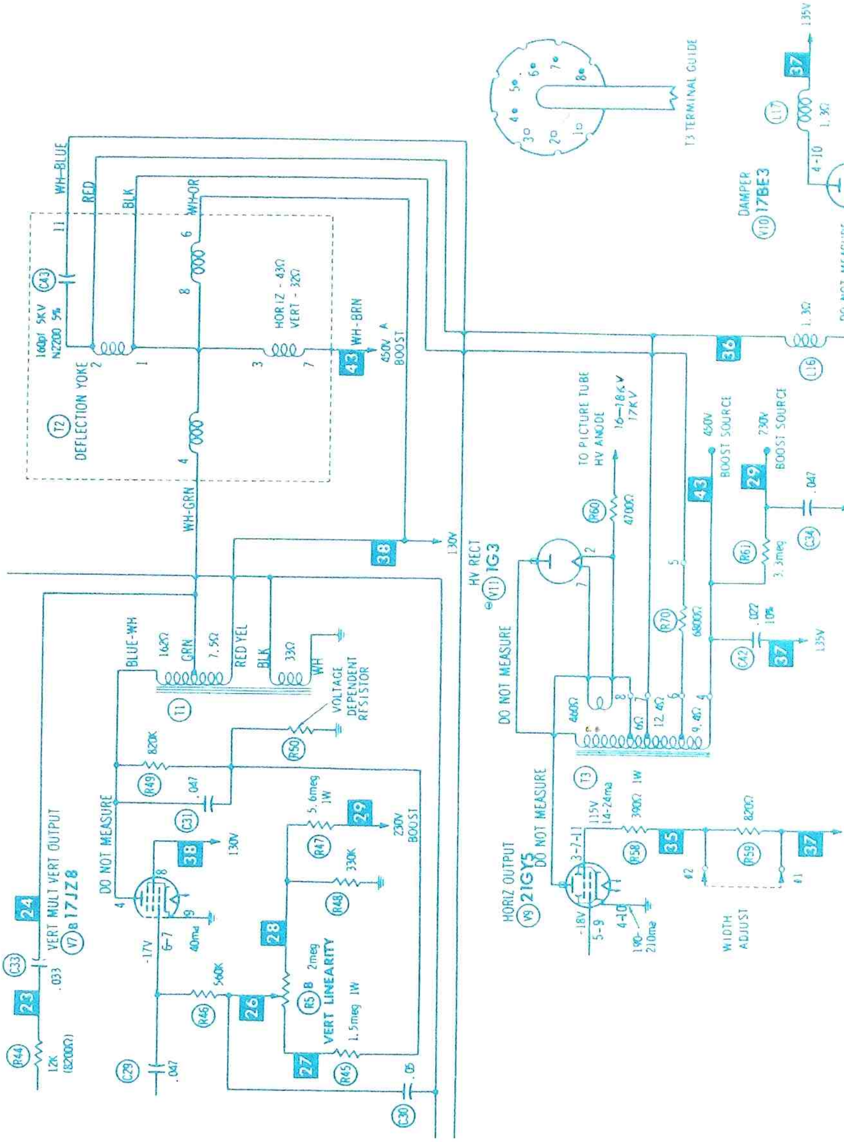


Fig. 1. Vertical, horizontal and high voltage circuits of Philco chassis 15G20.

in the flyback transformer and yoke. This intermittent short prevented the 1G3 filament from being heated and was the cause of no high voltage and no visible raster.

Moral: "Straughn, next time believe your eyes and investigate all symptoms. If it had not been for the off resistance reading in the boost circuit, you would have bought a new flyback transformer--and would have still been scratching your head." Oh, well. I like to investigate the unusual and experiment, so it's just as well, since everything worked out okay.

RCA CHASSIS CTC22A

This color set was dead, though by looking through the ventilation slits in the rear cover, I could see the tubes were lit. The set has a circuit breaker with the conventional red button protruding through a hole in the rear cover. This, when pushed in, immediately popped out again, indicating some kind of an overload. These circuit breakers (used instead of fusible surge resistors) open the B supply circuit if the current flow is excessive, and thus protect other parts from damage.

I decided the excess current was probably being drawn by the horizontal output tube, and removed the back. Found that the horizontal oscillator and output tubes were 5GH8 and 17JF6 respectively. The 5GH8 tested okay, which meant that the oscillator was probably working and feeding signal to the output tube. The lack of this signal would remove bias on the output tube and its cathode current could rise to the point where the circuit breaker would open up.

The roll chart on my tube tester is about three years old and did not list the 17JF6. However, it did list the 22JF6, whose settings should be the same, except for filament voltage. I looked up some 17-volt tubes on the chart and got the setting for my 17JF6 filament voltage setting from them. Then, using the other data from the 22JF6, I proceeded to check the 17JF6 which checked okay. Neither the 12CT3 damper tube nor anything like it was listed in my roll chart, so I took it and the other two tubes when I went to the wholesaler's for the set manual, which I felt I would need. The information for their tube tester was no better than mine, and they didn't even have the 12CT3 damper tube in stock. Not being of a trusting nature, I also purchased a new 5GH8 and a 17JF6 tube.

Back at my bedroom shop, the new tubes did not help, so I studied the schematic and found the low voltage power supply arranged as shown in Fig. 2. This was a new circuit to me, as most B supply circuit breakers are ahead of the rectifiers and have only two leads! The third lead went to a built-in grounded resistor, whose free lead went to the cathode of the horizontal output tube. If the cathode current of this tube became too high, the heat transfer to the circuit breaker element would cause the breaker to open up. So the trouble could still be due to excess current drawn by the output tube.

A further search of the schematic showed that the filaments (except the picture tube) were arranged in two strings with the tube filaments of each string in series. Removal of rectifier back where it belonged. For nothing better to do, started taking point-to-point resistance measurements. When I came to the 17BE3 damper tube I measured 5 megohms to ground from its cathode (pin 7) instead of the 10-megohms called for.

Were capacitors causing the low resistance?

The circuits involved are shown in Fig. 1. The path to ground from the cathode of the 17BE3 is through the horizontal yoke winding and the flyback transformer, the 3.3 meg resistor to the 230V boost terminal, the 5.6 meg resistor and the 330k resistor (vertical circuit) to ground. A further examination of this circuit showed the low resistance reading could be due to leakage in capacitors C42, C34, or C43, the latter mounted on the yoke. Unsoldered one lead of each capacitor and checked individually with the ohmmeter for leakage. All were okay.

Looking at the schematic again, it can be seen that leakage from the flyback winding to its core or from the horizontal to the vertical winding of the yoke could result in this low reading. The yoke is not the plug-in type, so to separate the flyback and yoke for individual tests it was necessary to unsolder all the horizontal leads of the yoke, first drawing a pictorial showing the connecting points. With the horizontal section of the yoke disconnected the resistance from pin 7 of the 17BE3 damper tube to the chassis went from 5 megohms to nearly the called-for 10 megohms. Then a check from any of the disconnected horizontal yoke leads to the chassis showed leakage, which should not have been present, and proved that a high resistance path from the horizontal to the vertical yoke windings did in fact exist.

At this point I called the nearest Philco-Ford Distributor Parts Dept. and had them send me out a new yoke. This was delivered two days later, at which time the pictorial drawing made previously came in handy. The set took off and worked fine until an arc developed at the point where I had broken the plastic ring holding the high voltage rectifier filament leads on the core of the flyback transformer. Must have broken the wire insulation.

Said a few choice words and then got out my bottle of dope and smeared it on the place where the arc had occurred. Let dry for an hour and then redoped. Because of prior experience repeated the treatment three times before trying to set out again. This time there was no arcing and I had a good receiver at a cost of a little over $13 and a lot of unnecessary work. Later sold it to a customer for $40 and his junk receiver in trade.

You're supposed to use your head, too

Hindsight told me that I had wasted a lot of time on what could have been a routine job if I had just remembered the faint trapezoid I saw for a moment on the screen, indicating a defective yoke. What fooled me was the apparent existence of a large amount of horizontal energy picked up by the neon bulb around the high voltage tube. Thinking back, I could see that the measured leakage between the horizontal and vertical yoke windings was not enough to cause lack of high voltage and failure to heat the 1G3 filament. This indicated that in operation a much lower leakage resistance must have occurred when the horizontal output plate current was cut off and higher voltage induced

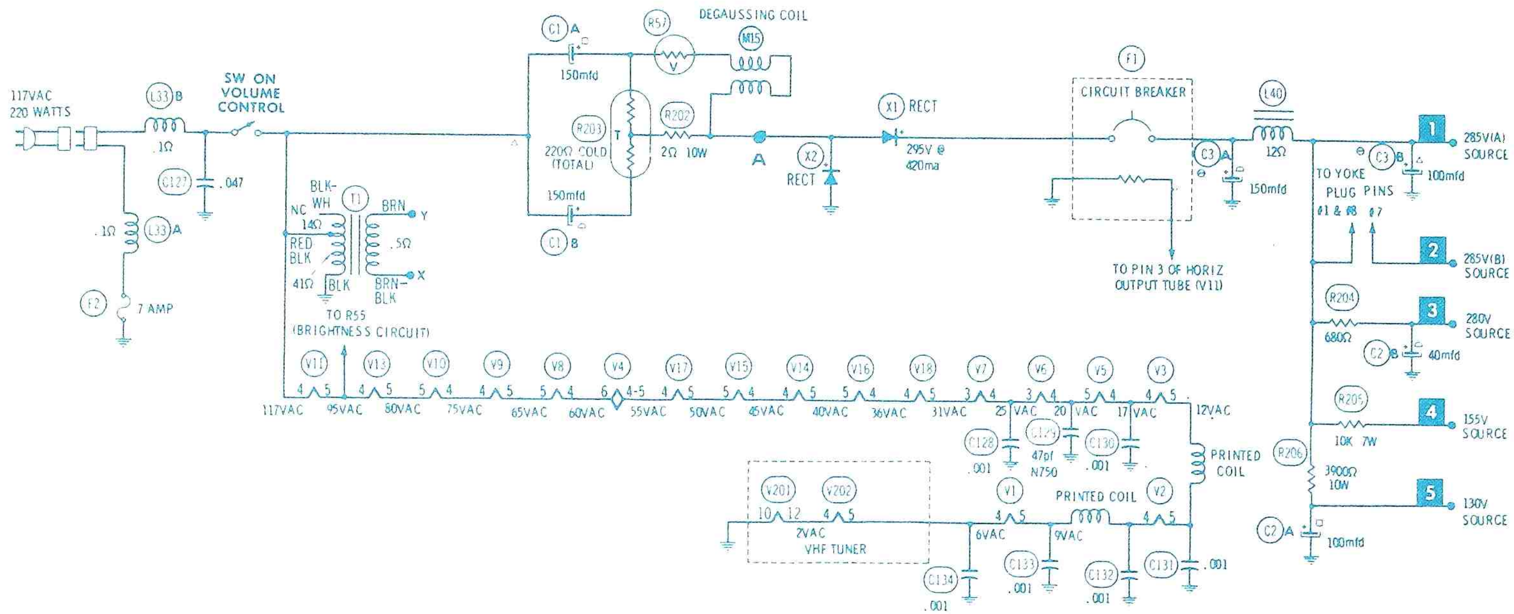


Fig. 2. Low voltage power supply of RCA Chassis CTC22A.

one tube in a string prevented the rest of the tubes in that string from lighting. So I removed a tube in the string containing the 17JF6 and turned on the set, which at once caused the circuit breaker to open. This was proof positive that the trouble was not due to excess cathode current by a tube in this string.

With the circuit breaker closed and the set unplugged from the line, I used the ohmmeter to locate the circuit breaker lead to the cathode of the output tube (had the lowest resistance to ground). The remaining two leads had to go to the B supply circuit. A check from them to the chassis (ohmmeter) showed a resistance of about 8,000 ohms. This seemed low until a check of the circuit diagram (Fig. 2 not complete) showed a number of fairly low resistance paths from B+ to the chassis. This was a fine state of affairs! The trouble was not because of excess current drawn by a tube or to a short on the right-hand side of the circuit breaker in the B supply system. Some more study of the schematic in Fig. 2 convinced me that the trouble would result if low voltage rectifier X1 was shorted.

To check this it was necessary to pull the chassis. Then I discovered I needed a long

E.J. IMMEL IS WINNER OF 1971 GERNSBACK SCHOLARSHIP AWARD

Winner of the second annual Hugo Gernsback Scholarship Award for 1971 is Earl J. Immel of Tom's River, N.J. The award was established by Radio-Electronics Magazine in 1970 in memory of its founder. NRI is one of eight home-study schools chosen to participate, with the awards going to currently enrolled students to help further their education in electronics.

The award "came as a complete surprise" to Mr. Immel, a student in NRI's Marine Communications Course. "He had no idea that I had nominated him," said Mrs. Immel. "It was a perfect Christmas gift. I put the letter in a box and wrapped it as one of his Christmas presents. Needless to say he was delighted." Mrs. Immel gave him another, belated Christmas present. Their second child, a girl, was born on New Year's Eve.

Special awards of $25, in honor of NRI's founder, James E. Smith, go to students Kenneth M. Biffle of Broken Arrow, Oklahoma, and Fred Wirth, Jr., of Madison, Wisconsin. NRI also gives honorable mention awards to the following students: John Esberg, Minneapolis, Minn.; Richard Mullins, Great Falls, Mont.; James R. Hart, Plant City, Fla.; James J. Walsh, El Paso, Tex.; Virgil Thomas, Pueblo, Colo.; Ralph I. Maxwell, Amherst, N.H.; C. W. Hartley, Enid, Okla.; Arnold Kimsey King, Woodland, N.C.; Barry Kreel, Toronto, Canada; James R. Lindner, Largo, Fla.; James O. Grove, Friendly, W. Va.; Joe P. Mifsud, Detroit, Mich.; Robert E. Walden, Sherwood, Oregon; John L. Fowlkes, Jersey City, N.J.; Douglas Robbins, Nashville, Tenn.; Lewis Miller, Coshocton, Ohio; Gerald D. Murray, Dayton, Ohio; F.B. Hays, Pensacola, Fla.

socket wrench, which I did not have. All my wrenches except a red 1/4" job are the usual short-shaft ones. So, off to town again to get a long-handled socket wrench and a fresh supply of diodes, as my supply of the latter was exhausted.

The wrench business set me thinking. Since I purchased the red long-handled wrench I have never used the corresponding short one. The long one had proved okay for all purposes, so why buy short wrenches except for the ease of carrying them on the job? Further, the only wrenches I use are those with the following handle colors (which also denote their sizes): RED, BLUE, GREEN, and YELLOW. All these sizes are from 1/4" and up. I would have been better off to start with by buying only long-handled wrenches. You might keep this in mind when you buy wrenches. If you get a complete set of the short ones in a case, also buy the aforementioned long-handled colors in the long-shaft wrenches.

To get back to the job: With the set out of the cabinet, X1 was located and proved to be completely shorted, as an ohmmeter test showed--just a few ohms even after reversing the ohmmeter test lead polarity. With the new diode installed, the circuit breaker stayed in when the set was turned on, and I received a beautiful color picture.

The diodes cost me 60 cents wholesale, but was stuck with two tubes it might be years before I could use; the price of a Sam's manual and two 80-mile round trips. The total bill came to $26.50, with which the customer was very happy.

(This is typical of the experiences of a spare-time serviceman. If I ever go full time I will get a complete set of manuals and subscribe to all new issues.)

As an afterthought, what caused me to believe that diode X1, if shorted, would cause the circuit breaker to open? If you look at Fig. 2 again, you will see that a breakdown in X1 would place the ac power line directly across C1a, C1b and C3. When the line voltage was opposite to that of the electrolytics, they would pass excess current and X2 would not rectify because C3 with incorrect polarity was directly across it. If continued for any length of time, all three capacitors would overheat and be ruined. The current flow for the instant the circuit breaker stayed closed was enough to open up this safety device and was the cause of the observed symptom. With the schematic to go with, much time and trouble would have been saved as this possibility could have been deduced almost right away. Without the diagram it would never have occurred to me that the circuit breaker was placed in such a strange position. The use of the third lug on the breaker, with its low resistance to chassis, would have confused the situation even more.

However, the position of the circuit breaker in Fig. 2 still confuses me. It offers no protection if X2 shorts. It looks as though it should have been placed at point A. Then protection against a short in either rectifier would have been present. Of course this would call for a different capacitance of circuit breaker as considerably more current normally flows at point A. To position it on the left-hand side of C1a-C1b would be out of the question. The starting current of the degaussing coil is too high. □

NRI HONORS PROGRAM AWARDS

For outstanding grades throughout their NRI courses of study, the following November and December graduates were given Certificates of Distinction along with their NRI Electronics Diplomas.

with highest honors

Otto Brown, Inez, KY
Melvin F. Bourn, Jacksonville, FL
Ray R. Burchardt, Wausau, WI
Steward F. Caldwell, FPO San Francisco
James D. Holler, Woodridge, IL
Samuel F. Houston, Buffalo, NY
Robert A. LaBudde, Madison, WI
Melvyn D. Lawin, Cary, NC
Earl Moore, Asheboro, NC
Joe Park, Ganado, TX
Billie H. Pierce, San Antonio, TX
Thomas L. Stovall, III, Andrews AFB MD

with high honors

David A. Adams, Camden, ME
Clarence D. Alger, Jr., Jamestown, NY
Dennis L. Andersen, San Pablo, CA
Elmer H. Blush, Jr., Arlington, VA
Joseph E. Bourque, Concord, NH
Robert L. Braley, Laval, PQ Canada
Larry W. Bridges, Harrisonburg, VA
Gustave A. Broset, Sr, Peru, IL
Benjamin P. Buchholz, Virginia Beach, VA
George S. Bulau, Centreville, VA
William A. Callis, Silver Spring, MD
John J. Cannarella, Madison, WI
Michael Dennis Cibak, Washington, IN
Ronald L. DeWester, Benkelman, NB Canada
Leonard Farney, Melrose, MA
Ludger O. Gagne, Haverhill, MA
John G. Gary, Detroit, MI
R. D. Glover, Calgary, Alta, Canada
James L. Haigler, Virginia Beach, VA
Peter L. Hendricks, Kamula, HI
John C. Hoenninger, III, San Leandro, CA
Robert B. Hoesly, Overland Park, KS
Edward Kaminski, Fall River, MA
Ronald L. King, Sugar Grove, IL
Lawrence Klein, Angola, NY
Richard M. Klinger, FPO San Francisco
Charles H. Kneiss, Suitland, MD
Stanley M. Krause, Fort Meade, MD
Joe F. Kyle, APO San Francisco
Panayotis A. Lebessis, Athens, Greece
Alex Lem, Toronto, Ont Canada
James R. Lindner, Largo, FL
Alton D. Locke, Romulus, MI
George Mamula, Washington, PA
Michael Markov, Lockwood, NY
Jerry L. Marsh, Dunkirk, NY
Earl W. Mason, Long Branch, NJ
Billie D. McConnell, Dallas, TX
William T. Metzger, Wappingers Falls, NY
Gordon R. Moiles, New Carrollton, MD
Michael J. Platt, Mankato, MN
Oren F. Potito, Ocala, FL
Robert M. Puryear, Washington, DC
Paul L. Reese, North Terre Haute, IN
William E. Rickard, Fredonia, NY
Anthony Romba, Schaumburg, IL
Charles F. Rothert, Valencia, PA
Floyd T. Rzewnicki, Leechburg, PA
Frank G. Schick, Romulus, MI
William F. Schwab, Elkins Park, PA
Chas S. Slingluff, APO New York
Ernest W. Sponaugle, Lima, OH
William Stapleton, Bronx, NY
Theodore R. Studerus, Albuquerque, NM
Wesley B. Terry, Carlsbad, CA
Lonnie Eugene Treese, APO San Francisco
Henry J. Umstetter, Jr., Turnersville, NJ
A. R. Underwood, Lizella, GA
William Vanderlaan, Virginia Beach, VA
Chas. T. Wielgopolski, Wilkes-Barre, PA
Charles P. Wilkins, III, Woonsocket, RI
Edward J. Zelt, St. Marys, PA

with honors

Robert R. Bales, Kincheloe AFB, MI
Lloyd R. Best, Abilene, TX
Charles Breckinridge, Jr., Little Rock, AR
Norman E. Buler, Lakeville, PA
Johannes M. Buyten, South Lake Tahoe, CA
Costantino Castrilli, Bernardsville, NJ
Clayton Comeaux, Raceland, LA
Sanford S. Cortner, Bellingham, WA
Sue Coulter, Lamont, CA
Robert J. Danders, Jr., APO New York
Robert F. Downer, Matthews, NC
C. F. Farabee, Olive Branch, MS
Charles R. Farnsworth, Portland, ME
Angelo E. Fiorino, Baltimore, MD
Valdis Freijs, Stapleton Staten Island, NY
Joel E. Gibson, Hoffman Estates, IL
Derrell J. Harrison, Beebe, AR
Richard J. Harrison, APO New York
Selden C. Hayes, Ballston Lake, NY
Kurt P. Hays, APO New York
James K. Henderson, Morehead City, NC
Robert L. Hinds, Muncie, IN
Edward F. Holscher, Roseville, MI
Robert H. Huff, Jr., Baltimore, MD
Jacob J. Jachna, Chicago, IL
Frank B. Laube, St. Louis, MO
Fred R. Lewis, Jr., Candler, NC
Gary Marsh, Hawthorne, CA
John H. Mason, White Sands MSL Range, NM
John D. McClintock, Jr. APO San Francisco
Carl J. McCormick, Bossier City, LA
Carlos Mier, Torrance, CA
David Miller, Old Town, ME
William H. Moore, Lancaster, CA
Marvin P. Morrison, Fort Meade, MD
Herbert Naugle, Hayward, CA
Marvin D. Neff, Middlebourne, W VA
Wayne H. Newton, San Antonio, TX
David L. O'Bryan, Vieques, PR
Robert A. Oehmichen, Kenner, LA
Robert B. Palmer, Jr., Las Vegas, NV
Enrico L. Perruzzi, Florissant, MO
William C. Perry, La Marque, TX
Harry J. Peterson, Duson, LA
Charles M. Philyaw, Palm Bay, FL
Leslie J. Potter, Albany, GA
R. Reg Potter, Mokomis, Sask, Canada
Frederick M. Prescott, Lawtey, FL
Avelino P. Rabara, Agana, Guam
Robert M. Rackliff, Stratton, ME
Frank G. Revill, Toledo, OH
Joseph E. Robidoux, Holloman AFB NM
Lino A. Rodriguez, Jr., Hobbs, NM
Leonard Salsbury, Fulton, NY
Harry J. Schuppenhauer, Kirkland, WA
Robert S. Sheffer, FPO San Francisco
Ralph E. Spangler, Dove Creek, CO
Walter Sposkoski, Townville, PA
John A. Tanguay, Denver, CO
William G. Taylor, Jr., Corpus Christi, TX
Robert Tefel, Bronx, NY
Donald D. Thompson, Peoria, IL
Carlos R. Travis, Statesville, NC
James L. Tutor, San Angelo, TX
Kenneth A. Tyler, Lousiville, KY
Donald Richard Voisin, Prince George, BC Canada
Edwin W. Warner, Independence, KS
Walter J. Wheeler, Topsham, ME
Raymond White, Danville, IL
Dennis J. Wieschowski, Alpena, MI
Joseph J. Witko, Carbondale, PA
Barry S. Young, Pen Argyl, PA
Mohammed Adel Zeitouni, Aleppo Syrian ARAB Republic

Inadvertently omitted from previous lists of honors graduates in the NRI Journal were the following:

WITH HIGH HONORS

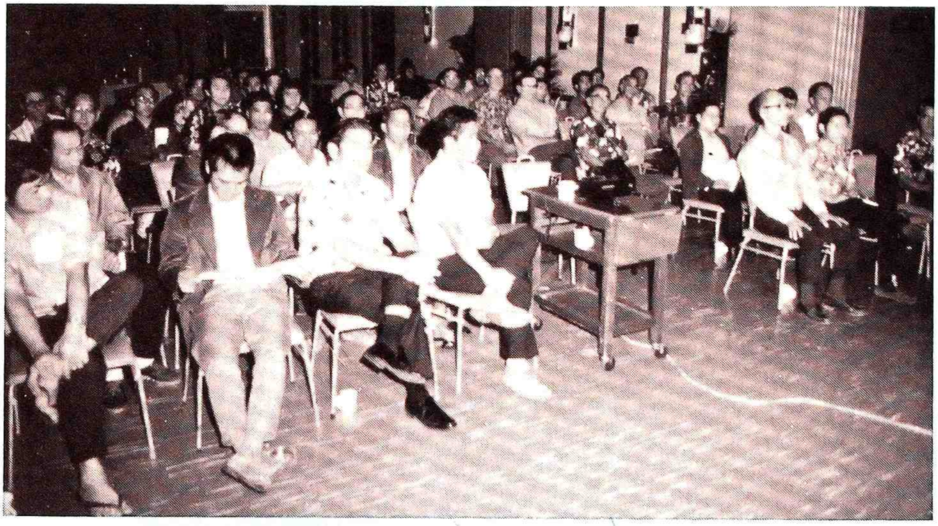
William A. Callis, Silver Spring, Md.

Luverne D. Grant, Phoenix, AZ

Is there an alumni chapter near you? Then why don't you visit it? You'll be made to feel very welcome, as well as meeting people experienced in your own field, and seeing demonstrations of innovations.

See Page 32 for meeting times and places of local chapters.

Alumni Meeting In Blue Hawaii



Fifty-two alumni and friends were at the meeting Tom Nolan held in Hawaii.

By Tom Nolan, Executive Secretary

During the month of November your Executive Secretary spent a short while in Hawaii. My son is in the submarine service at Pearl Harbor and while visiting him I was able to hold an Alumni meeting at the Ala Moana Shopping Center in Honolulu on the Island of Oahu.

As you can see from the photograph, we had a very good turnout of 52 Alumni and friends.

I wish to express my appreciation to Mr. Edward White, the Director of the Electronics Institute of Hawaii, who was instrumental in finding the meeting place and in encouraging some of his students to attend the meeting.

At the present time there is a strong possibility that we may be able to form a chapter in Honolulu. This would become the chapter the greatest distance away from home base that NRI would have.

I wish to express my thanks to the Alumni members and members of the Electronics Institute of Hawaii, along with Mr. Edward White who made this meeting possible.

While in Hawaii my wife, my son and myself were able to tour two other Islands, Maui, the "Valley" Island and Hawaii, "Big" or "Orchid" Island. Both the weather and the hospitality of Hawaii are wonderful and we appreciated every moment that we were there.

Alumni News

Andrew Jobbagy.	President
Charles Traham	Vice-Pres.
John Rote	Vice-Pres.
William Simms.	Vice-Pres.
Andrew Perry	Vice-Pres.
T. F. Nolan.	Exec. Sec.

Chapters Have Lively Meetings, Elect And Install 1972 Officers

DETROIT CHAPTER STUDIES SOLID-STATE CIRCUITRY

At the November meeting, Detroit Chapter members checked through five different transistor radios and observed variations in power supply current in each receiver.

James Kelley, Chairman, brought in two Zener diodes, and showed with a variable voltage source and an ammeter how to test Zener diodes. One was found to be 6 volts and the other 7-1/2 volts.

NRI student Lawrence Mytek was a visitor at the meeting. The Chapter wishes more students would visit, even if just to say hello!

Leo Blevens, back from a European tour, gave a talk on the status of the electronics field abroad and John Nagy, the chapter's voltmeter specialist, demonstrated that instrument.

FLINT-SAGINAW VALLEY STUDIES CONVERGENCE

At end-of-the-year meetings of the Flint-Saginaw Valley, Chairman Andrew Jobbaggy, Frederick Malek and Steve Avetta joined forces to give a program of instruction on the convergence setup of a color TV. Mr. Malek brought along his new Sencore CG153 color bar generator to compare with the Sencore Model 141; little difference was found in the results. George Rashead brought in a black and

white set with vertical troubles, and the members used it for a practical example of repair work.

The membership is looking forward to a new year of stimulating meetings.

NORTH JERSEY WELCOMES SECOND GENERATION MEMBER

Steven Kitchen, son of George Kitchen of the North Jersey Chapter, was welcomed as a new member at an end-of-the year meeting. Also welcomed was the evening's guest, Thomas G. Baker.

At the November meeting, Vice Chairman Franklin Lucas gave a lecture and demonstration using the chapter's transistor radio demonstration board. As it was a first for some members, he gave a follow-up demonstration at the next meeting. The talk was so interesting and informative that the meeting lasted longer than any have in many years, and the members felt that much was accomplished.

Election of officers for 1972 was held, and the whole slate of current officers was re-elected unanimously: Chairman George Stoll; Vice Chairman Franklin Lucas; Treasurer Leroy Frienschner, and Secretary Harry Weitz.

NEW YORK CHAPTER ELECTS NEW OFFICERS

At the November meeting of the New York Chapter, officers for the coming year were elected. They include Sam Antman, re-elected as Chairman, Al Bimstien, Executive Chairman; Jim Eaddy, First Vice Chairman; S. Kross, Second Vice Chairman; Ted Freije, Secretary, and Roy DaSilva, Treasurer.

Sharing the speakers rostrum were Willie Foggie, Steve Kross and Sam Antman, for a very interesting discussion on typical troubles in TV circuits and how to troubleshoot them. In December, the chapter played host to Tom Nolan, Executive Secretary. A record turnout was present for a lecture on solid-state devices and their use in color television. Mr. Nolan also installed the officers for the coming year. At the end of the meeting refreshments were served.

MANUFACTURER'S REPS SPEAK AT PITTSBURGH

At the November meeting of the Pittsburgh Chapter, William Sinclair, field representative for General Electric, gave a talk on the 1972 TV receivers, showing slides on the GE Model TR465, the company's first completely transistorized model. It apparently is a very easy chassis to service.

At the December meeting, Ralph Wright and Dick VanDervort, regional sales manager and area manager respectively for Sencore test equipment, showed the company's latest equipment and demonstrated how to use it in service work. The chapter appreciates the fact that these gentlemen take the time to come visit and increase members' knowledge of what equipment is available and how to use it.

New officers for 1972 are: Chairman, Charles Kelley; Vice Chairman, John Benoit; Treasurer, William Sames; Secretary, Joseph M. Burnelis; Directors, James L. Wheeler, George McElwain, and Thomas D. Schnader.

SAN ANTONIO CHAPTER ELECTS NEW OFFICERS

At the November meeting of the San Antonio (Alamo) Chapter, Bob Bonge and Sam Stinebaugh played a game of "What's My Line?" for members, based on the color killer circuitry and chroma bandpass circuitry in color TV receivers. Members in attendance found it a very instructive game, and with such a properly chosen subject and preparation, it couldn't help but be interesting.

The chapter's annual dinner was held at the Four Brothers Steak House. Eleven members, eight wives and two guests attended for a total of 21 people. This dinner has become a tradition with the chapter, and members always look forward to it.

Officers for 1972 have been elected. They include: Chairman, Robert E. Bonge; Vice Chairman, Ernest B. Hudson; Treasurer, Sam O. Bentler, and Secretary, Sam T. Stinebaugh.

Bob Bonge's first action as chairman was to appoint a very live wire, Guy Elder, to head a membership committee in an attempt to increase membership.

SPRINGFIELD CHAPTER HONORS TOM NOLAN

At a special meeting in December, the Springfield Chapter honored Alumni Association Executive Secretary Tom Nolan. The Chapter wishes to express sincerest thanks and appreciation to Mr. Nolan. At this meeting, he lectured for more than three hours, explaining in detail various phases and aspects of solid-state devices. Through blackboard illustrations, he showed troubleshooting techniques on many types of TV receiver, commenting that solid-state devices are here to stay, and tubes almost a thing of the past.

At the meeting, the Chapter was informed of a misfortune befalling its past chairman, Brother Bernard Frey, but at the same time the better news that he is on the mend. He had fallen from a tower while installing an antenna for his amateur radio station. At any rate, the chapter is glad to hear he will soon be able to travel around again.

● ● ●

white set with vertical troubles, and the members used it for a practical example of repair work.

The membership is looking forward to a new year of stimulating meetings.

NORTH JERSEY WELCOMES SECOND GENERATION MEMBER

Steven Kitchen, son of George Kitchen of the North Jersey Chapter, was welcomed as a new member at an end-of-the year meeting. Also welcomed was the evening's guest, Thomas G. Baker.

At the November meeting, Vice Chairman Franklin Lucas gave a lecture and demonstration using the chapter's transistor radio demonstration board. As it was a first for some members, he gave a follow-up demonstration at the next meeting. The talk was so interesting and informative that the meeting lasted longer than any have in many years, and the members felt that much was accomplished.

Election of officers for 1972 was held, and the whole slate of current officers was re-elected unanimously: Chairman George Stoll; Vice Chairman Franklin Lucas; Treasurer Leroy Frienschner, and Secretary Harry Weitz.

NEW YORK CHAPTER ELECTS NEW OFFICERS

At the November meeting of the New York Chapter, officers for the coming year were elected. They include Sam Antman, re-elected as Chairman, Al Bimstien, Executive Chairman; Jim Eaddy, First Vice Chairman; S. Kross, Second Vice Chairman; Ted Freije, Secretary, and Roy DaSilva, Treasurer.

Sharing the speakers rostrum were Willie Foggie, Steve Kross and Sam Antman, for a very interesting discussion on typical troubles in TV circuits and how to troubleshoot them. In December, the chapter played host to Tom Nolan, Executive Secretary. A record turnout was present for a lecture on solid-state devices and their use in color television. Mr. Nolan also installed the officers for the coming year. At the end of the meeting refreshments were served.

MANUFACTURER'S REPS SPEAK AT PITTSBURGH

At the November meeting of the Pittsburgh Chapter, William Sinclair, field representative for General Electric, gave a talk on the 1972 TV receivers, showing slides on the GE Model TR465, the company's first completely transistorized model. It apparently is a very easy chassis to service.

At the December meeting, Ralph Wright and Dick VanDervort, regional sales manager and area manager respectively for Sencore test equipment, showed the company's latest equipment and demonstrated how to use it in service work. The chapter appreciates the fact that these gentlemen take the time to come visit and increase members' knowledge of what equipment is available and how to use it.

New officers for 1972 are: Chairman, Charles Kelley; Vice Chairman, John Benoit; Treasurer, William Sames; Secretary, Joseph M. Burnelis; Directors, James L. Wheeler, George McElwain, and Thomas D. Schnader.

SAN ANTONIO CHAPTER ELECTS NEW OFFICERS

At the November meeting of the San Antonio (Alamo) Chapter, Bob Bonge and Sam Stinebaugh played a game of "What's My Line?" for members, based on the color killer circuitry and chroma bandpass circuitry in color TV receivers. Members in attendance found it a very instructive game, and with such a properly chosen subject and preparation, it couldn't help but be interesting.

The chapter's annual dinner was held at the Four Brothers Steak House. Eleven members, eight wives and two guests attended for a total of 21 people. This dinner has become a tradition with the chapter, and members always look forward to it.

Officers for 1972 have been elected. They include: Chairman, Robert E. Bonge; Vice Chairman, Ernest B. Hudson; Treasurer, Sam O. Bentler, and Secretary, Sam T. Stinebaugh.

Bob Bonge's first action as chairman was to appoint a very live wire, Guy Elder, to head a membership committee in an attempt to increase membership.

SPRINGFIELD CHAPTER HONORS TOM NOLAN

At a special meeting in December, the Springfield Chapter honored Alumni Association Executive Secretary Tom Nolan. The Chapter wishes to express sincerest thanks and appreciation to Mr. Nolan. At this meeting, he lectured for more than three hours, explaining in detail various phases and aspects of solid-state devices. Through blackboard illustrations, he showed troubleshooting techniques on many types of TV receiver, commenting that solid-state devices are here to stay, and tubes almost a thing of the past.

At the meeting, the Chapter was informed of a misfortune befalling its past chairman, Brother Bernard Frey, but at the same time the better news that he is on the mend. He had fallen from a tower while installing an antenna for his amateur radio station. At any rate, the chapter is glad to hear he will soon be able to travel around again.

● ● ●

white set with vertical troubles, and the members used it for a practical example of repair work.

The membership is looking forward to a new year of stimulating meetings.

NORTH JERSEY WELCOMES SECOND GENERATION MEMBER

Steven Kitchen, son of George Kitchen of the North Jersey Chapter, was welcomed as a new member at an end-of-the year meeting. Also welcomed was the evening's guest, Thomas G. Baker.

At the November meeting, Vice Chairman Franklin Lucas gave a lecture and demonstration using the chapter's transistor radio demonstration board. As it was a first for some members, he gave a follow-up demonstration at the next meeting. The talk was so interesting and informative that the meeting lasted longer than any have in many years, and the members felt that much was accomplished.

Election of officers for 1972 was held, and the whole slate of current officers was re-elected unanimously: Chairman George Stoll; Vice Chairman Franklin Lucas; Treasurer Leroy Frienschner, and Secretary Harry Weitz.

NEW YORK CHAPTER ELECTS NEW OFFICERS

At the November meeting of the New York Chapter, officers for the coming year were elected. They include Sam Antman, re-elected as Chairman, Al Bimstien, Executive Chairman; Jim Eaddy, First Vice Chairman; S. Kross, Second Vice Chairman; Ted Freije, Secretary, and Roy DaSilva, Treasurer.

Sharing the speakers rostrum were Willie Foggie, Steve Kross and Sam Antman, for a very interesting discussion on typical troubles in TV circuits and how to troubleshoot them. In December, the chapter played host to Tom Nolan, Executive Secretary. A record turnout was present for a lecture on solid-state devices and their use in color television. Mr. Nolan also installed the officers for the coming year. At the end of the meeting refreshments were served.

MANUFACTURER'S REPS SPEAK AT PITTSBURGH

At the November meeting of the Pittsburgh Chapter, William Sinclair, field representative for General Electric, gave a talk on the 1972 TV receivers, showing slides on the GE Model TR465, the company's first completely transistorized model. It apparently is a very easy chassis to service.

At the December meeting, Ralph Wright and Dick VanDervort, regional sales manager and area manager respectively for Sencore test equipment, showed the company's latest equipment and demonstrated how to use it in service work. The chapter appreciates the fact that these gentlemen take the time to come visit and increase members' knowledge of what equipment is available and how to use it.

New officers for 1972 are: Chairman, Charles Kelley; Vice Chairman, John Benoit; Treasurer, William Sames; Secretary, Joseph M. Burnelis; Directors, James L. Wheeler, George McElwain, and Thomas D. Schnader.

SAN ANTONIO CHAPTER ELECTS NEW OFFICERS

At the November meeting of the San Antonio (Alamo) Chapter, Bob Bonge and Sam Stinebaugh played a game of "What's My Line?" for members, based on the color killer circuitry and chroma bandpass circuitry in color TV receivers. Members in attendance found it a very instructive game, and with such a properly chosen subject and preparation, it couldn't help but be interesting.

The chapter's annual dinner was held at the Four Brothers Steak House. Eleven members, eight wives and two guests attended for a total of 21 people. This dinner has become a tradition with the chapter, and members always look forward to it.

Officers for 1972 have been elected. They include: Chairman, Robert E. Bonge; Vice Chairman, Ernest B. Hudson; Treasurer, Sam O. Bentler, and Secretary, Sam T. Stinebaugh.

Bob Bonge's first action as chairman was to appoint a very live wire, Guy Elder, to head a membership committee in an attempt to increase membership.

SPRINGFIELD CHAPTER HONORS TOM NOLAN

At a special meeting in December, the Springfield Chapter honored Alumni Association Executive Secretary Tom Nolan. The Chapter wishes to express sincerest thanks and appreciation to Mr. Nolan. At this meeting, he lectured for more than three hours, explaining in detail various phases and aspects of solid-state devices. Through blackboard illustrations, he showed troubleshooting techniques on many types of TV receiver, commenting that solid-state devices are here to stay, and tubes almost a thing of the past.

At the meeting, the Chapter was informed of a misfortune befalling its past chairman, Brother Bernard Frey, but at the same time the better news that he is on the mend. He had fallen from a tower while installing an antenna for his amateur radio station. At any rate, the chapter is glad to hear he will soon be able to travel around again.

● ● ●

DIRECTORY OF ALUMNI CHAPTERS

CHAMBERSBURG (CUMBERLAND VALLEY) CHAPTER meets 8 p.m. 2nd Tuesday of each month at Bob Erford's Radio-TV Service Shop, Chambersburg, Pa. Chairman: Gerald Strite, RR1, Chambersburg, Pa.

DETROIT CHAPTER meets 8 p.m., 2nd Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich. VI 1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 p.m., 2nd Wednesday of each month at Andy Jobaggy's shop, G-5507 S. Saginaw Rd., Flint, Mich. Chairman Stephen Avetta.

LOS ANGELES CHAPTER, Chairman Graham D. Boyd 3117 Virginia Ave., Santa Monica, Calif. 90404, (213) 828-8129.

NEW YORK CITY CHAPTER meets 8:30 p.m. 1st and 3rd Thursday of each month at 264 E. 10th St., New York City. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N.Y.

NORTH JERSEY CHAPTER meets 8 p.m., last Friday of each month at Midland Hardware, 155 Midland Ave., Kearney, N.J. Chairman: William Colton, 191 Prospect Ave., North Arlington, N.J.

PHILADELPHIA-CAMDEN CHAPTER meets 8 p.m., 4th Monday of each month at K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: Herbert Emrich, 2826 Garden Lane, Cornwell Heights, Pa.

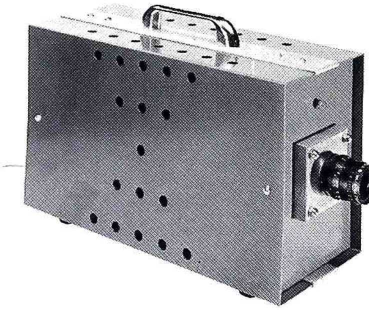
PITTSBURGH CHAPTER meets 8 p.m., 1st Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. & 2nd St. Chairman Charles Kelley.

SAN ANTONIO (ALAMO) CHAPTER meets 7 p.m. 4th Friday of each month at Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (3 blocks north of Austin Hwy.), San Antonio. Chairman Robert E. Bonge, 222 Amador Lane, San Antonio, Tex. 78218, 655-3299.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8 p.m., last Wednesday of each month at the home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Oliva J. Laprise, 55 Tecumseh St., Fall River, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7 p.m., 2nd Saturday of each month at the shop of Norman Charest, 74 Redfern Dr., Springfield. Chairman: Al Dorman, 6 Forest Lane, Simsbury, Conn.

Save $60.00-94.00 on Conar CCTV Camera



CONAR MODEL 800 CCTV CAMERA

Kit—800 UK, Reg. $199.50

Now $139.50

Wired—800 WT, Reg. $259.50

Now $165.50

- Made to sell for much more!
- Connects instantly to antenna terminals of any standard TV set!
- Operates up to 6 monitors at 1,000 ft. without special amplifiers!
- Available factory assembled or in kit form!

A complete, closed circuit TV system, including vidicon tube, precision 25mm. f1.9 lens, connecting cable, cabinet, and complete instructions—nothing else to buy.

1001 Uses in Homes, Schools, Stores, Factories

- IN THE HOME use the Model 800 to "watch" the front door to guard against strangers; to watch the kids at play and in swimming; to watch baby or sick persons; to put on your own TV programs ("kids" of any age love it!).
- IN HOTELS AND MOTELS use the Model 800 with your community antenna to show callers in the lobby to guests in their rooms; to display menu specials; to "watch" the desk or driveway entrance.
- IN STORES use to "guard" against shoplifters; to announce special sales by displaying merchandise; to put on storewide fashion shows; to "watch" entrances at night.
- IN SCHOOLS use for your own closed circuit educational TV programs within one classroom or many; to bring assembly programs to classrooms; to demonstrate special projects; to watch playground activity or cafeterias from the office.
- IN FACTORIES use for production line inspection; for watching processes in inaccessible locations; for guarding gateways, doorways and elevators; for checking on shipments; for warehouse control.
- IN HOSPITALS use the Model 800 to watch intensive care patients; give students close-up view of critical operations.

THE MODEL 800 can be located as much as 1000 feet from a TV receiver or monitor set without noticeable loss of picture quality. Even longer distances are possible, and more than six receivers can be used by simply adding amplifiers and matching devices.

Size: 5" wide, 7" high, 12¼" deep.
Weight: 11 pounds (with standard lens).
Power consumption: 45 watts (120V, 60-cycle, AC only).
Output: Modulated rf, any TV channel from 2 to 6.
Output level: Greater than 100,000 microvolts.
Output impedance: 75 ohms, unbalanced.
Sweep rates: Random interlace, Horizontal, 15,750 cps. Vertical 60 cps line locked.
Resolution: 240 lines—3 mc.
User controls: Horizontal frequency; Target; Beam; Focus; On/Off.
Internal adjustments: V. Height; V. Linearity; V. Centering; H. Width; H. Linearity; H. Centering; Channel Adjust; High Peaker.
Cable: 25 ft. shielded type supplied with camera.

NRI JOURNAL
3939 Wisconsin Avenue
Washington, D. C. 20016

Second-class
postage paid
at Washington, D.C.
and additional entry

Mr. Virgil Hicks E196-R956 GI
425 New York St. * 12/22/49
Huntington W Va 25704