Theodore E. Rose
Editor
J. F. Thompson
Associate Editor
J. B. Straughn
Technical Editor
L. L. Menne
Editor Emeritus

NRI NEWS

Vol. 19, No. 6 December-January, 1960-61

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

Noted Editor and Publisher Joins NRI Instruction Staff

Oliver Read

Mr. Oliver Read, formerly Publisher of ELECTRONICS WORLD MAGAZINE, Editor and Publisher of POPULAR ELECTRONICS, and Publisher of HI-FI STEREO REVIEW recently joined the NRI Instruction Department Staff.

J. Morrison Smith, President of NRI says: "It is our good fortune indeed to appoint a man with such rare abilities and pertinent experience to the NRI staff. Oliver Read, will be responsible for the NRI program of continuous revision of instruction materials—the hectic task of keeping pace with development in the Electronics industry. Also, Mr. Read will assist William F. Dunn, Director of Education, in our planning and development of new home-study courses.

We are confident every student will profit from Mr. Read's many years of experience in the Electronics field. Also, I am sure students and graduates alike will join with us in extending him a hearty welcome."

Editorial

As the holiday season approaches, we suddenly discover an increased awareness of the people around us. Busy shoppers, passing smiles, window decorations—even the brisk weather—serve as constant but temporary reminders of the event to be celebrated.

This is the logical time of year to reflect—take stock of what contributions we ourselves are making to society and to our fellow-man during the passing year.

My own personal reflections are crystal clear. Foremost, I want to extend a sincere commendation to every student (and graduate) who has put forth genuine effort in 1960, to improve his place in society and improve his own circumstances. The men who today demonstrate the courage and determination for self-improvement, will be the leaders of tomorrow.

(page two please)

Christmas Suggestions

See pages 4 and 16

Jules Cohen Wins Presidency of NRIAA For Coming Year

Three of Four Vice-Presidents Re-elected

See page 27

Editorial—from page 1

Perhaps self-improvement and betterment of your place in society were not among your primary reasons for enrolling with NRI. But nevertheless, what you bring to yourself in increased earning capacity, pride of accomplishment and greater confidence, can be directly translated into fulfillment of an obligation to yourself, your community, and your fellow-man. In demonstrating *any* interest toward self-improvement, you are identified as one who can be depended upon to assume responsibilities and obligations toward others.

On behalf of the entire NRI staff, I extend to each of you my heartiest best wishes for a Merry Christmas and Prosperous New Year. And—in 1961, I hope you will resolve to make yourself an even more worthy member of the brotherhood of mankind.

J. E. Smith
Founder

Everett Corey Joins NRI Staff

One of the newest members to the NRI staff is also, one of its most important. We refer to Mr. Everett Corey who recently joined us as Assistant to the President.

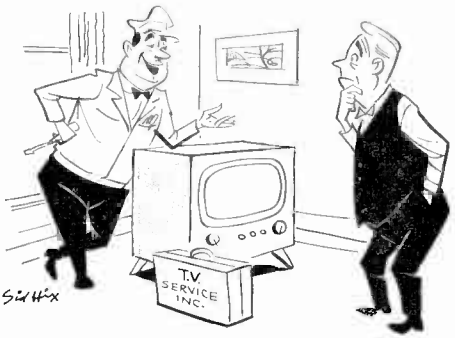
Educated at Syracuse University, Mr. Corey has been actively engaged in the administration and development phases of home study education for nearly twenty years.

Mr. Corey's objective and function will be to acquaint industrial organizations with the benefits to be derived from company sponsored NRI training programs. Our new Electronics and Communications courses in particular can effectively contribute toward alleviating the ever-increasing needs for competent technicians in these fields.

We consider ourselves fortunate to have a man with Mr. Corey's experience and abilities "on our side."

HOW YOU CAN HELP NRI GIVE FASTER SERVICE

When you write to NRI—whenever you send a payment, lesson or order, please be sure to give your full name, complete address *and* your NRI Student Number. If you are a *graduate, write* "Grad" after your name or "G" after your Student Number. If you will remember always to do this, we will be able to give you quick efficient service.



Drawn for BROADCASTING by Sid Hix

"I think tv gives us lots of educational benefits . . . it's putting my two kids through college."

Courtesy of Broadcasting Magazine

Build Your Own Resistor-Capacitor Tester

NRI proudly offers to all students and graduates a new Resistor-Capacitor Tester as a build-it-yourself kit or in assembled form. The high performance standard of our previous manufactured R/C Tester has been maintained. Actually the new model 311 Kit is quite similar to the previous instrument. We have however made certain design changes which improve the operation and which have eliminated the danger of damaging the instrument through improper use. The original R/C tester used the chassis as a part of the circuit and since neither test jack was at chassis potential it was possible to burn out parts in the instrument if a capacitor or resistor lead at one of the binding posts touched the front panel.

Through careful design the chassis of the Model 311 is not used as an electrical part of the circuit. In addition to removing the danger of damaging the instrument through accident or carelessness the effect of internal capacities between the leads and the chassis has been decreased thus improving accuracy of measurement at low capacity values.

Because of NRI's large buying power the price of this R/C tester is considerably less than its predecessor. This is true even if you purchase a wired Model 311. When purchased as a kit and put together by the owner an even greater saving results.

If you purchase a wired, tested, and calibrated Model 311, you will receive with it a complete instruction manual on its use. With the kit model you receive in addition a complete manual containing step-by-step assembly and calibrating instructions.

No one who can solder well and will follow the simple assembly steps should have any hesitancy about building this R/C tester.

The schematic diagram of the Model 311 is shown in Fig. 3, page 7. As you can see the circuit, with the exception of the function switch, is very simple using only a handful of parts. Because of the exceptionally clean design and layout it takes only a few hours to build and calibrate the Model 311.

The word calibration usually scares off an inexperienced man. However this is one piece of work anyone can do. The calibration of this instrument consists of putting on the bridge dial knob and attached pointer so the pointer will fall over the correct dial scale markings when making measurements. If a correct reading is obtained at any point on any range all other readings will be correct.

To calibrate the 311 you connect the extra 3 meg 1% resistor, included in the kit, to the binding posts, set the function switch to the Extended Resistance Range, plug in the tester, turn it on and wait for the eye tube to glow green. Then the shaft of the bridge potentiometer is rotated with your fingers until the eye opens as far as it will go. Next the knob is slipped on the shaft and the pointer turned so it is exactly over the number 3 on the Extended Range Scale. The set screw in the knob is tightened and the calibration is complete, in about the same length of time it takes you to read about it.

Wiring the switch takes more time; in fact there is more to wiring the switch than building all the rest of the circuits put together. We have had a vast amount of experience in wiring deck switches in NRI kits and others. It is evident that in kits, deck switches cause more than their fair share of trouble. This was worth a little research before writing the Assembly Manual for the Model 311.

We found, strange as it may seem, that most switch troubles were not caused by wiring errors but by soldering methods. If you try to wire up a deck switch mounted on the panel or lying on the work bench there is a real danger of solder or rosin running down the switch

(Continued page six)

Index

An Ideal Christmas Gift . . .

Six Transistor Portable Receiver Kit

Outstanding Features

Lots of power . . .

Excellent tone . . .

Plenty of volume . . .

Compact, convenient size and shape . . .

Good looking . . .

Six transistors. Superhet circuit. Long battery life. Directions for assembling are clear, easy to follow. No technical knowledge is needed.

HIGH SENSITIVITY

A six transistor receiver with sensitivity equal to many larger, more-expensive portables. Uses matched, pre-aligned i-f transformers; high Q loop; matched oscillater coil; RCA transistors. Circuitry includes a mixer oscillator, two i-f stages, germanium diode as second detector, driver stage and two transistors in push-pull class B operation for output stage.

EXCELLENT TONE

Big 4-inch speaker with full size output transformer delivers excellent tone quality—free of the "tinny" sound common to so many transistor portables. Top-notch performance indoors or out.

LONG BATTERY LIFE

Normal current drain of this receiver is only 15 ma. Four penlight batteries provide hours and hours of pleasant listening. No problem getting replacements. Inexpensive penlight cells are sold everywhere. Changing batteries takes half a minute.

EASY TO BUILD

The most easily assembled receiver of its size we've seen yet. Build it in one evening. You need only a soldering iron, long-nose pliers, and side-cutting pliers. Instructions tell you exactly what to do. Construction is clear and straightforward. Built to be handled like a portable—no delicate printed circuits in this receiver. Gain valuable experience with transistor circuits building this kit.

ATTRACTIVE STYLING

Housed in flexible, unbreakable, rugged, yet good looking case—the closest thing to brown cowhide—both in texture and strength. Over-all measurements are just 5⅜"high, 8¼"wide, 2¼" deep. Comfortable, flexible, strong carrying handle. Weight—including case and battery—two pounds. Two controls — On/Off/Volume and Tuning.

Hundreds of uses . . . You'll find hundreds of uses for this low-cost transistor r —it's perfect for baseball and foo.. games, picnics, hikes, cycling jaunts, and many other outdoor activities as well as private listening indoors. Also, civil defense authorities suggest every family keep a portable radio handy for use in case of emergency. CD stations are clearly marked on tuning dial.

Kit Contains:

pre-punched aluminum chassis
4-inch speaker with output transformer
ferrite rod antenna
three matched I.F. transformers
two section tuning capacitor
six transistor sockets
six RCA transistors
volume control and on-off switch
4 penlight batteries with mounting clips
sixteen resistors
eight ceramic capacitors
four electrolytic capacitors
hookup wire, solder, hardware
carrying case with handle
two dial knobs
detailed instructions

How to estimate Parcel Post charges from D. C.	
Local	**26¢**
Zones 1 & 2, up to 150 miles	**38¢**
Zone 3, 150 to 300 miles	**41¢**
Zone 4, 300 to 600 miles	**47¢**
Zone 5, 600 to 1000 miles	**55¢**
Zone 6, 1000 to 1400 miles	**64¢**
Zone 7, 1400 to 1800 miles	**74¢**
Zone 8, over 1800 miles	**83¢**

ORDER BLANK

NATIONAL RADIO INSTITUTE 3939 Wisconsin Ave., Washington 16, D. C.

291 KT

I enclose $..... plus $..... postage. Send items checked below.

..... Portable Transistor Receiver Kits, each $22.50 cash OR $12.00 herewith and two $5.75 manthly payments.

Parcel Post .....

5% discount on cash orders of 3 or more receivers

Total .....

Name .....

Address .....

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

(If you live in Washington, D. C., add 2% Sales Tax)

lugs on to the contacts and even on to insulating surfaces.

The undesired flow of solder and rosin is due to gravity. If you solder to a lug sticking straight up in the air it is almost impossible even for a skilled technician to avoid getting solder where it is not wanted.

If the switch is positioned so gravity cannot act on the molten solder and rosin, the finished switch will be every bit as good as one wired in a factory.

To position the switch properly, while it is wired and soldered, a jig is necessary,

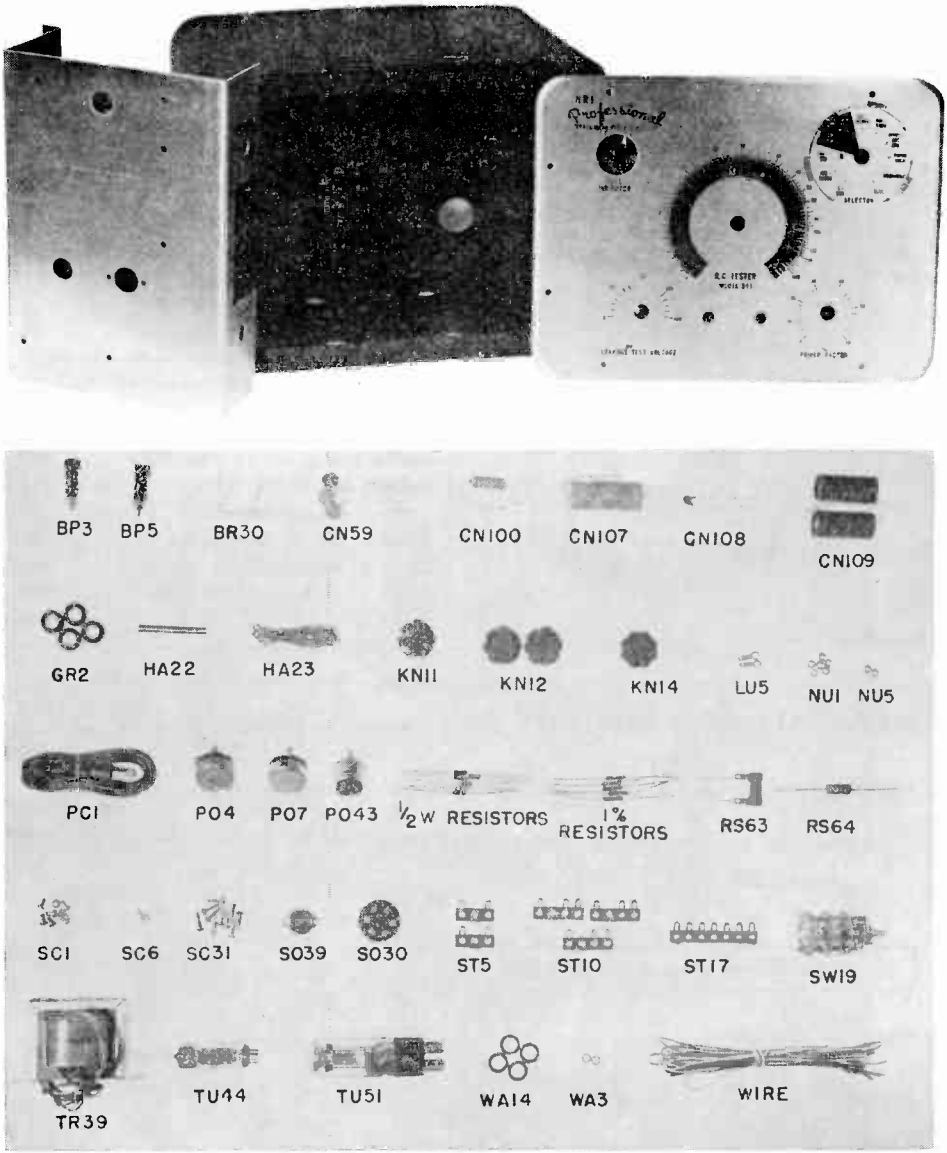


Fig. 1. These are the parts you receive in the Model 311 kit. Everything required down to the last nut and bolt is supplied including solder, an assembly manual and a manual of operating instructions.

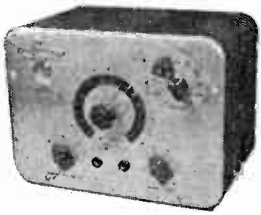


FIG. 2

WHAT THIS MODEL 311 R-C TESTER WILL DO:

The following tests can be made on capacitors and resistors with this instrument:

1. Measure the capacity of mica, ceramic, paper, oil filled and all types of electrolytic capacitors. The range is from 10-mmfd (.00001-mfd) to 1500-mfd.
2. Check the leakage of all kinds of capacitors.
3. Measure the power factor percentage (P.F.%) of electrolytic capacitors.
4. Reform electrolytic capacitors.
5. Measure the exact resistance value of resistors from 1-ohm to 150 million ohms (150 megohms).

but whoever heard of a construction jig being supplied with a kit? This was one problem which had to be licked and without adding to the selling price of the kit. The solution, once we worked it out, was unbelievably simple. Fig. 4 shows how the selector switch is held in the proper position when being wired. A rubber grommet is inserted into the hole in which the grommet will finally be used. The switch shaft and its bushing are pushed into the grommet permitting the switch to stand on its head, so to speak, in exactly the right position for safe soldering. The grommet also acts as a bushing so the entire switch can be rotated when soldering to the various lugs. All of the switch lugs except 10R are then bent so they extend out from the decks to make wiring and soldering safe and easy. 10R is not bent because the connection to it is made after the switch is mounted on the panel and this lug will be in the correct position for safe soldering.

Once the switch has been prewired all that remains is to mount the hardware on the chassis and panel, wire up a few resistors and capacitors on both sides of the chassis and connect the color coded switch leads to the proper points.

How To Operate The Model 311

The actual operation of the Model 311 is very simple. To measure the value of a resistor or capacitor the leads of the part are connected to the binding posts on the front panel, the Selector Switch is set to either a resistance or capacity ra which seems reasonable (any range be tried in case of doubt) and the instrument is turned on.

When the eye glows the main center knob is turned for maximum eye opening. Then you read the capacity or the resistance of the part on the proper dial scale.

In the case of an electrolytic capacitor the Power Factor Control is adjusted to see if the eye opening can be increased. At maximum eye opening the pointer of the Power Factor Control knob will indicate the power factor percentage.

To check the leakage of a capacitor the Selector Switch is set to paper/mica or electrolytic depending on the capacitor under test and the Leakage Test Voltage knob adjusted to the condenser working voltage or 400 volts, whichever is less. The action of the eye enables you to determine the amount of leakage present.

The above rundown of the 311 operation is of course very condensed. Full detailed instructions appear in the manual sent out with each Model 311.

Now the question arises how the circuit shown in Fig. 3 can make all these tests and measurements.

How a Resistance Bridge Works

A basic bridge circuit is shown in Fig. 5. With minor modifications, this bridge can be used to accurately measure resistance and capacitance. First, let's see how the basic resistance bridge works.

A potential, either ac or dc, is applied between points A and B. When the range setting resistor Rs and the bridge resistor Rb are adjusted so that the proportion existing between the range setting resistor Rs and Resistor Rb is the same as the proportion existing between the unknown resistor Rx and resistor Ra, the bridge is balanced and zero potential exists between points C and D. Notice that under these conditions the voltage drop across the unknown resistor Rx and the resistor Ra are equal. Also, the voltage drops across range resistor Rs and bridge resistor Rb are equal.

The indicator shown in Fig. 5 can be a milliammeter or a sensitive voltmeter. In most commercial bridges, a "magic eye" vacuum tube is used as a voltmeter in this circuit for both convenience and low cost. A "magic eye" tube is a very sensitive device and causes negligible circuit loading. Therefore, highly accurate results

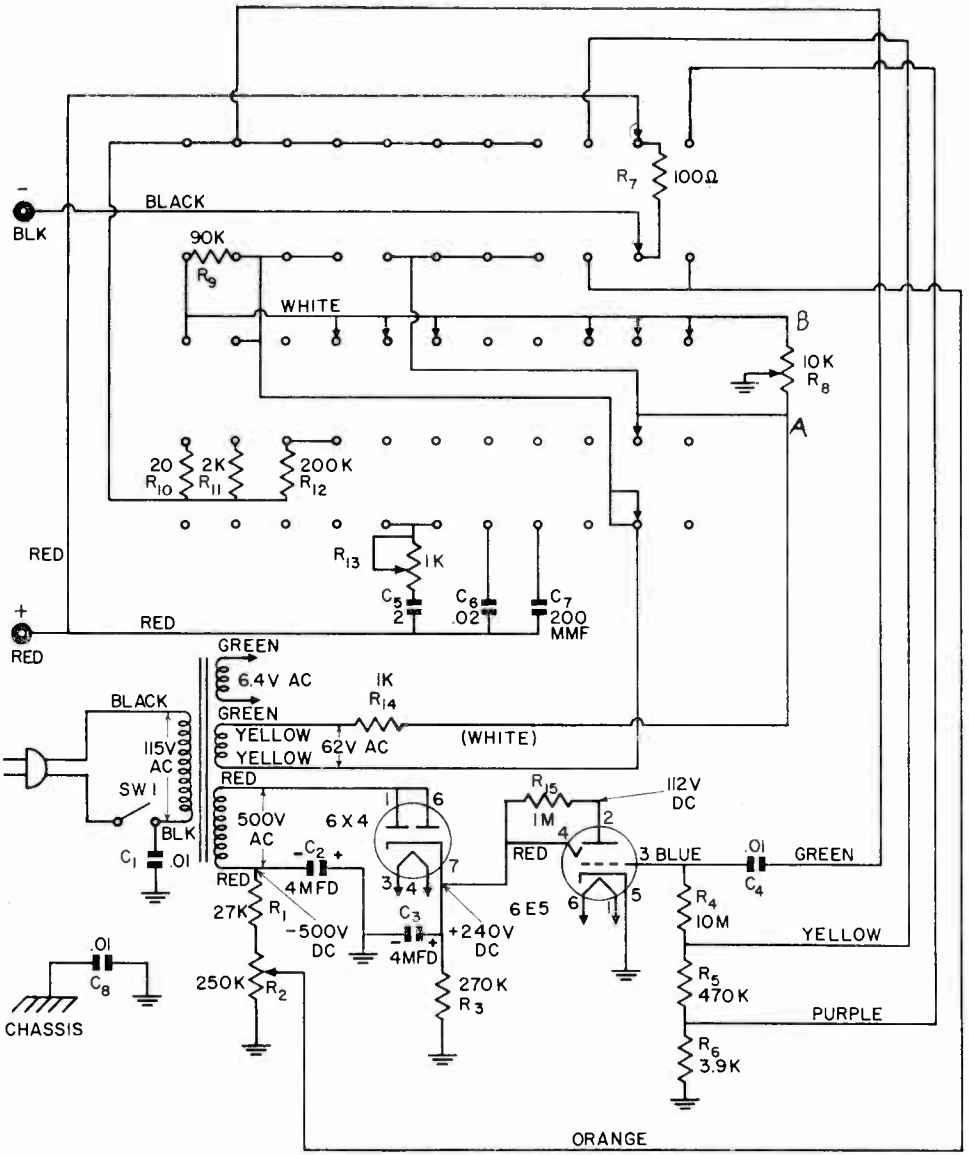


Fig. 3. Complete Schematic diagram for the Model 311.

are obtained without the use of an expensive milliammeter.

When an a.c. signal is fed to the grid of a "magic eye" tube, the grid is biased by the grid-leak method and the tube will serve as both a detector (rectifier) and an indicator. The "magic eye" tube in the Model 311 operates this way.

By using an ac source for the bridge circuit, and substituting a capacitor of known value for resistor Rs, the basic resistance bridge can be converted to measure capacity. A milliammeter, of course, cannot be used when the source voltage applied to the bridge is ac unless a meter type rectifier is employed. A "magic eye" tube, however, is perfectly satisfactory since it is self-rectifying.

Of course, numerous refinements of the

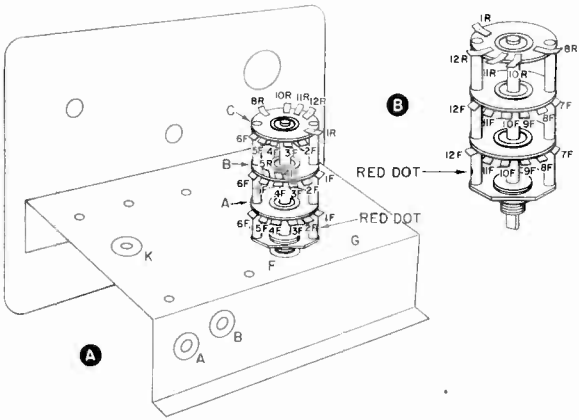


Fig. 4 The selector switch positioned for wiring, with terminals identified.

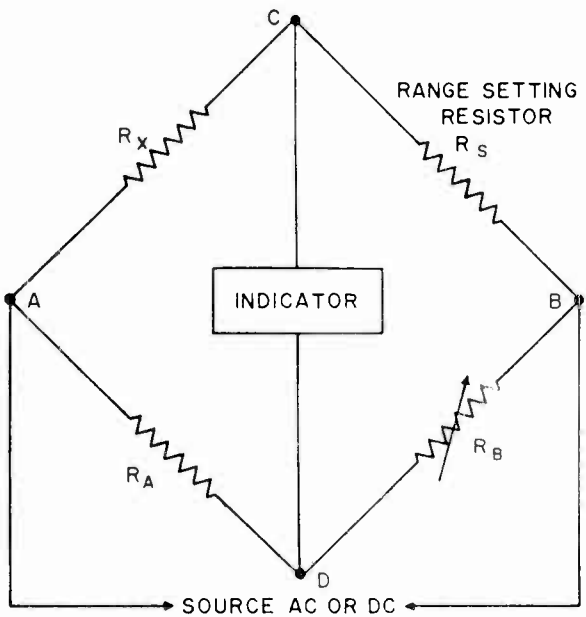


Fig. 5. A basic bridge circuit.

basic bridge circuit are possible. For example, greater stability is obtained when one side of the indicator is grounded. Also, both resistor Ra and resistor Rb can be made variable to obtain wider range. These refinements are included in NRI's Model 311 R-C Tester.

How the Model 311 R-C Tester Works

Fig. 6 shows a simplified circuit of the Model 311 when set for resistance measurements. Notice that one side of the indicator is grounded. Also, notice that variable resistor R8 replaces both resistor Ra and resistor Rb in Fig. 5. By varying the resistance in both these legs of the bridge simultaneously, an extremely wide range is obtained. The range setting resistors in the instrument are R10, R11, and R12. By switching the correct resistor into the circuit, the various ranges are obtained.

When the SELECTOR switch is set to the 1.8 Meg-150 Meg. position ("Extended" range), range setting resistor R12 is still used but an extra resistor (R9) is switched into the circuit between R8 and the 55-volt ac source. This increases the range in the instrument so that very high resistance values can be measured. R9 is shown in Fig. 3.

Fig. 7 shows a simplified schematic of the instrument when it is set for capacity measurements on the .00001-.005 mfd range or the .001-.5 mfd range. Notice that a capacitor, instead of a resistor, is used in one leg of the bridge. In the instrument itself, capacitor C6 or C7 is used in this application. On the two highest capacity ranges, 18-1500 mfd and 0.1-50 mfd, the circuit is changed slightly so that a resistor is switched in series with the range setting capacitor C2 and the indicator. This variable resistor is the POWER FACTOR control on the panel of the instrument. This extra control allows you to balance out the unavoidable internal resistance of an electrolytic capacitor and thereby determine the power factor. The circuit is as shown in Fig. 8 when the instrument is set to the two highest capacity ranges. Both resistor R8 and the POWER FACTOR control must be adjusted to obtain maximum opening of the eye when checking electrolytic capacitors.

The basic operation of the bridge is the same whether it is used for resistance measurements or capacitance measurements. When the instrument is set to the

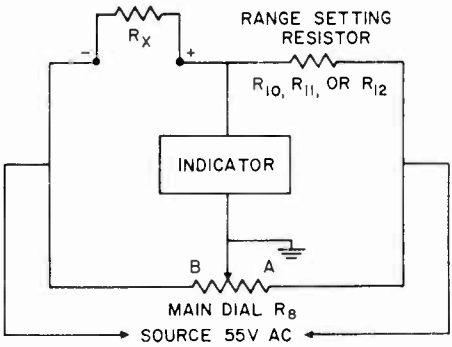


Fig. 6. Simplified circuit of Model 311 when set for resistance measurements.

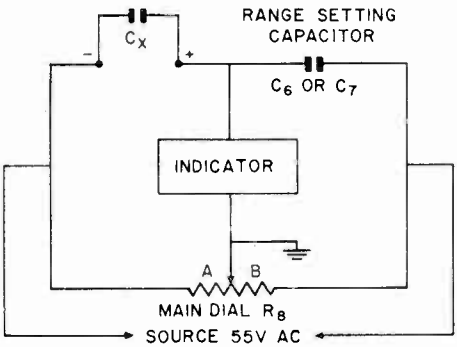


Fig. 7. Simplified schematic of Model 311 when set for capacity measurements.

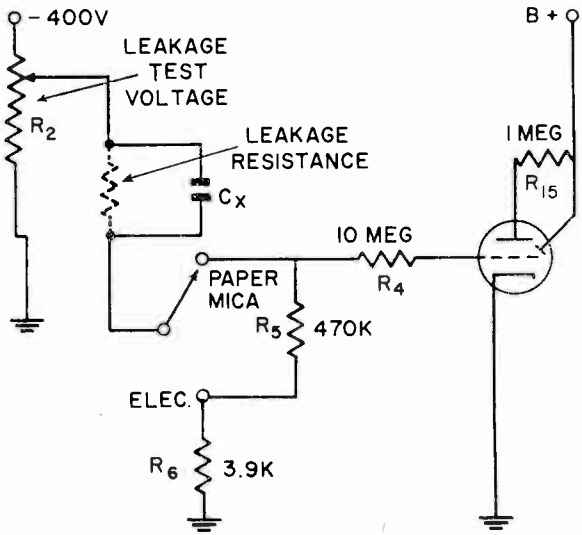


Fig. 9. Model 311 leakage test circuit.

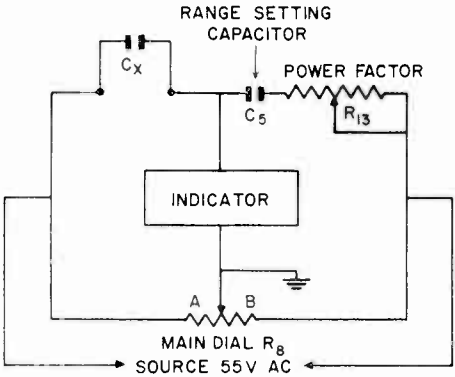


Fig. 8. Simplified schematic of Model 311 when set to the highest capacity ranges (18-1500 mfd or 0.1-50 mfd).

proper range, the dial is adjusted so that balance is obtained. Balance is indicated by maximum opening of the eye of the NULL INDICATOR.

The Leakage Test Circuit

Fig. 9 shows a simplified schematic of the leakage test circuit used in the Model 311. This is a special new type of circuit which is designed to give more accurate results with less chance of error. Notice that the leakage resistance of the capacitor under test is connected in series with either resistor R5 and R6 together or resistor R6 alone (depending upon the setting of the SELECTOR) forming a voltage divider across a variable dc voltage source. The dc voltage existing at the junction of the capacitor under test and resistor R5 (or resistor R6) is fed to the grid of the NULL INDICATOR as bias. As this voltage depends upon the leakage resistance of the capacitor under test as it is related to R5 and R6, and also upon the dc voltage being applied, the circuit will check the leakage of a capacitor under the dc voltage selected by the operator. When the LEAKAGE TEST VOLTAGE control is set to the working voltage specified by the manufacturer, the capacitor is tested under actual operating condition.

When the SELECTOR is set to the ELEC. leakage position, resistor R6 is connected in series with the leakage resistance of the capacitor. The voltage at the junction is fed to the grid of the NULL IN-

DICATOR through resistor R4 and resistor R5. If the capacitor under test has considerable leakage, there is a large voltage at this junction and this bias causes the eye of the NULL INDICATOR to close. If there is only slight leakage, however, the eye will remain open.

If an electrolytic has been out of service for some time it probably needs forming. To reform the dielectric just leave the capacitor connected for 10 to 15 minutes. If the eye has opened a normal amount by then the capacitor has formed up. If not the capacitor should be discarded. When the SELECTOR is set to the PAPER-MICA position, the leakage resistance of the capacitor under test is connected in series with the combination of resistors R5 and R6. Because the resistance of the voltage divider has been increased, the circuit is more sensitive. Therefore the circuit can now be used to check capacitors when even slight leakage would cause trou in the particular application. For ample, even slight leakage in a couplin capacitor will cause distortion and the PAPER-MICA position of the SELECTOR must be used in checking all coupling capacitors. Also, it should be used when checking ceramic and mica capacitors.

The discharge position of the SELECTOR is provided so that the operator can discharge the capacitor before making further tests and thereby remove the danger of accidental shock when disconnecting a charged capacitor from the instrument.

If you purchase the Model 311 as a kit or assembled (see page 16) you will be more than pleased. You will like its appearance, ease of operation and the time saved on those difficult service problems due to capacitor and resistor troubles.

Dale Stafford

Ohm's Law

by

Dale Stafford

NRI Consultant

To the beginning student in electronics, everything is new and strange and wonderful. For a time, he gets along fine, learning new terms and facts and fitting them in with the things he already knew. Then he runs headlong into Ohm's Law and, all too often, falls flat on his face.

For the benefit of those who may have this experience, we will try to explore this subject and point out some of the common pitfalls. If you are already well acquainted with Ohm's Law, the material in this article will probably be too elementary to be of much interest. It is hoped, however, that the new student may find it to be of real help.

To keep the discussion as simple as possible, we will attempt, in this article, to cover Ohm's Law only as applied to dc circuits. When Ohm's Law is applied to ac circuits, we must consider the fact that the opposition offered to the flow of current in a circuit is not the same for ac as it is for dc. This makes any attempt to cover both types of circuits in a single discussion rather involved and is apt to create more confusion than it clears up. It is best for the beginner to learn dc circuits first. Then ac circuits are much easier to understand.

Actually, there is nothing so very difficult about Ohm's Law. It is simply a fundamental law which explains, or defines, the relationship between the voltage, current, and resistance in a dc circuit. At first

glance, there seems little reason to suspect that it can be a very severe stumbling block for the beginner. There is even less to show why some students have little or no trouble while others, equally clever, flounder badly before they get straightened out.

Much of the trouble one sometimes has with Ohm's Law may be avoided if he remembers the following facts. Ohm's Law deals with three different things. These things are related in a definite way, so closely related, in fact, that the values of any two may be used to find the value of the third. However, no matter how closely they are related, they are completely different things and are measured in entirely different units of measurements.

Once a student has learned just what voltage, current and resistance are and has learned to apply the proper units of measurement to each, he doesn't have too much trouble in using Ohm's Law. Unfortunately, at the time he first encounters the subject he is trying to learn so many new things all at once that it is difficult to keep them neatly sorted out and get a clear view of the overall picture. A phrase which describes the situation rather aptly is the old saying about "not being able to see the forest for the trees."

As a result, he becomes confused and we hear such questions as "How many ohms are there in a volt?" or "How many volts are there in an ampere?" The answer, of course, is none. Volts, ohms, and amperes are completely different units of measurement used to measure different things. We can't say "So many volts equal one ampere" or "So many ohms equal one volt" any more than we can say "Two feet equal one hour" or "two tons equal one mile."

Everyone knows, of course, that when we measure anything we must use the correct unit of measurement, feet, pounds, gallons, or whatever the situation may require. For this reason, it may seem unnecessary to stress anything so elementary. The trouble is that when the student first starts to study the subject, he doesn't know either the units of measurement or just what it is he is supposed to be measuring.

It is not so hard to learn to measure time in hours or distance in miles when one knows what time and distance are. If, however, one had never heard of either, it would be a lot more difficult, wouldn't it? It is small wonder then that a stranger to electronics sometimes becomes confused.

In any dc circuit, there are, as already mentioned, three things which we must be concerned. The first is the current flowing in the circuit. The second is the force which causes the current to flow. The third is the opposition which is offered to the flow of current by the parts which make up the circuit.

Current flow in a circuit is due to the movement of electrons through the connecting wires and parts of the circuit. You know that all matter is made up of extremely small particles called atoms. These, in turn, are made up of even smaller particles called protons, neutrons, and electrons. The electrons made up the outermost portion of the atoms.

In the atoms of some materials, the electrons are tightly bound like the members of a loving and happy family and it is extremely difficult to make them leave home. In other materials, some of the electrons in the atoms can be easily dislodged. In fact, in a good conductor such as copper or silver, the outermost electrons in the atoms are continually flying off in all directions even when no force is applied to the circuit.

The vacant spaces in the atoms are filled by electrons dislodged from other atoms while the wandering electrons go on to fill vacant spaces in other atoms which have lost an electron. Thus, we have countless free electrons flying at high speed in all directions through the spaces between the atoms.

When a force is applied to the circuit, the free electrons all move in one direction. While it is unlikely that any individual electron will move more than a few inches per second, the force is felt almost instantly around the entire circuit. The reason is that the instant an electron is forced into motion, it repells the electron ahead of it and forces it to move. This electron, in turn repells an electron ahead of it and so on all around the circuit. The electrons repell each other because they are all negatively-charged particles and, as you know, like charges repell each other.

The effect is somewhat as if you had a pipe filled from end to end with marbles and suddenly tapped the end marble with a hammer. The marbles would begin to move at a fairly slow speed but the shock would travel almost instantly the full length of the pipe.

We know a fellow who gave his wife a $1,000 check for Christmas. If business is good next year,—he might sign it.

However, in an electrical circuit, we get a pulling as well as a pushing effect. Whenever an electron is forced out of an atom, the atom will then attract a free electron. For this reason, whenver an electron is forced into motion, another electron moves up to take its place. Thus, we have a force pushing and pulling the electrons around the circuit.

This movement of electrons around a circuit is what makes up a flow of current. The unit which is used to measure current flow is the ampere. An ampere is not a unit of quantity like a bushel or a dozen. Rather, it is a unit of rate-of-flow like the gallons-per-minute unit used to measure the flow of water through a pipe.

An ampere represents a certain number of electrons flowing past any point in a circuit in one second. The exact number of electrons is not important. You will seldom need to know this and it is such a large number it is hard to remember.

The force which causes electrons to move

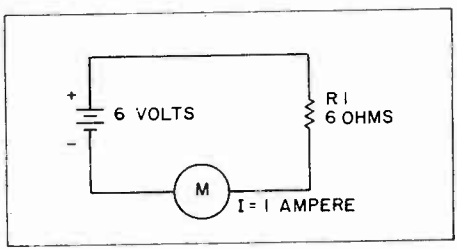


Fig. 1. A simple dc circuit.

around the circuit is called several names which all mean the same thing. These are electromotive force, difference in potential, potential difference, electric pressure, and voltage.

Let's see what voltage means. There will be an electrical pressure or strain existing between two objects if one of them has too many free electrons while the other has too few. There will also be a strain existing if both objects have too many or too few free electrons but one has more than the other. In any of these cases, electrons will attempt to move from the object which has the greater number of free electrons to the object which has the smaller number. If the two objects are connected by a conductor, electrons will flow from the object having the greater number to the object having the smaller number until the number in each is equal.

When an object has too many free electrons, we say that it has a negative charge or simply that it is negative. When an object has too few free electrons, we say that it has a positive charge or that it is positive. When both objects have too many electrons, both are negative but the one having the greater number of electrons is more highly negative than the other. When both objects have too few electrons, both are positive but the one having the fewer number of electrons is more highly positive than the other.

Electrons will attempt to flow from a negative point to a positive point, from a negative point to a point which is less negative or from a positive point to a point which is more highly positive. The strain of the electrons trying to move in this way is what we call voltage.

A voltage can be generated in several different ways. Two common ways of doing so are by the chemical action of a battery or by the use of a generator. The latter is a machine made especially for this purpose and works by moving a conductor, several of them in fact, through a magnetic field. It has a rotating part called an armature. This has several slots in which coils of wire are wound. In the frame of the generator are other coils, called field coils, wound on pole pieces arranged around the armature. A dc current flows through these coils, setting up magnetic fields across the armature. When the armature turns in these fields, a voltage is generated in the armature coils. The armature may be turned by a gasoline engine or some device may be used to turn it by using steam, a stream of water or the wind.

The unit of measurement is the volt. This is the amount of pressure that is needed to force one ampere of current through a resistance of one ohm.

The oppositon that a material offers to the flow of current is called resistance. As we previously mentioned, some metals such as copper have a great number of free electrons continually in motion flying in all directions through the spaces between the atoms. When a voltage is applied between the ends of a wire made of such a metal, a large number of free electrons travel through the wire and we have a large flow of current. We say that such a metal has a low resistance.

Other materials, such as a carbon resistor, have a great many fewer electrons in motion between the atoms. Thus, when a voltage is applied between the ends of a resistor, fewer electrons will travel through the material and the flow of current is much less than in the copper wire.

We say that such a material has a high resistance.

The unit used to measure resistance is the ohm. It is the amount of resistance which will permit a pressure of one volt to cause one ampere of current to flow in the circuit.

Remember, the force which is pushing and pulling the electrons around the circuit is the voltage and is measured in volts. The electrons moving around the circuit make up the current and the size or rate-of-flow of the current is measured in amperes. The opposition to the flow of current offered by the parts and wires of a circuit is the resistance and is measured in ohms.

When very large or very small quantities are to be measured, different units of measurement may be used. However, the names of these units are formed by taking the name of the original unit, volt, ohm, or ampere, and combining it with another word. If you will remember this, these other units should cause you no trouble.

Now, let's see how the voltage, current, and resistance are related in the simple circuit shown in Fig. 1. Here we have a 6-ohm resistor, R1, connected across the terminals of a 6-volt battery. For the sake of simplicity, we will say that R1 represents all the resistance in the circuit. Electrons will leave the negative terminal of the battery and flow upwards through R1 to the positive battery terminal.

The meter, M, shows that the circuit current is one ampere. This is what we would expect it to be. It takes one volt to force one ampere of current through a resistance of one ohm so it would take six volts to force one ampere of current through a 6-ohm resistor.

Since the voltage is what causes the current flow, if we increase the voltage, the current will increase and if we decrease the voltage the current will decrease. The change in the current will be directly proportional to the change in the voltage. If we double the voltage by using a 12-volt battery, the current will be doubled and the meter will read 2 amperes. If we halve the voltage by using a 3-volt battery, the current will decrease to one-half its original value and the meter will read one-half ampere.

Since the resistance is what opposes the flow of current, the current will also change if we change the resistance. The change in the current is also proportional to the change in the resistance, but, of course, in the opposite direction. The current increases when the resistance is decreased and decreases when the resistance is increased.

If we double the value of R1 in Fig. 1, making it a 12-ohm resistor, the current will decrease to one-half its original value and the meter will read one-half ampere. If we cut the resistance in half by using a 3-ohm resistor as R1, the current will be doubled and the meter will read two amperes.

The fact that voltage, current, and resistance are related in this way makes it possible for us to use the values of any two of these to find the value of the third. Suppose, in Fig. 1, page 13, we have no meter to measure the current, but we do know the battery voltage and the value of R1. We know it takes one volt to force one ampere of current through a resistance of one ohm. Therefore, we simply divide the number of volts by the number of ohms to find the number of amperes. Six divided by six gives us a current of one ampere.

Suppose we know that the battery voltage is six volts and the meter shows that the current is one ampere but we do not know the value of R1. We know that for each volt applied to a circuit, one ampere of current will flow if the resistance in the circuit is only one ohm. Since we have six volts applied to the circuit but only one ampere of current, we know the resistance is more than one ohm. We can find out how much more by dividing the number of volts by the number of amperes. In this case, six divided by one gives us six ohms as the resistance of the circuit.

Suppose we know that R1 is six ohms and the meter shows that the current is one ampere but we do not know the voltage of the battery. We know that it will take one volt for every ohm of resistance to cause one ampere of current to flow so we simply multiply the number of ohms by the number of amperes to find how much voltage the battery is providing. In this case, six multiplied by one gives us six volts as the voltage of the battery.

We can do the same thing with any other dc circuit so long as we know two of the values. If we know the values of the voltage and resistance, we divide the voltage value by the resistance value to find the value of the current. If we know the values of the voltage and current, we divide the value of the voltage by the value of the current, to find the value of the resistance. If we know the values of the resistance and the current, we multiply the value of the current by the value of the resistance to find the voltage value.

Ohm's Law, which shows this relationship between voltage current, and resistance is usually written in the form of three simple equations, $E = IR$, $I = E/R$, or $R = E/I$. Here, again, is a common pitfall for the beginner. To the newcomer in Electronics, equation is a strange and frightening word. He is not exactly sure what the purpose of an equation is nor is he used to seeing things expressed in this manner. Therefore, he feels that it is sure to be very hard to understand.

If the student has seen some of the equations used by engineers, he can scarcely be blamed for feeling uneasy. In some of these, the number or quantity on one or both sides of the equal mark (=) is made up of several numbers added together, subtracted from one another, or multiplied by each other. However, the simple equations used in Ohm's Law are no more complicated than a recipe for making lemonade.

There is nothing frightening about a recipe, is there? You know that if you add certain quantities of water, sugar, and lemon juice, you wind up with something entirely different - lemonade. Thus, the equation for this action might be written "1 gal. water + 2 cups sugar + juice of 6 lemons = 1⅛ gal. lemonade." These may be the wrong quantities—I never made much lemonade—but you can see what I mean. At any rate the equation simply means that one quantity is equal to another. In this instance, certain amounts of water, sugar, and lemon juice are equal to a certain amount of lemonade.

The equations used in Ohm's Law are much like simple recipes. Call them recipes if it makes you feel any better. Let's examine these recipes and see what each of them mean. The first is $E = IR$. Here E stands for voltage, given in volts. I stands for the current, given in amperes. R stands for the resistance, given in ohms.

The equation $E = IR$ means that the voltage is equal to the current multiplied by the resistance or "the number of volts is equal to the number of amperes multiplied by the number of ohms." The fact that the number of amperes is to be multiplied by the number of ohms could be written in any one of three different ways. We could write it: $I \times R$, I (R), or simply IR. Any one of these methods mean that one number is to be multiplied by the other. You can see that $E = IR$ is a much simpler way of stating that "the number of volts is equal to the number of amperes multiplied by the number of ohms" than it is to write out the statement.

You may often see this written "volts = amperes times ohms. This effort, by the writer, to simplify the discussion is fine except that it sometimes confuses the new student. Some students get the idea that if "amperes times ohms = volts" all three must be different units of the same thing just as pints, quarts, and gallons might be different quantities of water. This is not true, of course. Regardless of how the equation is written, it means that if the current in the circuit is a certain *number* of amperes and the resistance in the circuit is a certain *number* of ohms, the voltage applied to the circuit must be a certain *number* of volts.

Our next recipe is $I = E/R$. This means that the current is equal to the voltage divided by the resistance or "the number of amperes is equal to the number of volts divided by the number of ohms." The fact that a number is to be divided by another can be shown in three ways. We could write it $E \div R$ which means that the first number is to be divided by the last. We can separate the two numbers by a diagonal line called a slash mark, "/," like this: E/R. This means that the number ahead of the slash mark is to be divided by the number following it. In the third method, we can write one of the numbers, draw a line under it, and put the second number under the line, like this: $\frac{E}{R}$. This means that the number above the line is to be divided by the number below the line. Thus, we can write the equation, $I = E \div R$, $I = E/R$, or $I = \frac{E}{R}$. They all mean that "the number of amperes is equal to the number of volts divided by the number of ohms."

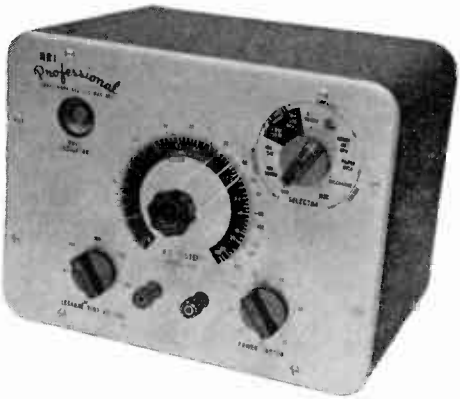
Our third recipe is $R = E/I$. Here, of course the slash mark means the same thing as in the previous equation. Therefore, the equation means that the resistance is equal to the voltage divided by the current or "the number of ohms equals the number of volts divided by the number of amperes."

Remember, when you use these equations that you are not saying that a volt is

(Continued on page 21)

Most of our troubles are caused by too much bone in the head and not enough in the back.

Christmas Suggestions



new—Model 311 R-C Tester Kit

Your answer to a high quality, accurate Resistor-Capacitor Tester at a "rock-bottom" price. Uses lab-type bridge circuit; fully variable DC working voltage up to 450V. 4 capacity ranges: .00001 mfd to 1500 mfd. 4 resistance ranges: one ohm to 150 megohms. 6 x 4 rectifier with 6E5 tuning eye null indicator. Professional appearance and operation. Easy to assemble. Gain experience and pocket the savings. Price complete with instructions **—only $19.75,** plus postage (see page 20). Also available fully wired—$28.75.

Model 240 V-O Kit

Takes less than an hour to assemble —pocket the savings. Quality components throughout. Rugged 3½" 50 microamper ± 2% meter.

Sensitivity: 20,000 ohms-per-volt DC.

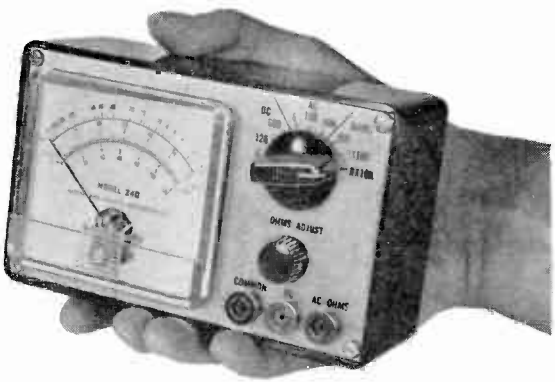
DC Ranges: 0-6-120-600.

AC Ranges: 0-6-120-600.

Ohmmeter Ranges: 0-1000 (can estimate ½ ohm) 0-100,000 ohms, 0-10 megohms.

Shipped complete with batteries and assembly - operating instructions. Size: 3¾" x 6¼" x 2".

$16.95
plus postage



Model 71 Tube Tester

Features ease of operation; four position element switches for flexibility; triple window, highspeed roll chart; freedom from obsolescence. Professional and impressive in appearance and operation. Checks over 700 different tube types for shorts, opens, leakage, emission. 4½" jeweled D'Arsonval meter movement. Seventeen filament voltages. Eight tube sockets. Size: 15¼" x 10½" x 6". Shipping weight: 15 lbs. Shipped Express charges collect. Detailed operating instructions included. Price—

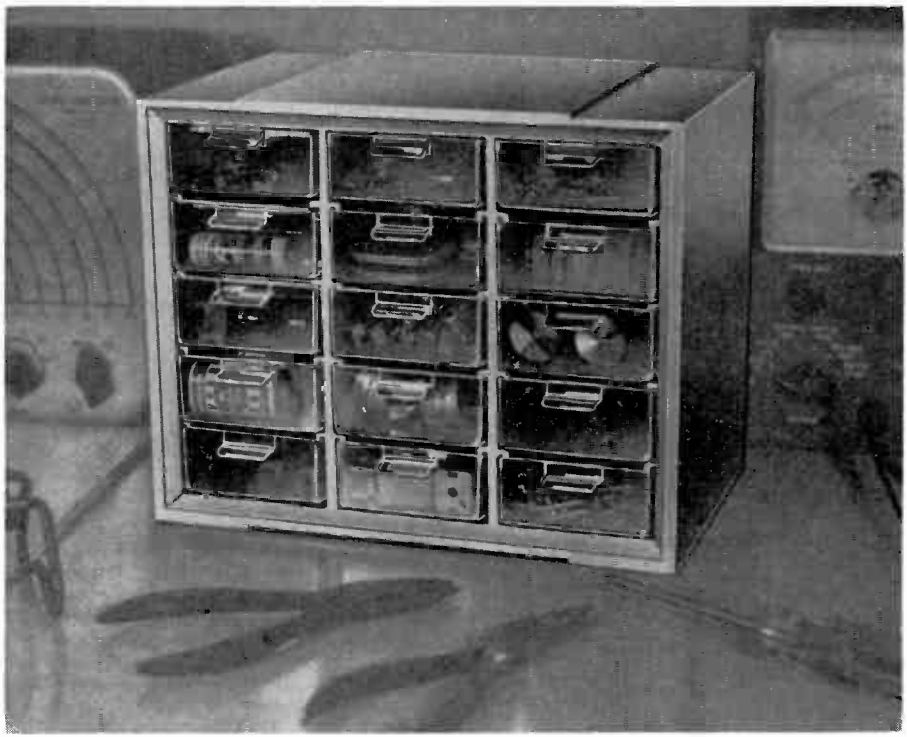
only $59.50.

70°-90° and 110° Picture Tube Adapters—

both for $9.75.

USE ORDER BLANK—PAGE 20

Nifty KnicKnack Cabinet



Glass jars are fine for canning—cigar boxes are good for cigars. But here's the practical, inexpensive, *easy* solution to storing those small parts.

The Nifty KnicKnack Cabinet has 101 uses. Perfect for anything small—from transistors and resistors—to jewelry and postage stamps. Sturdy breakproof styrene cabinet is finished in attractive beige; a neutral color to harmonize with any color scheme. Grooves at top and bottom of cabinet give an "interlocking" effect when stacked in groups of two or more.

Each drawer is molded of *one piece* clear plastic with pull handle at the front. Stop tabs prevent spillage yet drawers can be easily removed. Dividers lock into grooves—adjustable as required.

Press-on adhesive labels allow for indexing and inventory control.

Fifteen separate drawers: 5¾" long, 2⅝" wide, 1⅛" high. One moveable divider and one lable furnished per drawer. Cabinet 10" wide, 10⅜" high, 6⅜" deep. Shipping weight 4 lbs.

Order an extra cabinet. No limit on quantities. The ideal gift for someone you know!

just $4.88 each

(plus postage—see page 20)

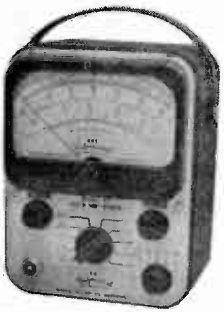
USE ORDER BLANK—PAGE 20

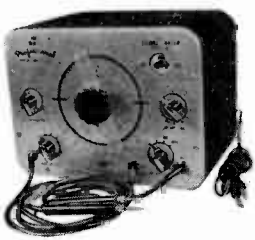
ATR "A" Battery Eliminator. A "must" for auto Radio servicing. Provides 6 volts at 10 amps continuous or 12 volts at 6 amps continuous. Will operate all 6-12 volt and transistor auto sets. Features accurate voltmeter and ammeter, variable output voltage control, on-off switch, safety-locking voltage selector, fuse, and leather handle. Can also be used as a battery charger. Uses full-wave dry disc selenium rectifier assuring noiseless, interference-free operation and extreme long life. Size: 6½" x 9⅛" x 8½".

Shipping weight: 22 lbs. Shipped Express Collect. NRI price **$42.95.**

Model 12 Vacuum Tube Voltmeter. Top performance—ease of operation—professional appearance—at a low price. Five ranges, 0-1200 volts AC-DC. Ohmmeter measurements to 1000 megohms in five ranges. Peak-to-peak AC volts. Metal black ripple case with aluminum panel. Size 7¾" x 5⅞" x 3½". Actual weights 5¼ lbs.; shipping weight 7 lbs. 50-60 cycle, 110-120 volts AC. Shipped Express Collect; test leads and complete instructions included. Price just **$45.00.**

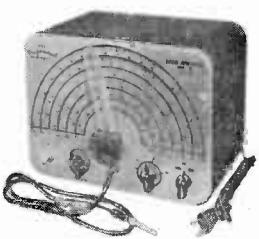
Optional Accessories: 30,000 volt High-Voltage TV Probe—**$6.50.** Crystal Detector High-Frequency Probe—**$9.50.**

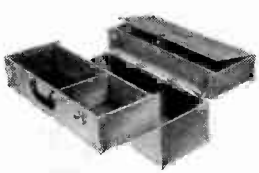




NRI Professional Model 35 Signal Tracer. A Multi-Purpose instrument; traces signals and aligns receivers. Tuned-type. Separate AF and RF inputs; built-in output indicator; visual and speaker output; calibrated attenuators; four bands with tuned circuits; range 170 kc. to 11.6 mc. plus audio. Actual weight 10¼ lbs.; shipping weight 12 lbs. Shipped Express Collect. 50-60 cycle, 110-120 volts AC. Sturdy black crackle finish case with brushed aluminum panel and deep etched lettering. A "twin" to the Model 311 R-C Tester in size and general appearance. Only **$57.50** with instruction manual and test leads.

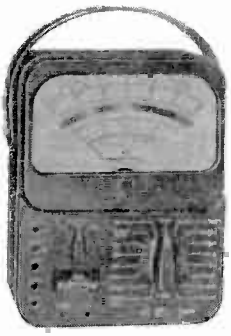
Model 90 Signal Generator—for AM-FM-TV alignment and trouble-shooting. Covers 170 kc. to 60 mc. on six bands. Permeability tuned R.F. coils. Three signals available—unmodulated R.F., amplitude modulated R.F. and 400 cycle A.F. Designed for rapid, easy alignment of receivers. Reliable marker for use with sweep generator. Cathode follower output and other engineering features make the Model 90 ideal for the beginner for experienced technician. 50-60 cycle, 110-120 AC only. Shipped Express charges collect—complete with output cable and detailed instructions. **NRI student and graduate price—$47.50.**





ARGOS Tube Caddies. The easy, orderly way to store tubes or carry tubes and tools on service calls. Just the thing for spare-time servicing. Choice of two Caddies. Popular Carry-All Caddy built of sturdy ⅝" and ¼" plywood covered with tough, luggage-type pyroxilin fabric. Size: 21" x 15" x 8". Capacity—262 tubes. **NRI Price $13.95,** postpaid.

Junior Tube Caddy. Size 15¾" x 12½" x 8". Holds 143 tubes. **$9.95,** postpaid.

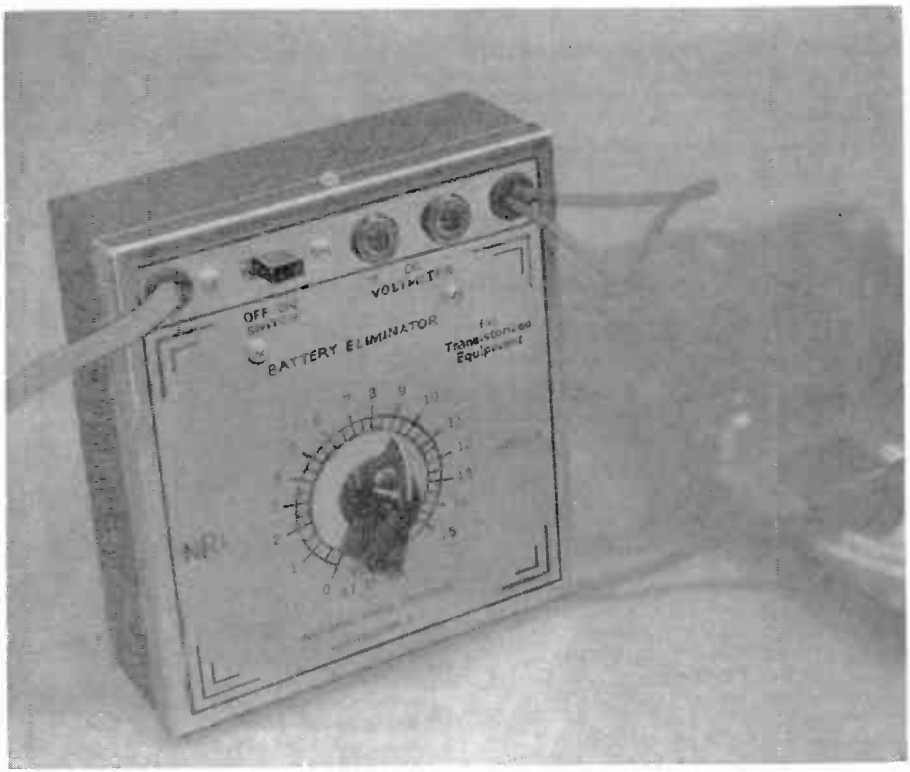


Model 48 VOM. Features complete portability and 59 r which start lower and go higher than other instrume its size and type. 8 DC ranges 0-6000 volts. 20,000 ohms-pe volt. 8 AC and output voltage ranges 0-6000 volts. 5000 ohms-per-volt. 7 DC current ranges 0-600 ma and 0-12 amps. 5 resistance ranges 0-200,000 ohms; 0-20 megohms. 8 wide-frequency response decibel ranges from —20 to +77db. 50 microamp meter with mirrored scale. 1% multipliers and shunts. DC polarity reversing switch. "Transit" switch position. Brass banana-type jacks and plugs. Complete with batteries, test leads and manual—**$42.95**, plus postage.

Optional TV probe—$5.50.

new—Model 2 Battery Eliminator

(for transistorized equipment)



This compact power supply is designed to take the place of the battery normally used to operate and service transistorized portable radios and other transistorized equipment. Speeds up servicing—quickly pays for itself in time savings alone. The NRI Model 2 supplies clean, filtered DC. Output may be varied from 0 to 15 volts for checks on sensitivity and operation under virtually all conditions. Output is sufficient for checking transistor receivers up to 22½ volts. Unit cannot be damaged by a direct short circuit. Permits voltage measurements at manufacturer's recommended voltages shown on schematic diagram. Size: 4½" X 5" X 1½". 110-120 V. AC 60 cycle only. Shipping weight—2 lbs. (not for auto radios)

$13.67

(plus postage)

Model T-401 REACTO

Picture Tube Rejuvenator-Tester

The complete, compact, portable test and repair instrument for TV picture tubes. Tests for all open conections, all open elements, useful life, cathode emission, gaseous tubes. Repairs open elements and inter-element shorts. Restores emission and brightness—often extending useful life of a picture tube for a year or more.

Housed in maroon leatherette case; clear plastic carrying handle; 4½" D'Arsonval meter movement. Neon bulb shows up shorts and open cathodes. Shipped complete with 110° Adapters at no extra cost. Size: 6¼" X 9½" X 4¼". Shipping weight: 6 lbs. Actual weight: 4½ lbs. Lists for $69.95.

only $44.95.

IMPORTANT SHIPPING INFORMATION: Read description of item(s) you wish to purchase to determine method of shipment—parcel post prepaid—plus postage—or Express COD for charges. Remit postage charges with your order for items marked "plus postage." Use table below. **Write for monthly terms on any item you select.**

	Local	Zones 1 & 2 up to 150 mi.	Zone 3 150 to 300 mi.	Zone 4 300 to 600 mi.	Zone 5 600 to 1000 mi.	Zone 6 1000 to 1400 mi.	Zone 7 1400 to 1800 mi.	Zone 8 over 1800 mi
Model 2 Batt. Eliminator	.24	.33	.35	.39	.45	.51	.58	.64
Model 240 Volt-Ohmmeter Kit	.26	.38	.41	.47	.55	.64	.74	.83
Nifty Knick-Knack Cabinet	.28	.43	.47	.55	.65	.77	.90	1.02
Model 48 VOM	.30	.48	.53	.63	.75	.90	1.06	1.21
T-401 Reacto Tester	.30	.48	.53	.63	.75	.90	1.06	1.21
Model 311 R-C Tester	.36	.63	.71	.84	1.05	1.29	1.54	1.78

ORDER BLANK

National Radio Institute Supply Division
3939 Wisconsin Ave.
Washington 16, D. C.

I enclose $..... plus $..... postage (where required). Ship me the item(s) I have checked below:

- ☐ Model 311 R-C Tester KIT, $19.75
- ☐ Model 311 R-C Tester WIRED, $28.75
- ☐ Model 240 V-O KIT, $16.95
- ☐ Model 71 Tube Tester, $59.50
- ☐ 70°-90° and 110° Picture Tube Adapters for Model 71, $9.75
- ☐ Nifty KnicKnack Cabinet, $4.88
- ☐ "A" Battery Eliminator, $42.95
- ☐ Model 12 VTVM, $45.00
- ☐ TV Probe for Model 12 VTVM, $6.50
- ☐ HF Probe for Model 12 VTVM, $9.50
- ☐ Model 35 Signal Tracer, $57.50
- ☐ Model 90 Signal Generator, $47.50
- ☐ Argos Carry-All Caddy, $13.95
- ☐ Argos Junior Caddy, $9.95
- ☐ Model 48 VOM, $42.95
- ☐ TV Probe for Model 48 VOM or 240 V-O, $5.50
- ☐ Model 2 Battery Eliminator, $13.67
- ☐ Model T-401 Reacto Tester, $44.95
- ☐ Tell me how I can buy the equipment I have checked on monthly terms.

Name ..... Stu No. .....

Address .....

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

(If you live in Washington, D. C., add 2% D. C. Sales tax)

the same as an ampere or that an ohm is the same as a volt. You can no more divide volts by ohms than you could divide dollars by apples. Yet you can divide a number of dollars by a number of apples to find something else which is entirely different . . . in this case the number which represents the *cost* of the apples. In Ohms Law you are simply using the *number* of volts and the *number* of ohms to find the *number* of amperes or the *number* of volts and the *number* of amperes to find the *number* of ohms.

Let's try a few more examples just to be sure we know how to use our "recipes." In Fig. 2, we show three simple circuits. In each of these, two values are given and we are to find the third. The correct equation for finding the unknown value is shown near the diagram of each circuit.

In Fig. 2A, the current is given as 3 amperes and the resistance is given as 4 ohms. We are to find the voltage of the battery. To do this, we use the equation E = IR. This tells us that "the number of volts = the number of amperes multiplied by the number of ohms" so we substitute the number of amperes and the number of ohms for I and R in the equation. Now it reads E = 3 X 4. Multiplying 3 by 4 we get 12 which is the voltage of the battery.

In Fig. 2B, the voltage is given as 6 volts and the resistance as 2 ohms. We are to find the value of the current. To do this we use the equation I = E/R. This tells us that "the number of amperes = the number of volts divided by the number of ohms." When we use the number of volts and the number of ohms given, we have "amperes = 6 divided by 3" or "I = 6/3." Six divided by three is two so the current is 2 amperes.

In Fig. 2C, the voltage is given as 12 volts and the current as 2 amperes. We are to find the resistance. Here we use the equation R = E/I, which tells us that "the number of ohms = the number of volts divided by the number of amperes." When we use the values that are given we have R = 12/2. Dividing 12 by 2, we find that R is 6 ohms.

As you can see by these examples, it is not really so hard to apply Ohm's Law to dc circuits. The only difficulty is in getting headed in the right direction. We hope that we have been able to post a few sign-posts to guide the stranger to this subject.

Sign in the showroom of foreign car dealer reads, "FREE DEMONSTRATIONS IN THE PRIVACY OF YOUR HOME."

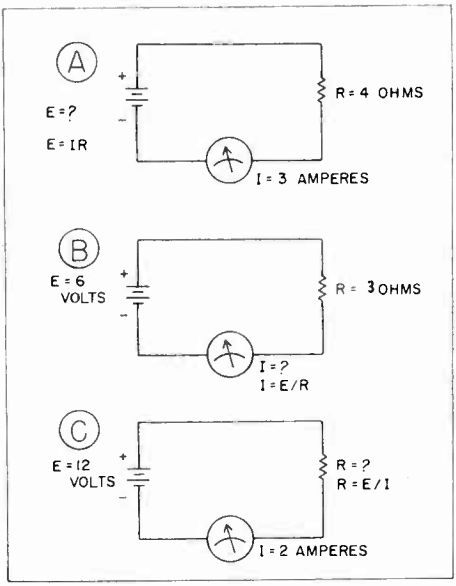


Fig. 2. Ohm's Law problems in dc circuit.

Here's One You Won't Have To Stock

RCA has recently announced development of a new tube—type A 2346, described as the "most powerful electron tube."

This tube, **17 inches high and 14 inches in diameter**—about the size of a nail keg—can produce 5 million watts at a frequency of 450 megacycles. It's said to have enough power to transmit a TV picture halfway around the world by bouncing the signal off a metallic balloon or other object in outer space.

Intended use of the A 2346 is industrial application and intercontinental TV. We doubt you'll ever see or run across this tube in your service work. But if you should, better suggest the customer buy a new receiver. We understand "most powerful" also applies to the price tag on this tube!

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

Thomas Henry Huxley

Hi-Fi Corner

by John G. Dodgson

Product Report:

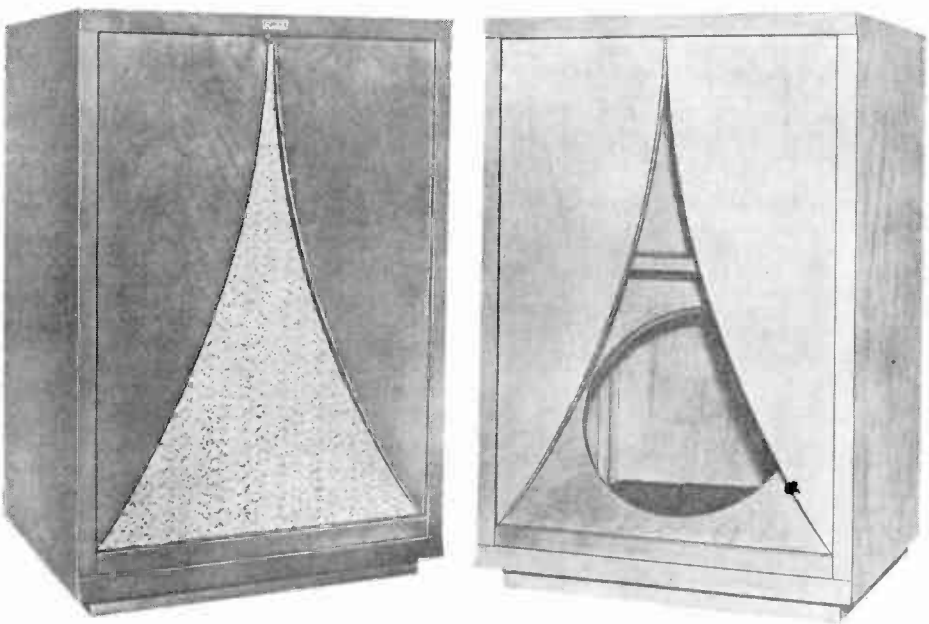
Karlson Speaker Enclosures

Quick Look: As shown in Fig. 1, the Karlson enclosure is unique in appearance; its internal structure is also unusual. Karlsons are available in several models for 15, 12, and 8 inch speakers. All are offered completely finished, assembled and unfinished or in kit form. Complete information can be obtained from Karlson Associates, West Hempstead, N. Y.

In General: This report concerns only the Model 15 which is a moderate-sized enclosure—22½" wide x 33" high x 18" deep. Built of ¾" plywood and with liberal bracing, it weighs about 80 lbs., plus, of course, the speakers.

The Karlson was originally designed for coaxial and full-range speakers. It can also be used just as a woofer enclosure. Best performance, however, is obtained with a coax, if the tweeter crossover is 3 KC or higher, or with a full-range speaker plus a tweeter again using a high crossover frequency. These latter suggestions are mine, not Karlson's.

Complaints: Right after the Karlson appeared, it was tested by the highly regarded (now defunct) Audio League. After commenting on its extraordinary bass response they noted some mid-range distortion. Shortly after, John Karlson modified the internal structure which apparently cleared up this trouble.



The Karlson Enclosure

Karlson kits are not difficult to build but they must be built properly and carefully. Just one loose joint can be disasterous. I know of several cases where sloppy work caused the owners to be disappointed—the trouble was theirs, not Karlson's.

Performance: Karlson claims the Model 15 bass response is better than a 30 ft horn with a 12½ foot mouth diameter. I don't know—not wishing to build one. However, with a 12 inch Wharfedale W-12, substantial output is obtained to below 30 cps and there is almost no doubling (harmonic distortion). Slow sweep with an audio generator from 100 cps down to 30 cps shows no peak or boom at any frequency. At 20 cps there is no audible output. However, switching the generator on and off creates tremendous pressure changes in the room proving substantial output.

Better bass response was obtained from the Wharfedale W-12 in the Karlson than in any other type enclosure.

Equipped with a J. B. Lansing D-123 the Karlson produces almost identical performance except slightly less output below 40 cps—probably because of its higher resonance. The mid-range, however, is a little brighter.

Several inexpensive 12 inch speakers were also tried. The bass response, as expected, was not as satisfactory as from the Wharfedale and Lansing units. Surprisingly though, all speakers produced substantial bass output below their resonant frequency. Moreover, the cheaper and poorer the speaker, the better it sounded in the Karlson as compared to its performance in a reflex or infinite baffle.

Remember, though, about silk purses and sows' ears. The better the speaker, the better the overall system.

The Karlson has a unique effect on the mid-range. John Karlson calls it "controlled ringing." Whatever it is, the Karlson enclosure definitely alters the mid-frequencies. Of course, all manufacturers (except Karlson) claim the enclosure should never "color" the reproduction—the purists are horrified by any mention of coloration. This "Karlson effect" should then, by all accounts, be detrimental—but it isn't. The "Karlson effect" brings "life" to the mid-range; it brightens it—opens it up. Simply, it adds "presence"—it helps to bring the orchestra into the room.

The high-end quality of any system depends on the tweeters or lack thereof. As mentioned previously the Karlson was designed for coaxial speakers and works well with them. I prefer separate units so I can try different ones and besides there is a wider choice of separate units. Two highly recommended tweeters for the Karlson are the Electro-voice T-35 and T-35B and the new University T-202. The T-35B is very easy to mount.

Horn tweeters such as the above, are best since there is not only a lack of space in the Karlson for a cone-type but the high efficiency of the horn is necessary to match the Karlson's high efficiency. Of course an array of cone tweeters could be placed in a separate cabinet on top of the Karlson.

Whichever tweeter is used, it should have a high crossover, 3 KC or higher, to take advantage of the "Karlson effect" in the midrange (assuming, of course, that the other speaker will work properly that high).

The Karlson is extremely efficient—20% to 40% depending on the speakers used. Of course the efficiency is incidental to the quality but one does have to pay for amplifier power. A 6 watt amplifier will drive the model 15 to concert level in an average living room—a 10 to 12 watt amplifier will probably never reach the clipping point. Coupled with this efficiency is the Karlson's remarkable dynamic range. There appears to be no sign of any compression no matter how abrupt the signal level change nor its amplitude. Remember that a 10 watt amplifier with just a 10% efficient speaker is equivalent to 100 watts driving some of the recent 1% efficient bookshelf types.

In addition, the Karlson exhibits an extremely wide dispersion. This effect, coupled with its dynamic range, its superb transient response and aided by the peculiar presence improvement, causes the Karlson to sound "big"—much larger than its moderate size. There is no effect whatever of the sound coming from a hole in the wall as is usually obtained from the smaller bookshelf type speakers. This "big sound" of the Karlson is not matched by any but some of the large corner horn systems.

All of the 12 inch speakers I have heard in the Model 12 sounded better in the Model 15. Considering the relatively little difference in price, the 15 is the better buy unless one is really strapped for space.

It must be mentioned that the Karlson 15 is designed for 15 inch speakers and

works best with them. The Lansing D-130 is particularly outstanding.

Conclusion: The Karlson exhibits some characteristics rarely, if ever, mentioned by competitors such as efficiency, wide dynamic range, superb transient response extremely wide dispersion, and others.

Even when equipped with the best speakers, the Karlson is not the "perfect reproducer." There are several small units now on the market with excellent bass and very low distortion. However, the unique characteristics of the Karlson make it an outstanding music reproducer. Moreover, its big sound eliminates the hole in the wall sound of the bookshelf types. As they say in boxing, "a good big one always beats a good small one."

In stereo, a pair of Karlson 15's can only be described as magnificent. Their characteristics are perfectly suited to stereophonic reproduction; in fact, they are better suited to stereo than mono, to my ears.

In short, I have been using Karlsons for over five years in my own system and see no reason to replace them.

New Products

Audio-Empire is now marketing a new 3-speed turntable. It is a belt-driven unit utilizing a step-type motor shaft for speed changes and featuring a synchronous motor and several other inovations designed to measurably reduce rumble.

Eico has brought out some new "decorator styled" equipment—completely different appearance than their present line. Two of the new types are shown in the current Allied catalog—I've seen photos of others and they are quite attractive, particularly a new tape deck.

Reverberation is destined to be the big selling point this year in the package hi fi field. *Fisher* has introduced a reverberation unit, called "Space-x-pander," to be used with components. I'll report on it as soon as it is available.

University has had their T-202 tweeter on the market for several months now. Its sound is very clean and smooth with excellent dispersion particularly when front-mounted as suggested by University.

Should you "do it yourself"?

Q. Can I save money by building my own hi-fi system?
A. Yes, if you do it the right way.

Q. Is the best way to build kits?
A. Yes, it is the easiest, the safest, and usually the least expensive.

Q. How can I choose the best kit?
A. First of all it's not the "best" kit, but rather, the one that has the specifications, appearance, and features you deem important. In short, after you decide what you want write for catalogs, visit local dealers, and talk to everyone you know who has built kits.

Q. Is it easy to build these kits?
A. Generally, yes. But, of course, the "ease" depends on the complexity of the kit.

Q. I've talked to some people who have had trouble with kits.
A. So have I, but the trouble is almost always the builder and not the kit.

Q. But these were experienced people.
A. I don't doubt it. Strangely enough most "kit trouble" is with the experienced. He doesn't "need" all of the step-by-step directions.

Q. It would be safer though to buy a factory built unit.
A. Generally yes, but it's also possible to buy defective factory built unit.

Q. Then a kit is better!
A. No. but it can be as good if well designed and built right. However, you are almost always safer with a factory built unit but you pay extra for the safety.

Q. Can't I save more money by building from diagrams in magazines?
A. Not unless you already have most of the exact parts. Even then the project could be a total loss depending on the design quality which you'd have to guess, based on the reputation of the magazine, the author, etc.

Q. Suppose I only have similar parts?
A. You're taking a chance since there's no way of judging the flexibility of the design. If you have sufficient equipment you could work out any "bugs" that might come up.

Q. What equipment would I need?
A. Depends on what you build. For an amplifier, the minimum would include: VTVM, sine and square wave generator, and scope.

Q. Wow! If things are this bad why are such articles so popular?
A. They aren't that bad—most articles are reputable. But you still can't save money.

Q. Then, and I repeat, why are the articles so popular?
A. Most of the projects have unusual features not found in commercial units, and there's that unmeasurable pride in "I built it myself."

Q. Suppose I copy one of the amplifiers on the market from the schematic.
A. Well, you won't save any money but you shouldn't have any trouble providing you don't change any parts values or the manufacturer's layout. This is better than following a magazine article but it would cost less to buy the factory built unit.

Q. Suppose there are special parts?
A. Before you start, write the manufacturer to see if he will sell you the special parts.

Q. Will I be able to get all parts?
A. Not necessarily. Some manufacturers will sell you any part you need but you'll often pay a premium price. Others, however, will release parts only to franchised service shops.

Q. Couldn't I use replacement parts listed in the service information.
A. Replacement for resistors, capacitors, and other such "normal" parts are OK, but substituting for a power or output transformer can cause trouble.

Q. It so happens I have a pair of good output transformers and I thought . . .
A. Fine, write to the output tranformer manufacturer and ask him for some circuit suggestions—don't copy somebody else's diagram for some other output transformer. Manufacturers of genuine high fidelity transformers such as Dyna, Acro, UTC will gladly supply diagrams.

Q. Now, Mr. Anthony, what is a "genuine" high fidelity output transformer?
A. What is a genuine high quality automobile? Seriously, to me, a good transformer is one specifically designed for high fidelity equipment, not for general replacement.

Q. My "$4.98 special" is not genuine?
A. Considering the cost of the other parts and the time you'll be investing in the amplifier, it would be foolish not to buy a new one.

Q. Can I use "used" parts?
A. Frankly, I wouldn't consider installing any used parts in an important project particularly those subject to wear like tubes and switches. Remember also that if a defect should occur in the unit you'll never know if it is due to a used part or some new trouble.

Q. So I should buy new transformers, tubes, and small parts! It would be cheaper to buy the factory built unit!
A. That is what I said to start with but you'd save with a kit.

Q. I still don't see why do it yourself projects are so popular.
A. It depends on the point of view. Suppose you go out and buy all the parts and spend about $20 more than the price of the factory built unit. Then you start cutting, drilling, etc., and 40 hours later you finish and it works fine! To start with, it is worth far more than $20 to some people to say "I built it myself." Some feel they have enjoyed 40 hours of recreation for only $20 and at 50¢ an hour it was a bargain!

Q. You forgot two more types.
A. Two? I know only one—the guy who figures his spare time is worth too much but he could still save on kits. What's the other type.

Q. The lazy man—me. I'm going out to buy a kit, see you next month.
A. Good luck.

———*n r i*———

Florida Graduate Offers His Radio-TV Business For Sale

Graduate Edgar M. Davis, 133 Townsend St., Wauchula Fla., tells us he would like to sell his thriving Radio-TV business because of other interests. It includes a 26' x 15' equipped shop with 26' x 15' showroom, four room house in rear of shop and seven room seperate house on same lot. Mr. Davis states the business averages $1200 to $1500 per month gross. Price—$15,000. Terms can be arranged.

Anyone interested can obtain further details by writing Mr. Davis at the above address.

Want Proof Electronics Is An *Amazing* Field?

Telephone engineers have recently doubled the conversation capacity of the second transatlantic telephone cable. The system, TASI (Time Assignment Speech Interpolation) was developed by Bell Telephone Laboratories and first put to use earlier this year on the telephone cable to Great Britain.

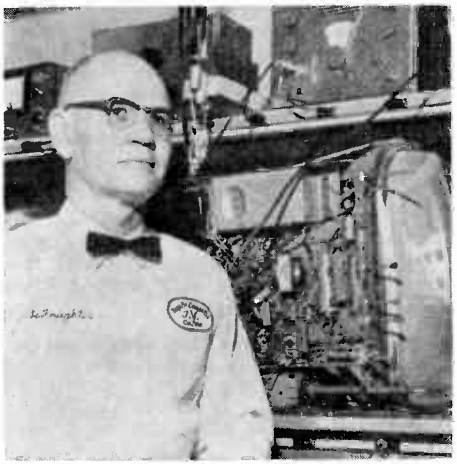
The TASI equipment just installed in New York and Paris contains some 35,000 transistors and diodes at each end.

The principle of operation is based upon the fact that most telephone circuits consist of two completely separate talking paths—one for each direction of speech. One of these paths is idle while the other is in use because normally one party listens while the other talks. During pauses in conversation both paths are idle.

TASI equipment takes advantage of this idle time. Operating in about **one-millionth of a second,** it searches out a momentarily idle path and connects that path to someone who at that very instant is starting to talk. When that party quits talking or pauses, TASI switches the path to someone else. When the first person starts to talk again, TASI instantly has a path for him.

TASI sorts out the fragments of conversations and sends each fragment in proper sequence to the person for whom it is intended. The two persons holding a conversation remain unaware of the whole process.

Graduate Proves Age Is No Handicap



Howard DeLaughter

When Howard DeLaughter opened a one-man television repair shop three years ago in Moultrie, Ga., three of his greatest possessions were desire, ability and a NRI diploma in Radio and Television Servicing.

For the past 25 years he had been a motion picture projectionist. Life in the projection room was the same thing day after day and DeLaughter found the time between reels hung heavily.

He had taken an NRI course in 1927 during the "battery" days of radio. When Electronics appeared as the answer to the monotony of the projection room, DeLaughter again turned to NRI.

On the arrival of the first lesson through the mail, DeLaughter, the father of one daughter already graduated from high school and the other almost through, saw that here was something really worth tackling.

After getting into the television techniques of the NRI course, DeLaughter got permission from the theatre manager to carry television sets into the projection room and to work on them during his spare hours.

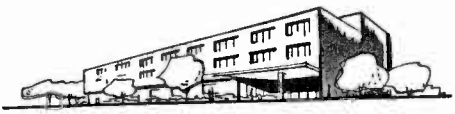
As his experience and knowledge obtained through the course grew, DeLaughter obtained a part-time job as television technician in a Moultrie service center. He soon built a reputation as a man who could put a television set in good working order and friends encouraged him to go into business for himself.

DeLaughter opened a small one-man shop in March of 1957 with a franchise to sell Hoffman television sets. The sign over the front of the shop proudly read DeLaughter TV & Electronics.

The three years spent on the NRI home study course paid off and business began to increase. After the first year in business for himself, DeLaughter hired his first technician. A year later he took in a partner and rented the building next door. The original location was converted into a shop and the next-door space became the showrooms of Ray and DeLaughter TV Co.

The business now employs five technicians, and keeps busy two pickup and delivery trucks. The showroom has on display Sylvania, Motorola and Hoffman models. Sales records prove the firm is selling more sets than any of the five competitors in the county.

NRI ALUMNI NEWS



Thomas Hull ..... President
F. Earl Oliver ..... Vice President
John Babcock ..... Vice President
Roland Tomlinson ..... Vice President
Howard Smith ..... Vice President
Theodore E. Rose ..... Executive Sect.

JULES COHEN WINS PRESIDENCY OF NRIAA FOR COMING YEAR

Three Of Four Incumbent Vice-Presidents Re-Elected

Jules Cohen of Philadelphia will be President of the NRI Alumni Association for 1961.

The membership chose Frank Skolnik, a former chairman of the Pittsburgh Chapter, to run against Cohen. It was not long after the ballots started coming in before it became apparent that Cohen would be the winner, in spite of the heavy vote for Skolnik in the Pittsburgh area.

Three of the four current Vice Presidents were returned to office: F. Earl Oliver of Detroit, John Babcock of Minneapolis, Howard Smith of Springfield, Mass. It was pointed out in the previous issue of the NRI News that none of the current Vice Presidents may again be a candidate for a vice presidency for three years due to the amendment of Article VI, Section 2 of our Constitution and By-Laws. But congratulations to Messrs. Oliver, Babcock and Smith upon their re-election for this term!

Jules Cohen

As the ballots came in at National Headquarters, the preponderance of votes for the fourth Vice-President shifted back and forth among Frank Catalano and James Eaddy of New York, Roland Tomlinson and J. Arthur Ragsdale, both of San Francisco, and John Berka of Minneapolis. J. Arthur Ragsdale finally squeaked through as the winner but he barely made it. This is the first time Ragsdale has been elected to a national office. Congratulations, Art!

Born in Philadelphia in 1916, President-Elect Cohen attended public schools in that city, graduated from high school in 1932 and went to work as an apprentice machinist. He also learned the fundamentals of the electrical business by working evenings and weekends with his electrician brother. Upon finishing his apprenticeship he entered into a journeyman for four years and was employed by the Midvale Heppenstall Co., Philadelphia, and has remained with this company for the past twenty years.

During World War II Cohen enlisted in the Seabees, served in the South Pacific, and upon his discharge returned to work in the Midvale Company. But he felt that machine shop practice was slowing down and, since he was now a married man with two daughters, decided to do something about it. He enrolled for the NRI course in Servicing. In his own words he "took to it like a duck to water," finished it in a year, then enrolled for the NRI Communications course and finished that in two and one-half years.

Cohen joined the Philadelphia-Camden Chapter in 1949. He liked the members and what they were doing, was impressed

with the chapter's potentialities, so he rolled up his sleeves and pitched right in to do his part. The members, in recognition of his ability and efforts, elected him Secretary of the Chapter in 1952, an office he has held ever since. The chapter has a paid-up membership of 170 members and is still growing! Cohen is himself largely responsible for the current growth and success of this largest of all the NRIAA local chapters.

The President-Elect conducts his spare time business from his garage and basement where he has a shop with all the instruments and supplies required for servicing radios, TV sets, record changers, taperecorders, and hi-fi. He has a long list of customers who keep him busy and he says "I don't have much time for myself but I always manage to find time for the Alumni Association."

And that is one of the many reasons why we will welcome Jules Cohen as President of the NRIAA when Tom Hull of New York, the incumbent President, relinquishes the office to him on January 1.

Chapter Chatter

SAN FRANCISCO CHAPTER'S Assistant Secretary and Program Chairman, Anderson Royal, analyzed the defects in a Radio furnished by Reginald Selby. The members present particularly enjoyed this talk and example of trouble-shooting.

At the next meeting Reginald Selby brought in another Radio with which he was having trouble. Messrs. Salvotti, Royal, and Charles worked on this one while the other members watched. A signal generator was connected to the grid of the 50L6 tube and the sound output was found to be satisfactory. The signal generator was then connected to the grid of the 12SQ7 tube of the first amplifier and the sound was found to be greatly distorted due to an open coupling capacitor.

The Chapter reports the recent admission of the following new members: Phillip Carruba, Willie Hawkins, Bartolome Flojo, and James McIntire, Jr. Congratulations to these gentlemen!

PHILADELPHIA - CAMDEN CHAPTER got off to a fine start for the current season. Sixty-one members invaded the establishment of Henry Whelan who played host to the Chapter. Through arrangements made by K. L. Fox of the United Motors Service, Phil Powell of the Delco Radio Division delivered a fine talk on transistors. Henry Whelan then took the members through his shop and showed them how to service auto radios and also answered all questions put to him. The members thought that this was an unusually enjoyable evening.

Dave Lintz of Globe Products was scheduled to address the members on Citizens Band equipment at the November meeting. This is something that is becoming of increasing importance and most members feel that they should get acquainted with this field.

Last Spring the Philadelphia Branch of the General Electric Company held a party for the Chapter which they called the "National Radio Institute Alumni Night." The members were so enthusiastic about this party that another one was arranged for December 12.

The Chapter reports only two new members—a small number for this chapter—admitted to membership recently. They are Alden Cribb and William Silvestri, both of Philadelphia. Welcome to the membership, gentlemen!

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER was informed by a few of its members who are doing part-time servicing, that they are considering going out of business. Is it because business is poor? On the contrary, they say they are thinking of quitting because business is *too good!* These fellows say they are swamped with service work. Other members say they have solved the problem by teaming up with another serviceman so that each works on alternate evenings.

The Chapter held its annual banquet at "The Nook" on the evening of October 18. The attending members spent a very pleasant and enjoyable evening.

The latest member to be admitted to membership is Mr. Charles Miller. Welcome to the Chapter, Charles.

PITTSBURGH CHAPTER'S Chairman Tom Schnader gave a talk on servicing transistor radios. Tom is the transistor radio repairman for the Motorola Distributor in Pittsburgh and is an authority on this subject. In his talk he outlined the kinds of troubles he has run into with the sets and the different tools and instruments he uses in repairing them.

Howard Tate, Vice-Chairman, also gave a fine talk devoted to troubles he has

encountered in TV servicing that were due to changes in value of resistors and condensers.

Four new members have recently been admitted to membership. They are Richard Ollio and Joseph Burnelis, both of Pittsburgh, Lawrence Remaley of Harmony, Pa., and William Packet of Braeburn, Pa. A hearty welcome to these new members!

SOUTHEASTERN MASSACHUSETTS CHAPTER held its annual banquet at "The Hangar" in Acushnet. Gigantic steaks were served, with peas, French fried potatoes, coffee, pie, and ice cream. Seconds were available and nobody was backward about taking advantage of it. Following dinner, there was a floor show featuring a ventriloquist and a dancer.

The following meeting featured a talk by the chief organizer of the Chapter and its first Chairman, Walter Adamiec. Speaking on the present need for technicians in industrial Electronics, he emphasized that the industry demands men who are qualified and that they can become qualified only by applying themselves diligently to a thorough study of Electronics. Walter stated that he intends to become an industrial Electronics technician and urged his fellow members to study electronic theory instead of being concerned only with the physical aspects of radio-TV servicing. This was quite an impressive talk.

LOS ANGELES CHAPTER members are pleased with their new meeting place, a hall behind the church at 4415 Santa Monica Blvd. Several meetings have been held there now and the members find the hall is well suited to their purposes.

A pot-luck picnic for members and their wives was held at Griffith Park. While not too many families showed up, those that did made up in spirit for what they lacked in numbers. Following the picnic the gang were guests of Chairman Eugene Decaussin, where Rexall Salisbury played Eugene's electric guitar and everyone sang songs. Those that attended the picnic had so much fun that they said they would not have missed it for anything.

At one meeting some discussion was devoted to a proposed state law to license TV and appliance servicemen. The members were all opposed to such a measure.

At practically all meetings Chairman DeCaussin makes it a practice to show quite a variety of films. These are all either educational or entertaining or both

Directory of Local Chapters

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

CHICAGO CHAPTER meets 8:00 P.M., 2nd and 4th Wednesday of each month, 666 Lakeshore Dr., West Entrance, 33rd Floor, Chicago. Chairman: Charles Teresi, 3001 N. Norica, Chicago, Ill.

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

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P.M., 2nd Thursday of each month, St. Agnes School Annex, 518 W. Pierson Rd., Flint. Chairman: George Rashead, 338 E. Marengo Ave., Flint, Mich.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P.M., 2nd Thursday of each month, "The Nook" Restaurant (rear), Hagerstown, Md. Chairman: J. Howard Sheeler, 300 Walnut St., Shippensburg, Pa.

LOS ANGELES CHAPTER meets 8:00 P.M., 2nd Friday and last Saturday of each month 4415 Santa Monica Blvd., Los Angeles. Chairman: Eugene DeCaussin, 5870 Franklin Ave., Apt. 407, Hollywood, Calif.

MILWAUKEE CHAPTER meets 8:00 P.M., 3rd Monday of each month. Radio-TV Store & Shop of S. J. Petrich, 5901 W. Vliet St., Milwaukee. Chairman: Philip Rinke, RFD 3, Box 356, Pewaukee, Wis.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER meets 8:00 P.M., 2nd Thursday of each month, Walt Berbee's Radio-TV Shop, 915 St. Clair St., St. Paul. Chairman: Kermit Olson, 5705 36th Ave., S., Minneapolis, Minn.

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

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

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P.M., 2nd and 4th Monday of each month, Knights of Columbus Hall, Tulip & Tyson Sts., Philadelphia. Chairman: Herbert Emrich, 2826 Garden Lane, Cornwell Heights, Pa.

PITTSBURGH CHAPTER meets 8:00 P.M., 1st Thursday of each month, 436 Forbes St., Pittsburgh. Chairman: Thomas D. Schnader, R.D. 3, Irwin, Pa.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, Bay View Bldg. & Loan Assn., Palm Ave. & Geary Blvd., S. F. Chairman: J. A. Ragsdale, 1526 27th Ave., S. F.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P.M., last Wednesday of each month, home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Arthur Hubert, 1566 Pleasant St., Fall River, Mass.

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

and the members always enjoy seeing them.

Since last report the new members admitted to membership are Douglas Young and Albert Mackler. A warm welcome to the Chapter, gentlemen!

NEW YORK CITY CHAPTER, as this issue of the NRI News goes to press, was making preparations to celebrate its twenty-fifth anniversary in November. A party was scheduled to commemorate the occasion and it promised to be a very enjoyable evening.

Tom Hull, long an outstanding leader of the Chapter, devotes a great deal of his time to preparing many interesting and informative lectures for the members. His current series has been on transistors and transistor circuits.

Jim Eaddy also covers transistor circuits, usually by covering the trouble-shooting end. He also gives the members many good tips on TV repairs.

Chairman Dave Spitzer livens things up at the meetings by talks ranging from business to Radio-TV repairs through various other enlightening or entertaining subjects.

There are very few meetings at which there aren't at least one or two new members admitted to membership.

CHICAGO CHAPTER reports that its newly-elected officers for next year, who will take office on January 1, are: Edwin Wick, Chairman; Charles Mead, Secretary; Walter Oakley, Treasurer. Congratulations to these officers!

Charlie Mead promised to make a box to be used as a question-and-answer receptacle. Members having any questions they want answered may write them out on a piece of paper and drop them in the box; the questions will then be answered at the next meeting.

MILWAUKEE CHAPTER at one of its meetings became engrossed in discussing the amount of equipment needed for ham operation as compared with the transmitter/receiver employed in aircraft, which fits in a box measuring 4½" x 5½" x 8½". This proved to be a fascinating subject and practically every member present added his two cents worth to the discussion.

A talk on transistors, their construction and uses, was planned for an upcoming meeting.

DETROIT CHAPTER held its customary Fall Stag Party at its regular quarters. A supper of fish, shrimp, cold cuts, with cheese, olives and other accessories was served, also coffee, beer and cold drinks.

The members usually enjoy penny ante poker or some kind of entertainment such as movies at these parties. This time, however, J. B. Straughn of the NRI Staff and Ted Rose, Executive Secretary of the NRIAA, were present as guests after having attended the meeting of the Flint Chapter the night before. So, instead of playing poker or being entertained, the members were glad of an opportunity to have Mr. Straughn deliver a talk and demonstration on servicing transistor Radios to them. In the demonstration Mr. Straughn used the NRI Model 250 Oscilloscope and NRI Transistor Radio.

SPRINGFIELD (MASS.) CHAPTER held another of its popular Shop Meetings at the home of Arnold Wilder. Chairman Norman Charest brought in a TV receiver that was every inch a "dog." But also as usual, he managed to get it going. Joseph Rufo again showed his skill by fixing a transistor Radio in ten seconds flat.

It is not known whether any of the members besides the Secretary noticed how many trips Arnold Wilder made from the doorway of his shop to the other end of it, and answered more questions in two hours than Mr. Khrushchev did at the United Nations—and not once did he take off his shoe and pound the table.

Gus Lorenzatti and Frank Piantek tackled a honey of a TV set that had a defective vertical sweep section. The attending members regretted that their efforts did not cure the receiver's ills at this meeting; there just wasn't enough time and they hoped to bring it to the next Shop Meeting.

The next regular meeting was scheduled to feature a lecture by Mr. Brad Gage on future developments of Bell Telephone, and the showing of a colored movie entitled "Thanks For Listening." Howard Smith had already seen this film and stated that he knew it would be highly interesting to the members.

FLINT (SAGINAW VALLEY) CHAPTER has begun a series of seven lectures—one per month—conducted by Professor DeJenko of the University of Flint. The first lecture was scheduled for November 10. In this series of lectures, Professor DeJenko will cover Radio-TV Servicing from a basic screwdriver adjustment to

the use of the wide-band oscilliscope. This gives members an excellent opportunity to bring themselves up to date on present-day servicing methods and problems. At last report fifteen members had signed up for the series. Any NRI student or graduate is eligible to attend the lectures; those interested should get in touch with George Rashead, 338 E. Marengo, Flint; A. Jobbagy, 5507 S. Saginaw Rd.; or Arthur Clapp, 1016 Knapp, Flint.

The Chapter was host to NRIAA Executive Secretary Ted Rose at its October meeting and J. B. Straughn of the NRI Staff. The meeting featured an excellent Walt Disney film on rocketry and space exploration, followed by a lecture and demonstration by Mr. J. B. Straughn on servicing transistor receivers. A buffet supper was served at the close of the meeting.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER'S Ray Thompson gave a demonstration of the B & K Television Analyst. The members present all agreed that Ray did a fine job with this demonstration.

The members enjoyed an evening as guests of KMSP-TV, Channel 9 in Minneapolis-St. Paul. They had the opportunity to observe a live commercial taped, played back to be checked, retaped because of words missed by the announcer, played back again to be rechecked, and then placed on the air—all in a very short time. The members were much impressed by the staff of Channel 9 and the Chapter owes them many thanks for their cordial hospitality.

As we go to press, preparations have been completed for a banquet to be held for Chapter members and their wives at the Tempo Restaurant in Minneapolis. Such an event not only provides the Chapter with an enjoyable social evening but also gives the wives a chance to get to know each other.

IN MEMORIAM

Springfield Chapter members only recently learned of the death last spring of Marcellus Reed, an early member and a past Secretary of the Chapter. He was a loyal and much-respected member of the group.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT AND CIRCULATION OF

NRI News, published bimonthly at Washington, D. C., for October 1, 1960.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, National Radio Institute, 3939 Wisconsin Ave., N. W., Washington 16, D. C.

Editor, Theodore E. Rose, 3939 Wisconsin Ave., N. W., Washington 16, D. C.

Managing editor, None.

Business manager, None.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Elsie Smith Davis, RFD 1, Rochester, N. H.

The National Radio Institute Charitable Trust c/o J. E. Smith, 4521 Crest Lane, McLean, Va.

Carol Smith Galbraith, Michael Morrison Galbraith, 430 E. Ledbetter Drive, Dallas 16, Texas. Gail Galbraith Peek, 305 N. Virginia Ave., Falls Church, Va.

James E. Smith, Sarah Morrison Smith, 4521 Crest Lane, McLean, Va.

Emma Smith Stuart, 2108-A San Miguel Canyon Rd., Salinas, Calif.

James Morrison Smith, Susan Morrison Smith, Lee Morrison Smith, James Morrison Smith, Jr., Terry Morrison Smith, 4523 Crest Lane, McLean, Va.

Marjory M. S. Sarich, Charles B. Sarich, James R. Sarich, 4525 Crest Lane, McLean, Va.

David H. Smith, RFD 1, Rochester, New Hampshire.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 51,322.

NATIONAL RADIO INSTITUTE
H. E. Luber, Ex. Vice-Pres.

Sworn to and subscribed before me this 12th day of September 12, 1960.

Charles Alexander, Notary Public
(My commission expires January 14, 1964.)

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

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

Return Postage Guaranteed

Mr. Lester N. Rodgers
3 Sadsury Ave.
Christiana, Penna.

E30-D322-G

4A