nri journal

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- THE NEW CONAR AUDIO COLOR
- IN-CIRCUIT TESTING OF TUBES AND TRANSISTORS
- 1965 ELECTRONICS REVIEW AND FORECAST

MAY • JUNE 1965 35 CENTS

NEW!

Touch Control Lamp Kit

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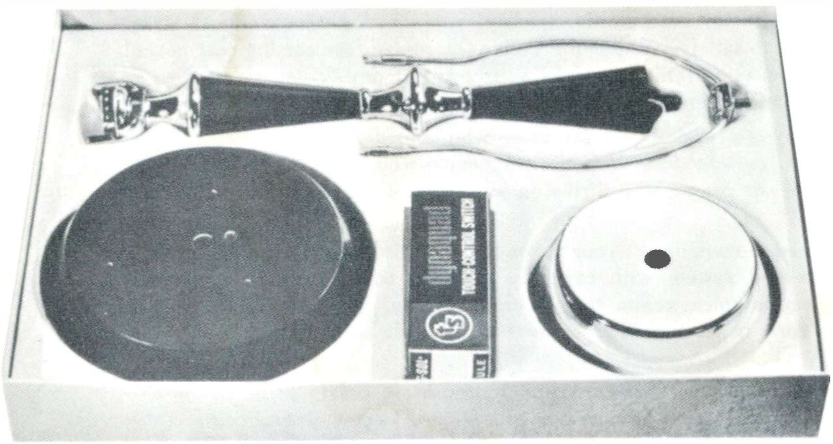

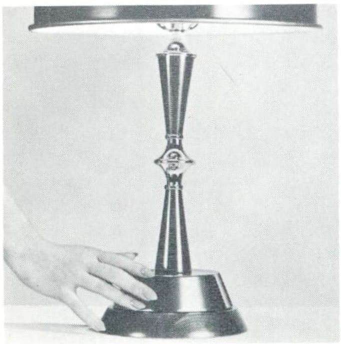

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nri journal

MAY/JUNE, 1965

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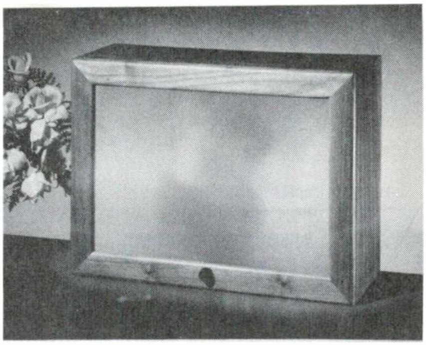

ON OUR COVER

If you're the imaginative type, you probably make beautiful pictures in your mind as you hear the sound of music: cool greens, blues, and violets with softly keyed tunes, blaring reds and yellows with loudness or dissonance, and all the hues in between with the medium loud, medium tempo arrangements. If you go to hear a concert or combo rendition, the pictures to accompany the music are supplied for you, as Ted Beach says in his article beginning on Page 4. Now CONAR has developed an instrument by which you can SEE in color what you hear: the Audio Color, a photorhythmicon device that translates the sound from your hi-fi, stereo, tape recorder, or even most radios, to patterned colors across its frosted screen. It's sort of the way smelling the aroma of a steak charcoal-broiling makes it taste better, or in essence, two senses used on the same thing heighten its enjoyment. Tune in on Ted's story, Page 4, for details.

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CHARTS AND NOMOGRAPHS FOR ELECTRONICS TECHNICIANS AND ENGINEERS. Donald W. Moffat, Gernsback Library. 99 pp., (8-1/2 × 11), $5.95.

Contains solutions to hundreds of math problems that technicians, engineers, hams, and students might have. Just turn to the appropriate page, put your ruler in place, and read the answers. Saves hours of time in routine calculations; with step-by-step instructions, examples for using each chart.

PRACTICAL GUIDE TO MECHANICS. Audel. 384 pp., $4.00. Available from Sams.

"The laws of mechanics affect every action we make. Man is constantly moving something, constantly doing work. There is always some specific object that must be moved a specific distance in order to accomplish the desired results.

"When equipment or tools are employed, force is applied and energy expended."

The book offers, in everyday terms, a complete study of basic mechanics, the branch of physics that deals with motion and the phenomena of the action of forces on bodies.

A general review of the mathematics, including algebra and geometry, needed to deal with mechanics is included, as well as fundamentals and the application of mechanics to such devices as levers, planes, wedges, pulleys, and various types of gears and gear trains.

HOME WORKSHOP AND TOOL HANDBOOK. Audel. 448 pp., $5.00.

A practical guide written for the home craftsman, student, or beginner.

Chapters include: Planning the Home Workshop, The Workbench, Hand Tools and Their Uses, Hand Tools for Cutting, Boring Tools, Fastening Tools, Miscellaneous Hand Tools, Sharpening Woodworking Tools, Power Tool Selection, The Circular Saw, The Radial-Arm Saw, The Band Saw, The Jigsaw, The Woodturning Lathe, The Jointer and the Shaper, The Sander, The Drill Press, Portable Woodworking Machines, Common Woods and Their Uses, Common Wood Joints, Painting, Practical Shop Mathematics, Safety Suggestions. Available from electronics parts distributors, bookstores, or Howard W. Sams and Co., Inc., Indianapolis, Indiana.

HI-FI TROUBLES --- How You Can Avoid Them; How You Can Cure Them. Herman Burnstein, Gernsback Library, Inc., 154 W. 14th St., New York, N. Y. 10011. 160 pp., $3.95.

Tells in layman's language how to locate troubles in an audio system, what to do about them, and how to do it....what the average audiophile can do himself and what he should leave to the technician. (Also a useful guide to technicians.) It's aimed at helping the listener to be his own hi-fi doctor, with solutions to such problems as noises in switches, deteriorating equipment, excessive hum, tubes, resistors, distortion, bass and treble problems, special installation problems, stereo and tape troubles, etc.

Local Chapters of NRI Alumni Association Seek New Members

There are local chapters of the NRIAA in fourteen cities in the U. S. These chapters were founded and are maintained by NRI graduates. Their purpose is to provide facilities for NRI men to hold meetings for the benefit of the members. The meetings are devoted primarily to talks, demonstrations, and discussions on the practical side of Radio-TV servicing. These programs are generally conducted by the senior members of the Chapter, who lead, guide, and otherwise help the more inexperienced members.

The members also enjoy the opportunity to associate with other fellows who have the same interests as they in Radio-TV-Electronics. They like to get together, swap experiences, hold "bull" sessions. Many Chapters serve refreshments such as cold drinks, coffee and doughnuts or snacks. This helps the members to relax and enjoy the good fellowship.

Membership in a local Chapter is NOT limited to graduates. Students are just as eligible as graduates. All local Chapters constantly strive to get as many new members as they can and extend a warm welcome to any NRI student or graduate who wants to join or visit the Chapter.

If there is a local Chapter in your area (see "Directory of Local Chapters" on page 32) we strongly suggest you drop in on some meeting night and get acquainted.

'65 GODDARD AWARD GOES TO J.E. SMITH

NRI's founder, J. E. Smith, has been selected by the Alumni Citations Committee of Worcester Polytechnic Institute as the 1965 recipient of the Robert H. Goddard Award for outstanding professional achievement. The award, made under the joint sponsorship of the WPI Alumni Association and the college board of trustees, will be given to Mr. Smith at the college's reunion luncheon June 12.

Mr. Smith graduated from Worcester Polytechnic in 1906 as an electrical engineer.

Prof. Goddard, one of the college's most illustrious alumni, is generally recognized as the "father of modern rocketry", as well as for other outstanding scientific achievements. His early experiments with rocket propulsion, at a time when such efforts were generally considered visionary and impractical, actually formed the scientific basis for the world's present and future accomplishments in space exploration.

MARKING REFERENCE MANUAL

Every tool user and technician has his much used reference manual with one or two sections thumbed most frequently. To open the manual instantly to this most wanted section mark the chapter with a permanent tab. The tab is made from a strip of plastic tape fastened to the beginning of the chapter in question. The photograph illustrates the use of such a tab. The strip is doubled over and in this way fastened to the edge of the page so that it can be "spotted" immediately by the manual user.

Glen F. Stillwell

The Sound of Music: Enhance With New CONAR Audio Color

Hues of Varying Intensity Move Across the Screen, Responding to Changes of Pitch and Tempo of Tune

By E.B. BEACH

Motion pictures were for many years mute, and pianists and organists used to supply mood music for the changing scenes on the theatre screen. Audiences soon became tired of the same old thing, however, and movie attendance fell off considerably. After Edison invented his fabulous "talking machine," it was not long until there were "talkies" and movies were given a new life.

In the very same way, some sort of visual stimulation can be added to enhance high-fidelity music. Concertgoers can see the movement of the conductor's hands, watch as the tympanist plays a roll on the kettle drums and feel the excitement as the cymbals crash together. In the home, this beauty of motion and color is left to the imagination of the listener, and visual stimulation is totally lacking. Stereophonic sound has added a new dimension to high fidelity, but still does not give complete satisfaction to the senses...sight is still missing.

For these reasons, then, the color organ or photorythmicon came into being. The CONAR Model 103 is perhaps one of the most advanced of those presently available.

BASIC DESIGNS

A color organ in its simplest form would consist of an amplifier and a light source as shown in Fig. 1. The amplifier takes the low

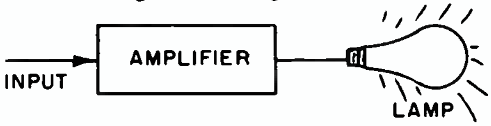


FIG. 1. Simple color organ.

level audio signal from the sound system (usually from the loudspeaker) and builds it up to a level sufficiently high to light the lamp. The lamp brilliance will vary in step with the loudness of the music.

The simple system described above does not represent a very practical color organ. Indeed, how monotonous it would be merely to watch a lamp flicker in step with music loudness! Music has, in addition to intensity variations, basic changes in pitch or frequency which go to make up the tune, melody, or theme of the piece. Individual instruments also are restricted in the range of frequencies they can play; violins mid to high, trumpets low to mid, cello mid to low, etc. Therefore, a practical color organ should

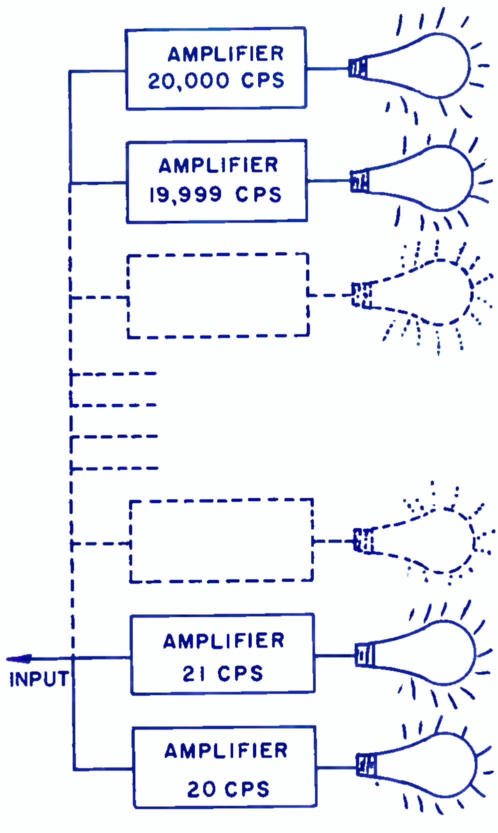


FIG. 2. Ideal color organ.

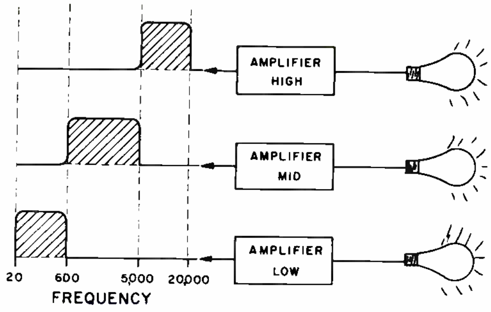


FIG. 3. Practical three-channel color organ.

have some means of indicating changes in the pitch as well as loudness of music. Ideally there would be an infinite number of amplifier lamp combinations, each one responding to one discrete frequency as shown in Fig. 2. Practically speaking, the frequency spectrum is usually divided into three bands or groups of frequencies for application to the lamps as shown in Fig. 3. These bands are usually considered to be low (20 cps to 600 cps), mid (600 cps to 5,000 cps), and high (5,000 cps to 20,000 cps) frequencies.

Displays

The problem with our color organ shown in Fig. 3 is that there must be some suitable way to display the light from the three lamps. After all, even with three frequency and loudness-sensitive lamps to look at, we would hardly enjoy staring at three identical glaring, naked bulbs even for a short period of time! Coloring each lamp a different color (red for low, blue for mid, and green for high, for example) would be at least one way to create a watchable display. Other display possibilities are shown in Fig. 4. Each of these displays has been used, and each works quite well. However, they all have one lacking in common...they are static and unmoving, with little variation from one piece of music to the next.

Circuits

Aside from the display part of a color organ, the electronic part is of prime importance. Fig. 5 shows several configurations used for the lamp amplifier. Fig. 5A shows a vacuum tube power amplifier, transformer coupled to the lamp. Outside of the expense of a power supply and output transformer, the two major disadvantages of this circuit are heat and long warmup time. This amplifier belongs with the horse and buggy...in the past.

Fig. 5B is a product of our rocket age and uses the relatively new LDR (light dependent resistor). A small lamp illuminates the LDR, whose resistance varies in step, controlling current to a 120-volt lamp directly. Advantages: large power control, simplicity. Disadvantages: fairly high driving power required, rather costly.

The SCR (silicon controlled rectifier) circuit shown in Fig. 5C can also be used to control a regular 120 volt lamp (up to 500 watts or more) directly from the power line. The largest disadvantage here is the expense of the SCR and its control circuitry. Three of these circuits in a color organ would make it much too expensive for the average person.

The transistor amplifier of Fig. 5D represents perhaps the ideal circuit in terms of sensitivity, cost, and complexity. It is an "instant on" circuit, like 5B and 5C; is quite sensitive, and can supply an adequate amount of power to the lamp. It is this type of circuit that is used in the CONAR Model 103 Audio Color. This circuit, along with a unique dynamic type of display, make the Model 103

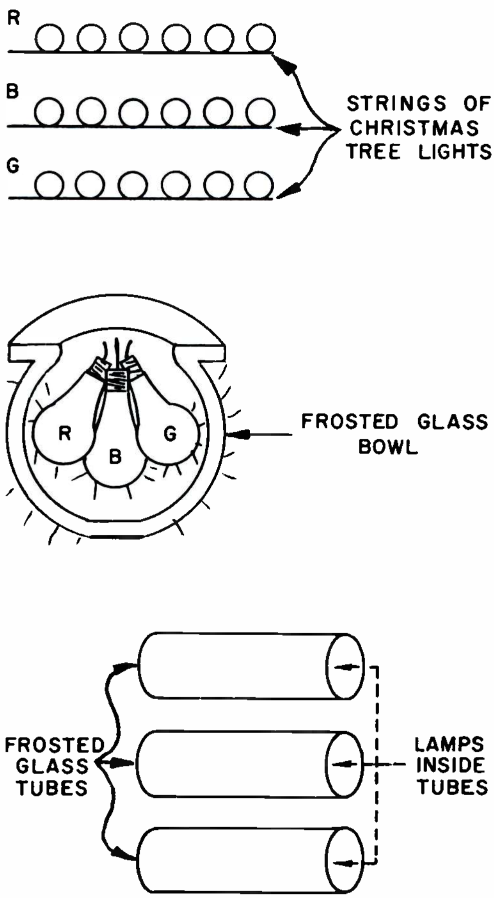


FIG. 4. Three display units.

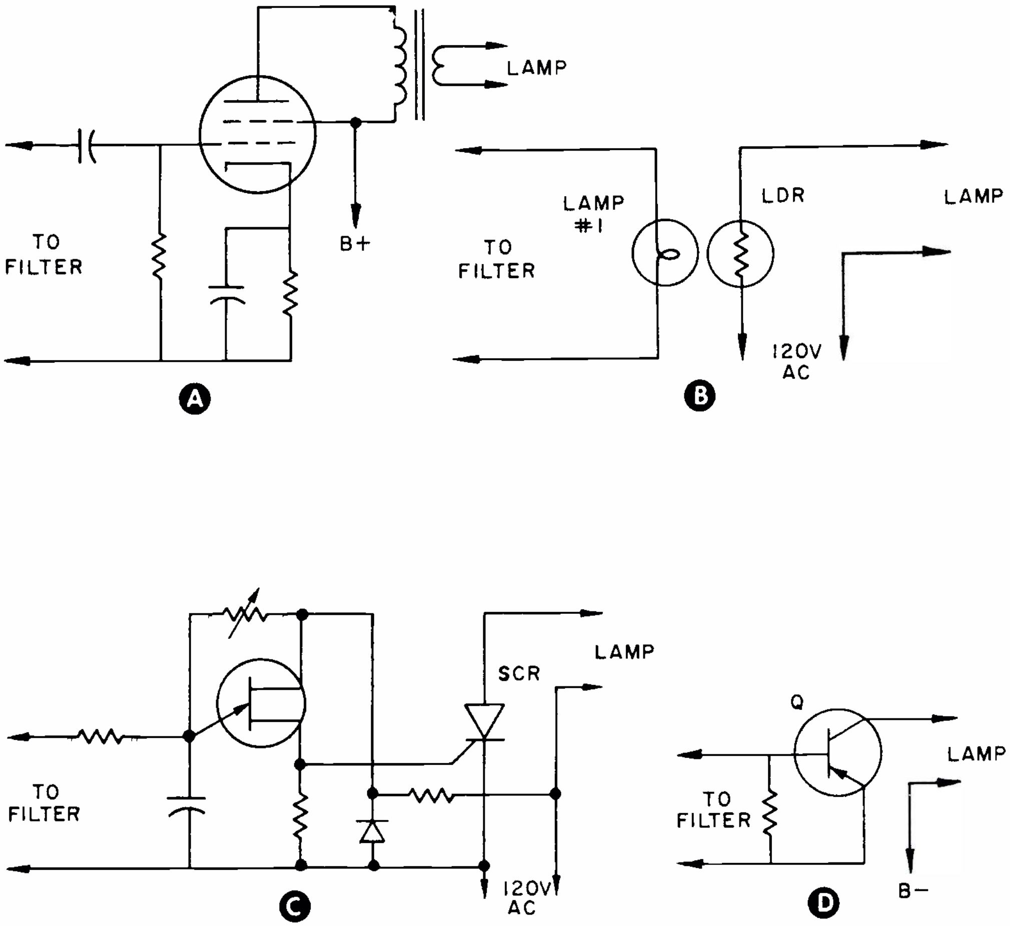


FIG. 5. Tube (A), light dependent resistor (B), silicon controlled rectifier (C), transistor (D) lamp amplifiers.

a truly remarkable audio instrument, producing mobile changing color patterns rather than mere flashes of colored light as do the rest of the color organs.

CONAR MODEL 103

Actually, the Conar Model 103 Audio Color is unique in its field...It is the only commercial color organ available for under one hundred dollars, and the only such unit supplied either as a kit or as a fully assembled and tested instrument. In addition to its low cost, the Model 103 has perhaps one of the most interesting and attractive display presentation of any color organ ever devised. Here's how it works.

Optical Displays . . . .
The display of the Model 103 consists of four principal parts (refer to Fig. 6):

(1) the light source.
(2) the color disk.
(3) the projection screen.
(4) the clock motor.

In operation, varying intensity sound actuates the lamp (A). The metal chassis (B) acts as a reflector to direct the light rays forward through the color disk (C) and onto the rear of the projection screen (D). The motor (E) turns the color disk at a slow (1 rpm), constant rate.

The color disk is a clear plastic disk, upon which are applied random areas of red, blue, yellow, gray, magenta, and green light filters. As these colored areas pass in front of the lamps, the light transmitted to the screen changes its color.

The spacing between the lamp and the disk

(F) and the spacing between the disk and the screen (G) have been selected to produce two specific results. First, the light which passes through the disk is sufficiently diffused so that the projected patterns on the screen do not show the distinct boundaries between the various color areas of the disk. In other words, the image of the color patterns is "out of focus" on the screen, causing the patterns to blend into one another.

Second, the placement of these components is such that light from either lamp will illuminate the entire screen, although the illumination will be uneven. For example, the lower lamp shown in Fig. 7 will shine on the screen from B to C as indicated. Motor bushing (D) does not lie in the path of the light to the screen at C, and therefore will not cast a shadow. The light pattern at A will be the brightest and most pronounced because it is closest to the lamp. The pattern at B will be less bright than that at A, and the pattern at C will be the least bright of all.

In use, BOTH lamps will be operating in a random fashion, producing a total light pattern which is a complex composite of the two individual patterns. At the same time, the motor slowly rotates the color disk, causing an endless changing and shifting of the projected patterns. Now, let's see how the two lamps are actuated by sound signals from the loudspeaker.

Circuit Details . . . .

The electronic part of the Model 103 is also worthy of a detailed description, which follows. Unlike some of the color organ circuits described briefly earlier, the Model 103 has not three but two amplifier channels. One amplifier channel responds to low audio frequencies (20 cps to approximately 600 cps) only. The other amplifier channel responds only to the higher audio frequencies (600 cps to 20,000 cps). Each amplifier output is connected to one of the two lamps shown in Fig.

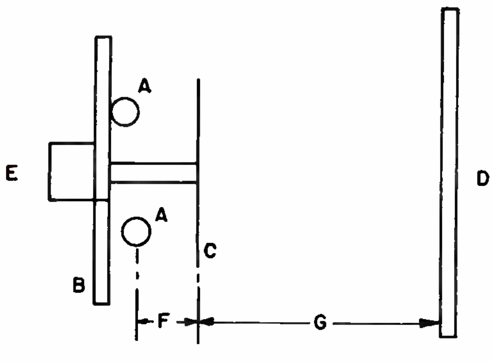


FIG. 6. Optical display of the Model 103.

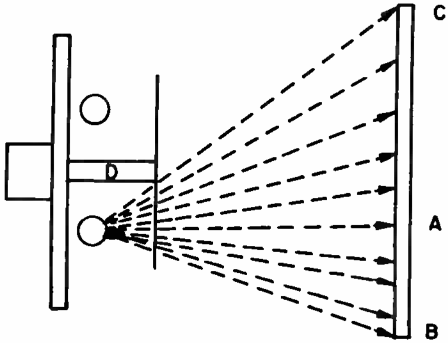


FIG. 7. Illumination of lower lamp.

7. Simple resistor-capacitor filters are used to separate the audio driving signal into the low and high frequency channels.

An added feature of the Model 103 is the wideband preamplifier stage used ahead of the resistor-capacitor filter circuits. Many color organs use the low level loudspeaker signal to drive the filter sections directly. Unless very high-gain amplifiers are used (such as that in Fig. 5C), this arrangement requires the volume of the hi-fi amplifier to be turned up to an uncomfortably high level to supply the power needed to drive the lamp amplifiers as well as the loudspeaker. The preamplifier will, with normal operation of the hi-fi (that's less than 100 milliwatts power, for example, from a transistor portable radio) drive the Model 103 to full output brilliance!

Fig. 8 is a complete schematic diagram of the Model 103 Audio Color. A total of four power transistors is used - Q1, Q2, and Q3 are audio amplifiers while Q4 is used as a half wave rectifier. Transformer T1 delivers 25.2 volts ac at one ampere to the rectifier and filter. Resistor R8 acts as a current limiting resistor to protect Q4, while C6 and C7 provide 1000 mfd of filtering. The nominal capacity of the power supply section is 30 volts dc at a full load current of one ampere.

Transistor Q1 is the common emitter preamplifier and drives Q2 and Q3 through their filter networks. Thermal stability of the preamplifier stage is insured by the use of a small value of emitter-base resistor, R2 -68 ohms. Resistor R1 and capacitor C1 couple the low level speaker signal to the base of Q1. Bias resistor R3 is connected

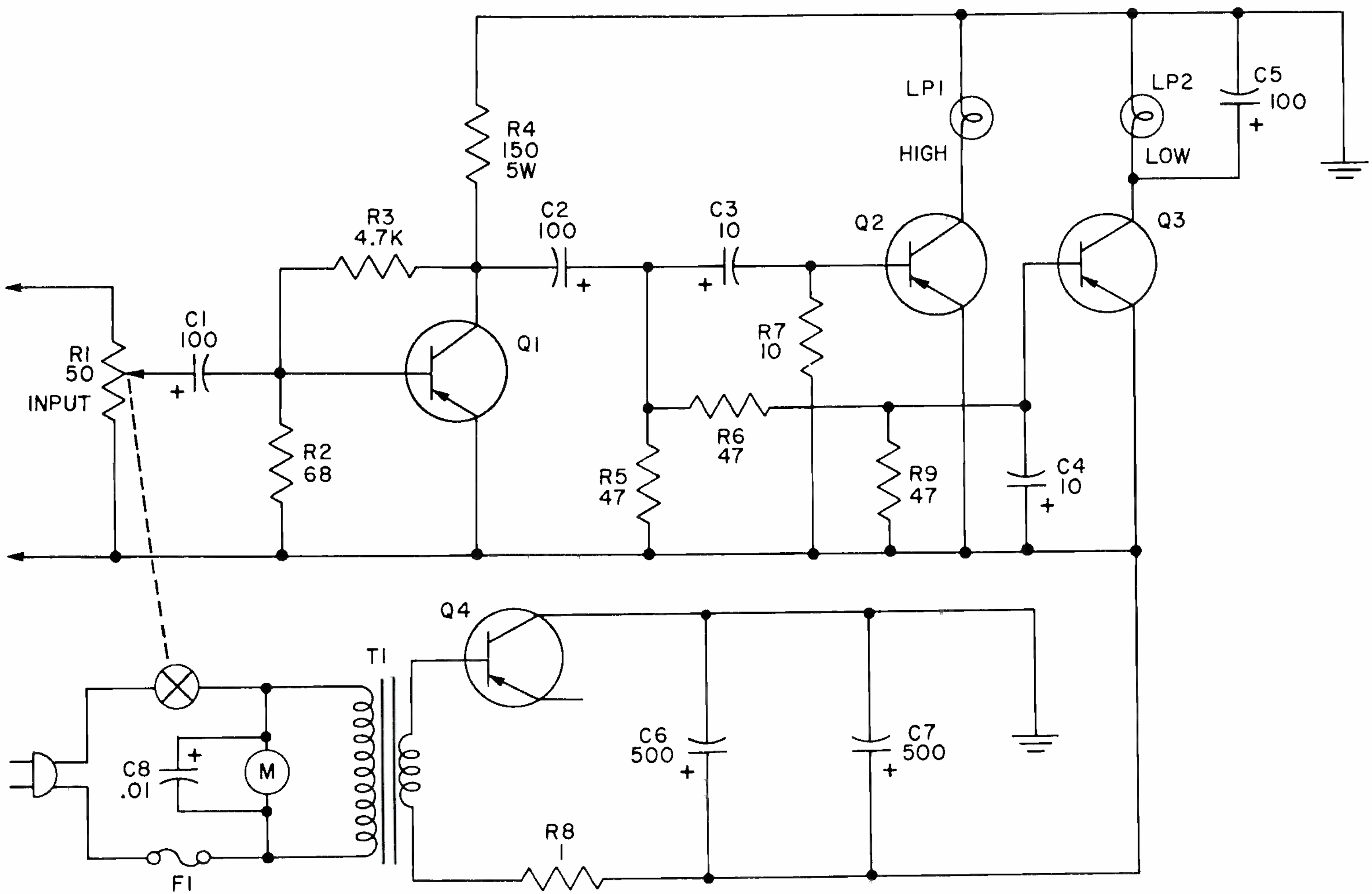


FIG. 8. Schematic of the Model 103 Audio Color.

between collector and base of Q1 to provide a degree of shunt type negative feedback to the base. This feedback, while it lowers the available stage gain, further increases bias stability provided by R2. At the same time it increases bandwidth and lowers the output impedance of Q1 to more nearly match the low input impedances of Q2 and Q3.

Output transistors Q2 and Q3 are also connected in the common emitter configuration. In order to obtain the maximum possible power output from these stages, they are both operated full Class B with no forward bias (other than leakage current, which is low). Transistor Q2 is the high frequency amplifier, and drives lamp LP1 in its collector circuit. Capacitor C3 and resistor R7 make up the high pass filter which passes only those frequencies above 600 cps. The low value of R7 (10 ohms) provides bias stabilization for Q2. Resistor R6 and capacitor C4 act as the low pass filter preceding Q3. Resistor R9 provides bias stabilization for Q3 while C5 aids in suppressing high frequencies in the collector of Q3.

The two lamps LP1 and LP2 are special automotive type high intensity lamps. They provide a maximum amount of brightness and at the same time they are capable of supplying the varying illumination needed in a color organ. Ordinary incandescent lamps are not able to follow rapid changes in frequency and loudness, so are not really suitable for use in a color organ. The special lamps used in the Model 103 are extremely rugged, and have a life expectancy that is quite long, due to the intermittent class of operation in which they are used.

Specifications

The following is a list of some of the electrical and mechanical specifications of the Model 103 Audio Color:

Sensitivity -- less than 100 mw.
Input connections --- 3, 4, 8 or 16 ohms
Power consumption -- 45 watts maximum
Electrical and optical crossover -- Approximately 600 cps.
Frequency response -- 20 cps to 20,000 cps
Weight -- 10 lbs.
Dimensions -- 11-1/4" x 15-1/4" x 6".
Finish -- natural oiled walnut.

KIT VERSION

As noted earlier, the Model 103 is available from CONAR either as a fully assembled and tested, ready-to-operate instrument or as an easy to assemble kit. While it may be a convenience to some people to be able to unpack and use immediately their assembled Audio Color, the simplicity of construction (and lower price) of the kit version makes the kit also look very attractive.

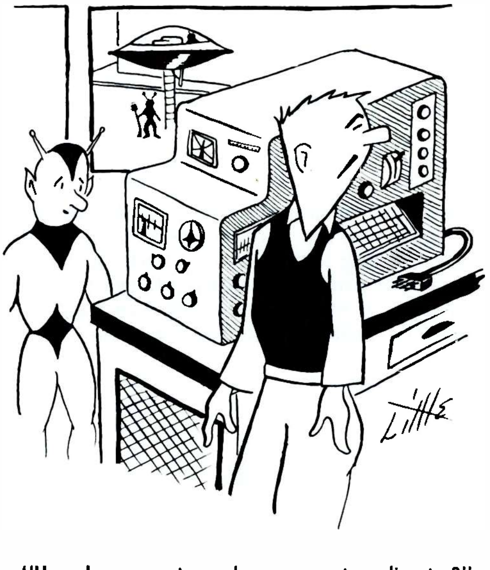
Kit Contents

The kit version of the Model 103 contains all the parts needed to put together the instrument quickly. Quality parts are supplied (just as in the assembled version) in a neat package, along with the required assembly instructions. A separate eight-page instruction manual tells in simple language how to connect and use the Model 103 with your hi-fi.

Assembly

Assembling the Model 103 is simplicity itself. The instructions are divided into three parts: a very useful booklet containing the General Assembly Instructions, and two large assembly sheets which show the actual assembly of the unit.

Each of the assembly sheets is printed in three colors to aid in the construction, and each sheet has all the needed figures and illustrations for the assembly work on that sheet---no flipping back and forth from page to page in a manual. The first sheet gives parts-mounting instructions for the various components. The second sheet contains all the wiring instructions and shows how to install the completed unit in its cabinet. And that's all of it! About a four-hour job for anyone who knows one end of a soldering iron from the other. (For those who DON'T know one end of a soldering iron from the other, there is a very complete section on soldering in the General Assembly Instruction manual!)



"Hey, Joe, we got any dope on a meteor diverter?"

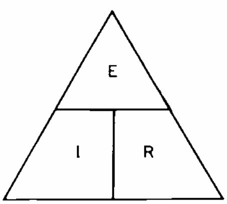
BY STEVE BAILEY

DEAR STEVE:

I have had a great deal of trouble remembering the formulas for Ohm's Law. Is there any shortcut I can use, or do I have to memorize each one?

P. B.
California

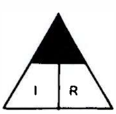
In the diagram below, I have shown a simple chart many new students in Electronics have found to be extremely helpful in learning the Ohm's Law formulas. In addition to helping you find the formula you need, this chart will help you to memorize them more quickly.



To use it, you simply cover the block containing the letter that represents the value you are trying to find. If the remaining letters are side by side, you multiply the values they represent. If one letter is above another, you divide the bottom value into the one above it.

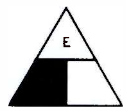
For example:

Find E:



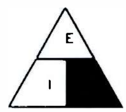
therefore, $E = I \times R$

Find I:



therefore, $I = \frac{E}{R}$

Find R:



therefore, $R = \frac{E}{I}$

(NOTE: Ohm's Law was explained in detail in the March/April edition of the NRI Journal.)

DEAR STEVE:

I would like very much to have an index that I could use to locate information in my lessons. Do you have one available, or are there plans to make one up?

S. C.
Arizona

I have received many requests for an index to each NRI course. However, after studying the point, I do not believe it would be too practical.

Here at NRI we have a staff of technical writers who are constantly revising and rewriting each lesson text. This is necessary if we are to keep each course completely up to date. New material is being added and out-of-date material removed. Explanations are rewritten to improve and simplify the material. Lesson texts are often given new numbers to improve presentation.

I have estimated that it would take at least three years to present a fully comprehensive index. The only trouble is that revisions and changes made during that period would make the index out-dated even before printing. Thus, it would be of little or no value.

If you wish to make up an index of your own according to the lessons you receive, you could clip the study guide from the front of each lesson and cut out the various chapter titles and discussions. These could be filed either as they are or pasted on a card and filed in alphabetical order.

Another method you could use that would avoid defacing the lessons would be to type the chapter titles and discussions on separate index cards. These could be filed in alphabetical order. It would then be very easy to locate information on any subject.

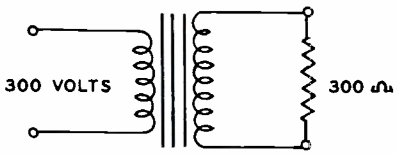
DEAR STEVE:

I would like to know about current relationships in a transformer. I realize that voltage will be stepped up in a step-up transformer and stepped down in a step-down transformer, but what happens to the current?

C. C.
Florida

The easiest way to remember current and voltage relationships in a transformer is to remember that they are opposite. However, the turns-ratio will remain the same, only turned around.

In the circuit I have shown below, we have a step-up transformer with a 1:3 turns-ratio. The source voltage is 300 volts and the secondary resistance is 300 ohms.



In a step-up transformer, the secondary current is stepped down. Since the secondary voltage is 3 times the primary voltage, the secondary current is equal to 1/3 the primary current. Of course, 3 is 1/3 of 9, so the primary current is equal to 9 amperes.

The main thing to remember is that the secondary current is stepped down in a step-down transformer; the secondary current is stepped up in a step-down transformer.

Since this is a 1:3 step-up transformer, the secondary voltage is equal to 300 × 3 or 900 volts. The secondary current is equal to

$$I = \frac{E}{R} \text{ or } \frac{900}{300}$$

which is equal to 3 amperes.

By now student E. M., Wake Island, must be thinking that the title of Steve's column, "Communications", should be changed...obviously, ye editor and Steve had a breakdown in THEIR communications, like in the difference between X, the unknown quantity and the times sign, and capacitive and capacitances.

With apologies to E. M., all the other readers we managed to confuse, and Steve, herewith is the letter from his March/April column and Steve's answer, complete with times signs.

DEAR STEVE:

In Lesson 7BB, we are given the formula $\frac{1}{6.28 \times F \times C}$ for determining capacitive reactance. Also, we are given the formula $\frac{159,000}{F \times C}$. Which one is correct?

E. M., Wake Island

Both of the formulas you have shown are correct. The difference is in the way the value of the capacitor is expressed.

Whenever you are trying to find the reactance of a capacitor with a value expressed in farads, you use the formula $\frac{1}{6.28 \times F \times C}$. F (frequency) is expressed in cycles and C (capacity) is expressed in farads.

If the value of the capacitor you are working with is expressed in microfarads, you use the formula $\frac{159,000}{F \times C}$. Again, F is expressed in terms of cycles, but C is expressed in terms of microfarads.

Should the value of the capacitor be in micromicrofarads, you can convert to microfarads by moving the decimal point six places to the left. You can then use the formula $\frac{159,000}{F \times C}$.

DEAR STEVE:

What is the difference between an effective voltage and an RMS voltage?

B. B.
Virginia

There is no difference between an effective voltage and an RMS voltage. These terms are used to describe the same thing.

The abbreviation "RMS" stands for root-mean-square, which is the effective value of an ac voltage. It corresponds to the value of dc voltage that will cause the same heating effect.

To give you an example, suppose we have a circuit with a fixed value of resistance. A certain amount of dc will be required to force a current of 1 ampere through the circuit. Let's assume a dc voltage of 100 volts is required to do this. Then, we substitute an ac source in the place of the dc source and insert an ammeter in the circuit to measure the current. The ac voltage is increased until the ammeter indicates a reading of 1 ampere. The ac voltage is said to be 100 volts since it is producing the same effect as 100 volts dc. It is described as 100 volts effective ac.

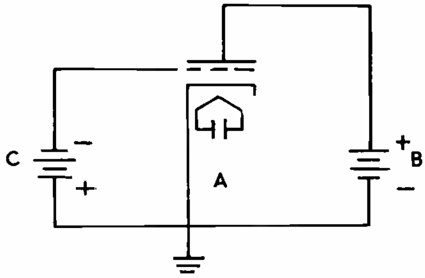
DEAR STEVE:

I have seen the terms "B+" and "B-" used quite often on schematic diagrams. Apparently they are used to indicate a voltage source and perhaps ground. Would you clarify this for me?

J. S.
Maryland

The term "B+" is used to describe the plate and screen voltages in a receiver. "B-" is used to refer to the ground circuit of a receiver.

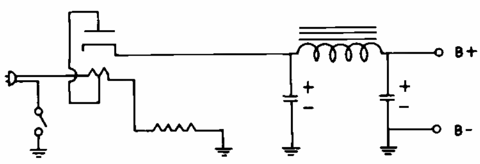
Shown below is a diagram that is typical of those you have seen in your lessons.



Notice that the plate voltage is supplied by the "B" battery. Also, notice that the positive terminal of the "B" battery is connected to the plate. Thus, the plate voltage is known as the "B+" voltage. "B+" is the most positive point in a receiver.

The other end of the "B" battery is connected to ground. This is the common negative point in a receiver. So, when a connection is made to the common negative, we say it is connected to "B-" or ground. This is the most negative point in a receiver. When a voltage measurement is given on a diagram, you know it is taken with respect to this point.

In modern receivers, the "B" batteries have been replaced by power supplies. An example of one is shown below. Notice that the positive side is referred to as "B+" and the negative side as "B-." This is a typical ac-dc power supply.



DEAR STEVE:

Please send me more information on modulation and modulated signals. I am presently studying Lesson 2BB.

D. R.
Alabama

In Lesson 2, you are given only a brief introduction to modulation. It is defined on page 19 of that lesson. Modulation is the process by which we combine an audio signal and an rf carrier.

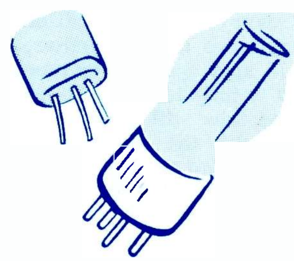
The audio signal is known as the modulation signal since it is used to change the characteristics of the rf carrier. Since the rf carrier is the signal being changed, it is the modulated signal.

In later lessons, you will study the processes we use to modulate a signal and will study modulation and demodulation (the process of removing the audio signal from the rf carrier) completely. All you need to know at the present time is the definition of modulation.

Convictions are splendid when they relate to important matters; they are a public nuisance when they provoke a row over a petty detail . . . . BRUCE BARTON

IN-CIRCUIT TESTING OF TUBES AND TRANSISTORS

By J.B. STRAUGHN



The actual repair of equipment using vacuum tubes more often than not starts with a test of all tubes. This time-wasting procedure has some justification, not only because tubes are the parts which most often fail but also because tubes are easily removed, checked in a tube tester, or substituted.

But what if tubes were soldered into their circuits rather than plugged into sockets; would they be laboriously removed from the set, connected to a tube tester with clip leads, and tested? Of course not! The serviceman would never test or substitute a tube unless he had good reason to suspect that it was involved in the symptom that he was trying to correct.

This recalls the "good old days" of wartime servicing, when we all hoped the trouble was

The CONAR Model 510 transistor power supply.

something other than a tube. We couldn't get tube replacements and would have to become temporarily an engineer, while we redesigned the stage to work with the nearest replacement tube we could lay our hands on.

Fortunately, replacements for most transistors are available, but most transistors are soldered in. Why is this done instead of using available sockets? Some reasons are as follows:

1. Low-power transistors are made with flexible leads which are sometimes difficult to get into a socket; which often make poor socket contact and which easily lend themselves to soldered connections. Also there are generally only three leads to be soldered, rather than the seven or more socket connections required for most tubes.

The CONAR Model 230 Signal Tracer.

2. Transistors are almost as reliable as resistors and capacitors, which are wired in place, and one must admit it is seldom that a resistor or capacitor requires replacement in a transistor receiver.

3. Most transistors can be checked quite accurately in the set as we shall see later in this article.

4. Wiring-in makes it impossible to pull out and reinsert a transistor while the equipment is turned on. This can (not always) be a disastrous occurrence because it is quite possible that some capacitor will be charged to the full supply voltage when the transistor is removed. The transistor may be damaged due to the capacitor discharge that occurs when the transistor is reinserted.

In view of the above, it is apparent from a servicing viewpoint that there is little if any advantage in using sockets in most transistor applications.

IN-CIRCUIT TUBE TESTING

To carry out the parallelism of tubes and transistors a little further, let's see how we could spot a defective tube without checking it in a tube tester. The best check is to see if the tube will pass a signal. This can be done with the familiar circuit disturbance test, carried out by touching the control grid with the tip of a screwdriver, while holding the metal shank in your hand. A click or thud in the speaker shows everything from that point to the speaker, including the tube, all parts and operating voltages, are okay. But, what if no click is obtained at the input of some stage, for example the grid of VT1 in Fig. 1?

Since a click was obtained at the grid of VT2, the first thing to do is to measure the cathode voltage of VT1. Lack of cathode voltage would show that VT1 is not drawing any plate current. This could be due to a burned-out fila-

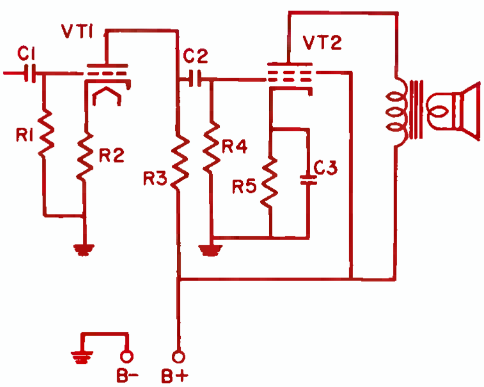


FIG. 1. Typical audio section in a tube receiver.

ment in the tube, an open in plate load R3, or possibly to an open in the grid resistor, resulting in a negative charge building on the grid side of C1 to the point where the plate current would be cut off. The latter possibility is easily checked by shorting R1, and if the cathode voltage then appears you know that R1 is open. Next measure the plate voltage. Lack of voltage shows R3 is open. But if the plate voltage is equal to the B+ voltage, it confirms that the tube is not drawing plate current. If the filament is lit, either the cathode is open in the tube, or the cathode has lost emission. In either case, the tube is defective and must be replaced.

Suppose, however, the tube voltages are normal and the signal is weak. How can you in-circuit check the tube? An easy way is to measure the plate voltage and then connect a 0.5 volt source (a variable transistor power supply such as the CONAR Model 510 is ideal) across R1. Note the resulting change in plate voltage. The amount of voltage change is twice the stage gain. If you divide the change in plate voltage by the change in grid voltage you have the stage gain. The formula is:

$$\text{Gain} = \frac{\Delta EP}{\Delta EG}$$

And because ΔEG equals 0.5, the gain is twice ΔEP (Δ, pronounced delta, means the change in).

This gain test is fine for resistance coupled stages but does not work in transformer coupled stages. In the latter case a signal tracer, such as the CONAR Model 230, which is calibrated to measure stage gain, should be used. However, in any tube amplifier using a cathode bias resistor, a change in grid voltage will result in a change in cathode current and hence cathode voltage, if the tube is working.

Although tubes and circuit parts can be rapidly and accurately in-circuit tested, servicemen will still use tube testers because tubes are plug-in devices. This brings us up to soldered-in transistors and what to do about them.

IN-CIRCUIT TRANSISTOR TESTING

Just as with tubes, stage isolation is the first step towards location of a defective transistor. In the case of a dead receiver or amplifier, the quickest check is made with a circuit disturbance test. However, in transistorized equipment no disturbance will occur if you touch the base or any other electrode. This is due to the low input impedance of the transistor, which prevents any voltage variation when you touch an electrode with your hand.

A definite disturbance with its accompanying thud or click results if a change is made in the emitter-base forward bias. This can easily be done by using the voltage source in the ohmmeter section of a VTVM. If the VTVM has a separate ON-OFF switch, it should be turned off and the function switch set to ohms. In the case of the NRI Model W or the CONAR Model 211, where the ON-OFF switch is on the function switch, unplug the VTVM from the power line.

Check the receiver schematic and note whether the emitters connect to the negative or positive side of the transistor set voltage

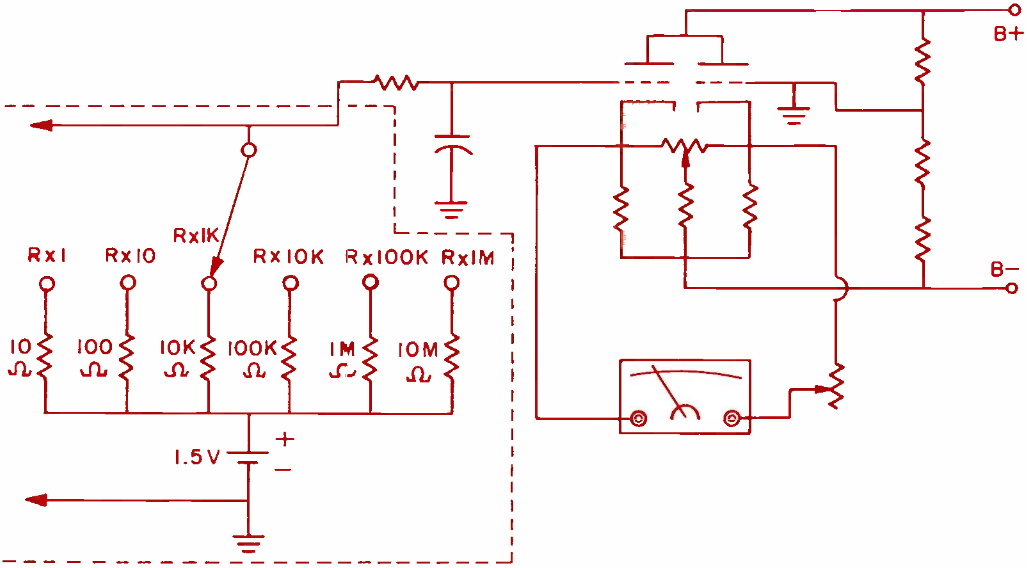


FIG. 2. The ohmmeter circuit of a VTVM.

source. Connect the VTVM ground clip to that point. Set the VTVM range switch to the RX IK position. Note that there is a 10K ohm resistor in series with the 1.5 volt battery and the VTVM probe as shown in Fig. 2.

With the set turned on, touch the probe to the base of each transistor in turn, working from the output towards the input. This will change the forward bias on the transistor, and a click or thud will be heard in the loudspeaker if everything is okay from that point to the speaker. The 10K resistor in the VTVM circuit will prevent any damage to the transistors.

The VTVM is turned off or unplugged from the power line so its meter will not flop around when making the test; usually the meter won't be damaged, but the sight of a meter pointer wildly gyrating and hitting its stop is liable to be unnerving to the careful technician.

The check will not localize a weak or otherwise improperly operating stage. For such a complaint a signa. tracer should be employed.

Once the defective stage is isolated, it is a simple matter to check the transistor.

Transistors have collector and emitter currents which are controlled by the base-emitter forward bias. You should remember the two following bias rules:

1. For PNP transistors the base voltage will be approximately 0.1 to 0.2 volts more negative than the emitter.

2. For NPN transistors the base voltage will be approximately 0.1 to 0.3 volts more positive than the emitter voltage.

These two rules are illustrated in Figs. 3 and 4. Note that voltages are not to be measured to ground, because in either PNP or NPN transistors the positive or negative side of the circuit may be grounded. This is a radical departure from the usual B- ground we expect in tube circuits.

In the case of an NPN transistor, make your tests from the negative side of the supply voltage and use the positive side of the voltage supply for the common point in checking electrode voltages for PNP transistors. Of course you can also measure directly between the emitter, base, and collector if desired.

IN-CIRCUIT TRANSISTOR TESTING FOR OPEN OR SHORTED ELEMENTS

Open Emitter: There will be no noticeable voltage drop across the emitter resistor, due to the fact that under these conditions the transistor is drawing little if any current.

Open Base: There will be a slight voltage drop across the emitter resistor. The base voltage itself may not be noticeably affected.

Open Collector: This condition generally shows up as abnormally low emitter and base voltages.

In the above three checks also look for an appreciable increase in collector voltage in those circuits where the collector is returned through a resistor to the voltage source rather than ground. Figs. 3A and 4A are examples in point.

Emitter to Base Short: The emitter and base voltages will be equal. Also look for an appreciable increase in collector voltage in circuits such as those shown in Figs. 3A and 4A.

Base to Collector Short: The base and collector voltages will be equal. The emitter will also increase to almost the same level as the base and collector voltages, as the emitter will follow the base voltage.

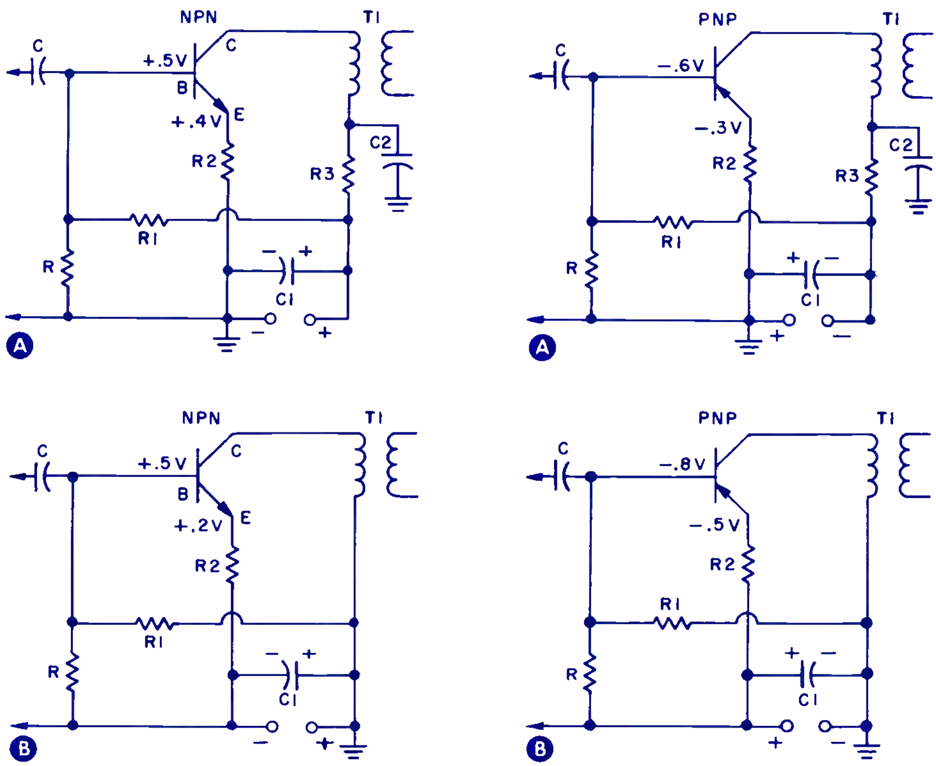
Emitter to Collector Short: The emitter and collector voltages will be equal. The base voltage may not be noticeably affected.

Remember that these are general rules and may not be 100% applicable to every conceivable circuit application. However, they are still excellent guides as to the location of the trouble.

If the above tests do not show a transistor defect, let's go a step further and see how we can actually check the ability of the transistor to amplify.

Locate a series resistor in the collector circuit such as R3 in Figs. 3A and 4A. Connect a VTVM across the resistor to measure the voltage drop. Short the base to the emitter. This will cut off the transistor and consequently reduce the voltage across the resistor to practically zero. A transistor that cannot be cut off is defective and should be replaced.

If a dc voltage drop can be measured across the primary of T1 in Figs. 3B and 4B, this voltage should also drop to zero when the base and emitter are shorted together. If T1 is an iron core transformer, its dc resistance will be high enough for this test. If these are rf transformers, the primary resistance will be too low for an appreciable dc voltage to be present.



FIGS. 3 and 4 show variations in grounding that may occur in either NPN or PNP circuits. Also note that the collector to ground voltage may be extremely low in either NPN or PNP.

In such a case, measure the voltage drop across the emitter resistor, R2 in Figs. 3 and 4. Again short the emitter to the base. There will be a decrease in the measured voltage but the reading will not drop to zero even though the emitter current is cut off, because the short forms a voltage divider consisting of R1 and R2 in series. However, lack of a decrease in voltage points to a defective transistor.

OTHER CHECKS

Here are two other checks you can make with the transistor still in the circuit. In both cases a VTVM ohmmeter is used (the voltage in a (multimeter type ohmmeter may be great enough to damage the transistor). Even with the VTVM ohmmeter you should begin all measurements on the highest meter setting and gradually work down to a setting that gives you a mid-scale reading. All of these tests are made with the receiver turned off or its batteries removed and the ohmmeter turned on.

Connect the ohmmeter leads to the base and collector terminals of the transistor under test. Note the reading. Reverse the ohmmeter leads. Again note the reading. Leave the meter connected in the position that gives you the highest reading. This represents the reverse bias position. Short the emitter and base terminals together. The resistance should decrease considerably.

Now remove one of the ohmmeter leads from the base terminal and connect it to the emitter terminal. Leave the other ohmmeter lead connected to the collector terminal as in the previous test. Note the reading. Short the emitter and base terminals together. This time the resistance should increase substantially.

These tests with the ohmmeter are of the good-bad variety and will not necessarily detect transistors that are weak or that have leakage. However, in most cases a good-bad test is quite sufficient.

These ohmmeter checks may also be used on transistors when they are out of the circuit.

TRANSISTOR REPLACEMENT

When replacing a transistor, use the exact type number if possible. Often, the transistor will have a color dot or suffix letter or number following the type number. This is a coding used to classify the transistor as to Beta or gain groupings. In order to maintain the original performance characteristics and balance this coding should be observed, particularly if used in push-pull output circuits.

In push-pull output circuits transistor failure in one circuit may cause the companion transistor to fail. This does not always occur but be sure to check for this possibility when replacing output transistors.

It is not necessary to replace push-pull output transistors in "pairs" in all cases, but it is advisable to check for distortion or unbalance in order to determine whether both transistors should be replaced.

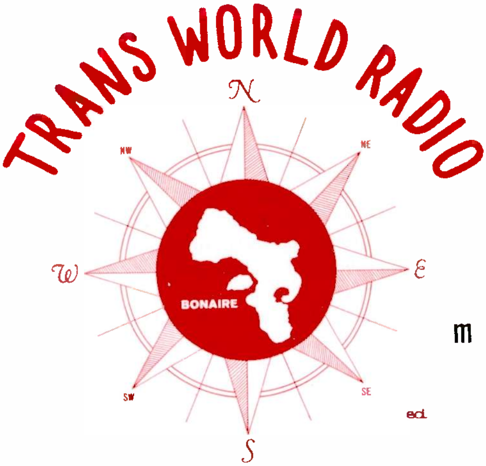
In the case of transistors using thin wire leads not much heat will be transmitted over these leads. However, it is a good idea to take care in making soldered connections to transistors. Application of excess heat, or prolonged application of a properly heating soldering tool to a transistor lead or terminal, can permanently damage the device. To be on the safe side observe the following precautions when soldering to a transistor lead or terminal.

1. Always solder as far as possible from the body of the transistor.
2. Never, under any circumstances, apply a hot soldering iron to a lead or terminal at a point closer than one sixteenth of an inch to the body of the transistor or for longer than about 10 seconds.
3. Use the smallest available soldering tool - preferably one of the soldering pencils intended for use with transistors or printed circuit components.
4. Make sure that the surfaces to be soldered and the tip of the soldering iron are adequately tinned and cleaned so that the connection can be made as quickly as possible.
5. Always grip the lead of the terminal to be soldered with a pair of longnose pliers at a point between the intended solder connection and the case or body of the transistor. This permits the pliers to act as a heat sink and to conduct heat away from the internal elements of the transistor.

The metal shells of most power transistors operate at the collector voltage. Make certain that no short to the chassis exists when the metal shells of these transistors operate at voltages above or below ground potential. When such power transistors are removed or replaced, make sure that all the original mounting components including the mica insulating spacer (with silicon grease applied to both sides) and insulating spacer washers are installed with the replacement.

From this article you can see that checking tubes and transistors without special equipment need not be either difficult or time-consuming.

TRANS WORLD RADIO



most — powerful — voice

NEW YORK, N. Y. (ED) -- Picture the world's most powerful voice emanating from a tiny island in the Caribbean. Seems unbelievable, but it's true.

The voice is Trans World Radio, owned and operated by an interdenominational missionary organization. The island is Bonaire, one of the loveliest resort spots in the Netherlands Antilles, a virtual paradise for nature lovers, fishermen, and skin divers.

With an AM transmitter 10 times as powerful as the largest commercial station in the United States, and seven complex antenna systems -- one almost as tall as the Empire State Building -- Trans World Radio beams religious, cultural, and educational programs in 24 languages to 100,000,000 radios around the clock.

Listeners in 89 countries, including those behind the Iron Curtain -- its primary target -- are able to receive this unique service which has been proved over the years to fill a deep need.

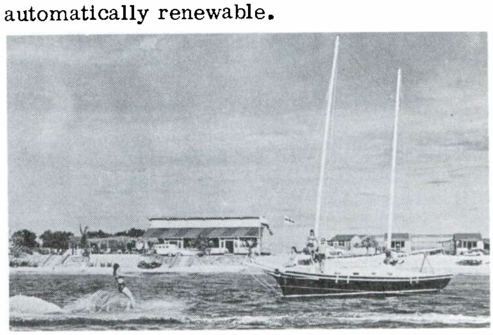
Trans World Radio was conceived about 15 years ago by an American Baptist minister who, with other Protestant evangelical leaders at a meeting in Switzerland, recognized a gap in religious communication outside the United States.

The minister, Dr. Paul E. Freed, traveled extensively after that, finding that many doors to preaching were closed. This realization led him to establish in 1954 the "Voice of Tangier," which beamed its spiritual messages to Europe for six years, until Morocco nationalized all private radio stations.

TWR then relocated to the most unlikely of gospel centers -- the international playboy princedom of Monaco.

But this move to Monaco had several advantages. First, the "voice" was 1,000 miles closer to Russia and to Europe's geographical center; second, the broadcast became 10 times more powerful than at its former location, and third, broadcasting facilities installed by Adolf Hitler were ready and available. Trans World rented the installation from Radio Monte Carlo with a 10-year lease, automatically renewable.

FROM HERE



HOME OF THE VOICE IS BONAIRE,

A TINY RESORT ISLAND IN THE CARIBBEAN

WHICH TWR SHARES WITH

RESIDENTS, FLAMINGOS, AND VISITORS.

BONAIRE BROADCASTING STARTED IN 1964.

From Monaco, Trans World reached people whose native tongues were Russian, Spanish, Latvian, Hebrew, Swedish, Portuguese, French, Italian, German, and Arabic and expanded to communicate with people who spoke dialects within these languages.

The organization decided to supplement its already powerful transmission in the early 1960's. The government of the Netherlands Antilles (Aruba, Bonaire, and Curacao) offered Dr. Freed a site on Bonaire, 60 miles north of the coast of South America, an island whose unique physical properties make it an optimum location for long distance radio broadcasting.

The land is level with salt water flats or the ocean on all sides, providing efficient ground system for the antennas and yielding increased radiation of power and a stronger signal in the target areas.

October 1, 1964, was the official opening date for the two super-power stations in Bonaire, known as the Island of the Flamingos since it is one of the world's rare breeding places for the brilliant pink-red birds.

Bonaire also boasts 140 species of birds other than the flamingo, and an abundance of game fish and lobsters. Because it's a place free of large industries, and overflowing in nature's sunny finery, it's one of the few remaining rare vacation destinations.

The island has a colorful history, too. Once the domain of the Indians who lived a simple country life, it became the playground of Europeans in the 16th century. About the same time, pirates frequently plundered the island's riches. Then the islanders focused attention on salt mining, chief industry of the 17th century, and now it also looks to TWR.

Consistent with the unusual circumstances and paradoxes of Trans World Radio's history is the fact that the broadcasts have never been jammed by the Russian government, although the messages have been penetrating deep behind the Iron Curtain.

Founder of TWR is Dr. Paul E. Freed.

Perhaps the reason lies in one of the many thousands of letters to TWR that attest to its effectiveness. One Hungarian stated: "We may have an Iron Curtain at the border, but there is no Iron Curtain above us."

Not only does testimony pour in from people who are deprived of religious freedom but from those in the hinterlands where there are no missionaries; from the handicapped unable to attend religious services, and from those who had been searching for the deeper meaning in life.

Typical among the programs offered are quiz shows, children's entertainment, dramatic skits, news, interviews, prayers, sermons, and music. The "commercial" is the Christian message. The programs are prepared at TWR's headquarters in Chatham, New Jersey.

Trans World Radio receives its major financial support from Protestant churches of every denomination around the world, but listeners contribute when they can as a token of their gratitude.

With the added complex at tranquil Bonaire of a 500,000-watt AM station and a short wave transmitter of 260,000 watts (the strongest single short wave transmitter in the world) Trans World Radio is now the largest religious broadcasting organization in the world, including the Vatican.

TO HERE

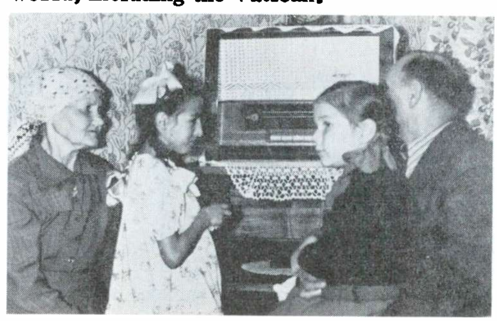
THE MESSAGE GETS THROUGH,

EVEN BEHIND THE IRON CURTAIN AS HERE.

100,000,000 RADIOS IN 89 COUNTRIES

RECEIVE TWR'S RELIGIOUS, EDUCATIONAL

AND CULTURAL PROGRAMS FULL TIME.



1965 REVIEW and FORECAST for the ELECTRONIC INDUSTRIES

Reprinted Courtesy
ELECTRONICS INDUSTRIES

By ROBERT J. BRAMLETT
Assistant Editor
and EDWARD G. SHAUD, Jr.
Marketing Manager

THE U. S. ELECTRONIC INDUSTRIES have again rung up a record level of total sales --though the growth rate was not quite as spectacular as in recent years.

Estimated sales of $16,136,000,000 for electronic products sold in 1964 put the total about a billion dollars ahead of 1963's $15,125,000,000.

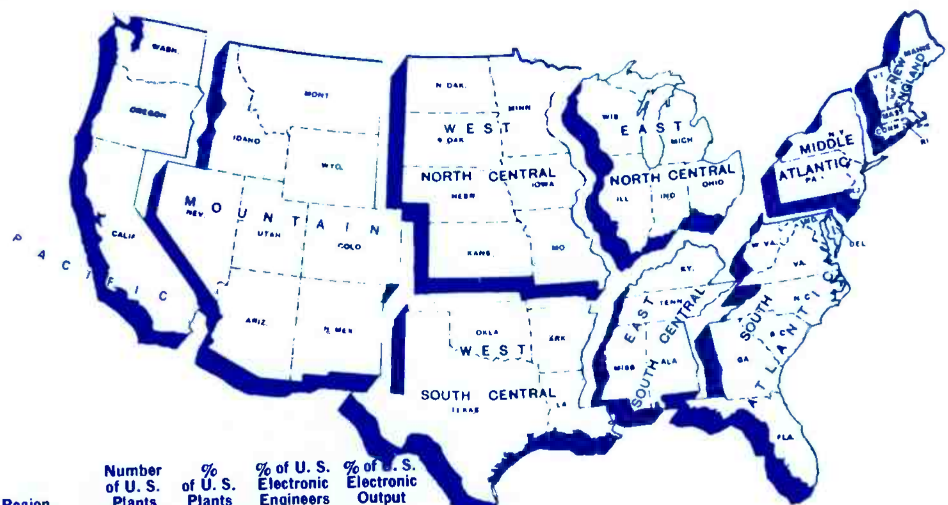
The industry reached this 16-billion-dollar level in spite of moderately severe cuts in defense contracts, and the failure of more than 118 electronic firms--a new high.

While nearly all major segments of the electronic industries showed gains, there was a marked difference in their growth rates.

For 1965, sales of electronic products within U. S. industry are expected to increase by 13%, and consumer sales may increase as much as 5.9%. Although still the biggest customer for electronic goods, the U. S. Government is expected to buy enough to account for a sales increase of only 2.6% .

The electronic industries are emerging from a period of rapid growth. The defense budget increased by about 40% in the past decade; NASA has come on the scene at a $5-billion-plus spender, of which $1.3 billion was spent on electronic products and systems in 1964.

Looking toward the second half of the 1960s, the electronic industries foresee yearly sales increases. The growth rate, however, is expected to diminish slightly, though no minimum or plateau is expected in the foreseeable future.

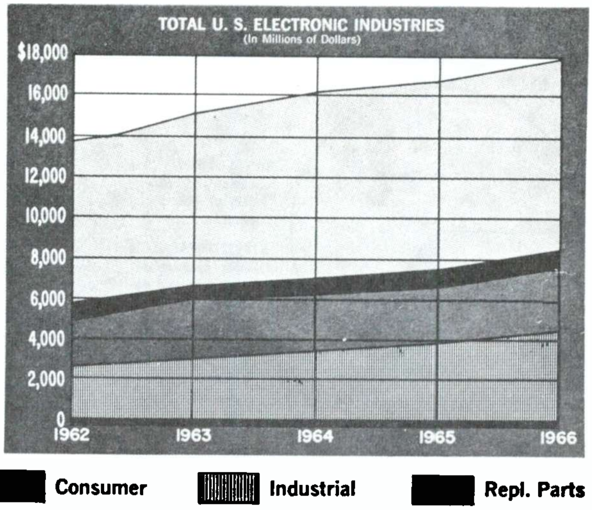


Region	Number of U. S. Plants	% of U. S. Plants	% of U. S. Electronic Engineers	% of U. S. Electronic Output
New England	875	14.64	10.70	10.60
Middle Atlantic	1,949	32.57	24.20	36.50
South Atlantic	307	5.13	10.10	5.30
East North Central	1,220	20.38	14.43	23.00
East South Central	56	.93	.41	.50
West North Central	189	3.16	4.99	2.60
West South Central	100	1.67	5.12	2.30
Mountain	109	1.82	2.62	2.50
Pacific	1,179	19.70	27.43	16.70
TOTAL	5,984	100.00%	100.00%	100.00%

United States, by Geographic Division—
1964 Electronic Industries

The prediction for total sales for the electronic industries in 1965 is a level of slightly higher than $17 billion, another record in dollar sales volume. For 1966 the forecast is for nearly $18 billion--not quite as high a percentage increase, but still another sales record.

As the growth of the defense market slows, industry experts look for ways to fill the gap. Consumer products, industry controls, automation, and expanded foreign markets are receiving increased attention.

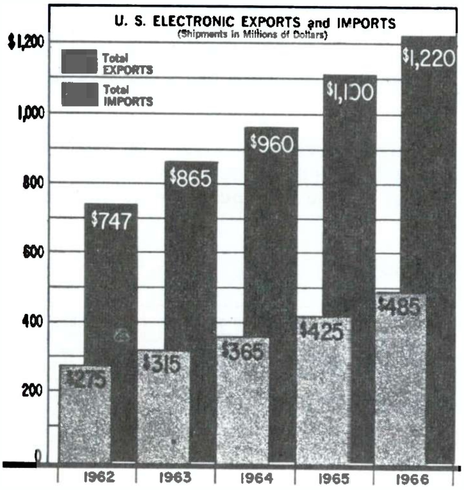


Annual sales of U. S. electronic products now account for about 2.6% of U. S. gross national product, which in 1964 was estimated at $624 billion.

INTERNATIONAL MARKETS

The U. S. now produces about 60% of the total world output of electronic products. The Common Market nations, or European Economic Community (EEC), comprise the next largest single producing area. Japan ranks third, as an individual nation.

Of the estimated total of $865 million in exports of U. S. electronic products in 1963 (the latest figure available), Canada received the largest share, nearly $112 million. The United Kingdom imported more than $47 million; France received U. S. exports valued at $67 million; and West Germany took some $87 million. Exports to the EEC totalled nearly $195 million.



Biggest exporter to the U. S. has been, and still is Japan, which shipped nearly $162 million of its electronic goods into this country in 1963. The 1964 total is expected to be nearly 5% more. Canada is a distant second with slightly more than $53 million. The EEC exported $43 million in electronic goods to the U. S. in 1963 and the United Kingdom $36 million. If U. S. trade barriers are relaxed, imports could rise substantially.

ESTIMATED WORLD ELECTRONIC OUTPUT
(In Millions of Dollars)

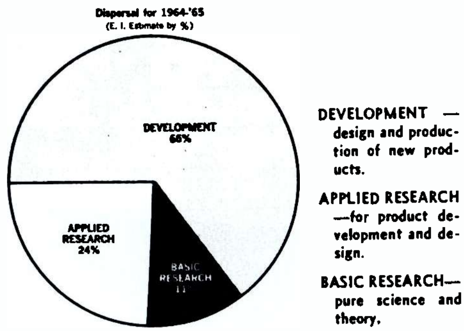
	1962	1963	1964	1965	1966
TOTAL	$22,000	$24,300	$26,300	$28,400	$30,300
United States	13,800	15,100	16,100	17,000	17,900
Japan	1,600	1,900	2,500	3,000	3,400
Britain	1,500	1,600	1,700	1,800	1,900
European Economic Community	3,800	4,300	4,500	5,000	5,400
Canada and all other nations	1,300	1,400	1,500	1,600	1,700

Although total dollar sales volume is much less than that of the U. S., the aggregate rate of growth in electronic output in all other countries taken together appears to be nearly 15%. Current rate of growth of U. S. sales in electronic goods is about 5.5%. By far the fastest grower in electronic output, so far, is Japan. Dollar volume of Japan's electronic output in 1964 could reach $2.5 billion.

RESEARCH AND DEVELOPMENT

Expenditures for research and development, including basic research, are at a high level, and should continue to increase during the next few years. Detailed figures on R and D expenditures are somewhat elusive. Current

ELECTRONIC R & D FUNDS



estimates put the total for electronic R and D in 1964 at about $3.7 billion. This includes funds from government, industrial, and private non-profit sources. The government, alone, spent $2.4 billion.

Total expenditures in 1964 for all R and D in all scientific disciplines are currently estimated at $20 billion. By 1966, total expenditures for R and D may approach $24 billion. The U. S. government share of the 1964 total is about $13.8 billion.

Average current dispersal of funds for electronic research and development are estimated as follows: for development (design and production of new products)--65%; for applied research (product development and design)--24%; for basic research (pure science and theory)--11%.

CONSUMER

Consumer buying accounted for $2.7 billion in 1964, compared with $2.5 billion in 1963--more than a 7% rise.

Sales of television receivers showed substantial growth from 1963 to 1964. Estimated sales for 1964, including all types, were $1.2 billion. Fastest growth rate in consumer electronic products belongs to color television.

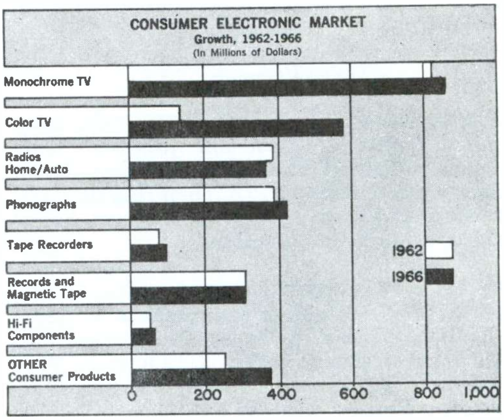
A sales level of slightly more than $3 billion is predicted for 1966; consumer sales should keep pace with an expected increase in disposable personal income. Pacing the consumer electronic market will be sales in color television which are expected to show total sales increases of more than $200 million by 1966.

Additional sales of about $50 million by 1966 should result from marketing such items as electronic organs, electronic ovens, toys, and consumer communications equipment.

Faster and newer developments in industrial and consumer electronics are expected to eventually fill the market gap left by declining government procurement.

INDUSTRIAL

Some sources predict that the future growth of the electronic industries depends upon the industrial and consumer markets. This surely



seems so when we observe that both segments experienced outstanding rises from 1963 to 1964. Industrial electronic sales accounted for more than a 12% rise from $3.06 billion in 1963 to more than an estimated $3.4 billion in 1964.

In contrast, there was a rise of more than 10% in government procurement in 1963 over 1962; and only a 5% increase in 1964 over 1963.

INDUSTRIAL ELECTRONIC MARKET
(In Millions of Dollars)

	1962	1963	1964	1965	1966
TOTAL	$2,710	$3,060	$3,430	$3,877	$4,350
Computing & Data Processing	1,065	1,240	1,375	1,600	1,800
Industrial Control & Processing	215	244	270	310	360
Test & Measuring	260	280	300	330	365
Communications, Broadcast, Commercial Sound & Navigation Aids	860	935	1,065	1,170	1,310
Nuclear Electronic	44	47	55	57	60
Medical, Scientific, Educational & Other Industrial Equip.	266	314	365	410	455

Square-Wave Calibrator For Your Scope

The circuit depicted in the drawing is a conventional low voltage power supply section of an average oscilloscope, altered slightly to provide a 15-volt, 120-cycle, square-wave output for reference measurements and signal-locking the internal sawtooth oscillator.

As shown, the center-tap of the power transformer is lifted from ground and a resistor, capacitor, and zener diode are installed in series with the line. The zener is a 400 milliwatt type, bridged by a 1-watt bias-limiting resistor, and a small bypass condenser. The resistor value is chosen experimentally between the two values listed, because the voltage present at the center tap depends upon the individual power supply load, and is different for different model instruments. It should be high enough in resistance to allow 30 volts bias (zener not yet connected) between ground and the center tap.

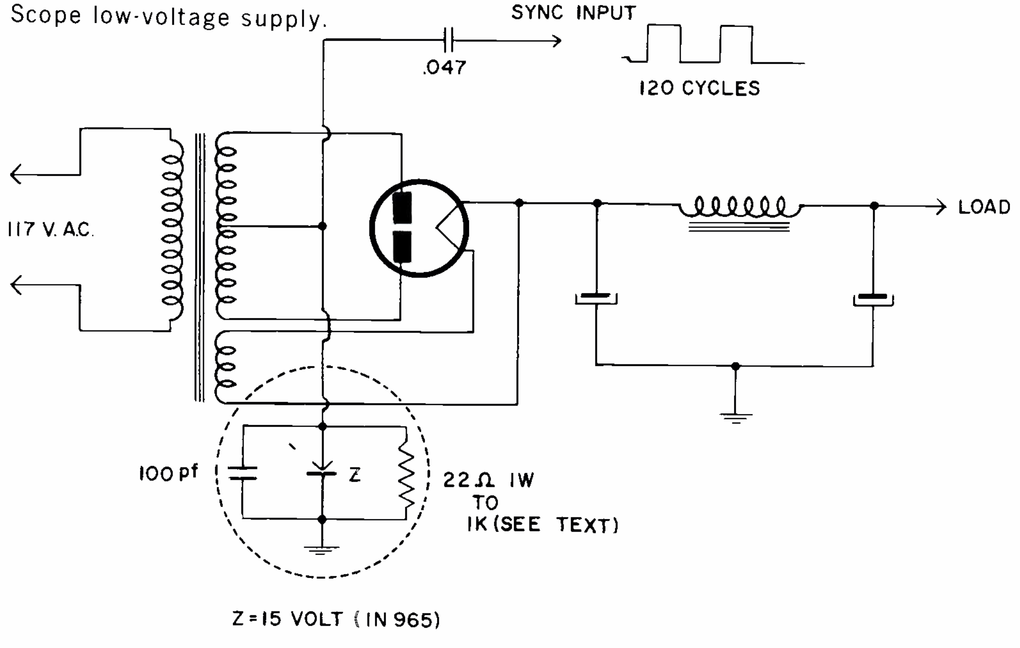
The exact zener voltage need not be 15 volts. In fact, a 6-volt zener gives an improved square wave, due to the clipping action nearer the base of the rectified sine wave.

Square-wave sync pulses are usually preferred over the commonly used LINE sine wave—locking source because of the fast rise-time characteristic and consequent positive triggering action. Some scopes are very weak in this particular operational area.

When the zener chosen is of an even voltage number, such as 10, 12, or 15 volts, the square-wave component on the screen gives a handy voltage reference level for input voltage comparison purposes. This voltage may be made available by connecting the output .047 capacitor to a special binding post installed on the front panel of the oscilloscope.

GEORGE D. PHILPOTT

Scope low-voltage supply.



what's new?

* * * * * * * * * * * * * * * *

Commuters someday may be riding over an elevated "magnetic" highway in cars without wheels if a new concept of transportation proposed by Westinghouse engineers proves practical.

The system would float the vehicle magnetically and drive it with an electric motor that has no rotating parts.

To demonstrate the principle of the magnetic suspension system, a small, one-passenger vehicle has been constructed at the Research Laboratories.

The laboratory test vehicle is supported by strong, ceramic-type permanent magnets placed lengthwise along the underside of the vehicle. Similar magnets, of the same polarity, form a double track beneath it.

Since magnets of like polarity repel each other, the experimental car floats about one-fourth of an inch above its magnetic track. There is no physical contact and, therefore, no friction between the vehicle and its magnetic rails. The vehicle simply "rides" on a layer of air.

The United States has established a radar fence on the West German border, an electronic warning barrier to prevent accidental overflights. Called Project Wind Drift, it uses three ground control interception radar stations and provides continuous radar surveillance, positive aircraft control and immediate retrieval capability. U. S. Air Force-Europe and Ground Electronic Equipment Installation Agency relocated three radar towers from North American sites and added internal electronic equipment for the fence, under crash conditions with top AF priority. The equipment includes one search and two height finder radars, five video mappers, and additional VHF/UHF communications devices.

* * * * * * * *

Europe's worst traffic jam will be eased next year with installation of a traffic control system in Munich. Plans call for a complex of 130 radar, ultrasonic, and photoelectric detectors to feed traffic flow information. The information will be processed by an Elliott Arch 9000 computer, which has an operating speed of 40,000 basic calculations per second. A complete system of safety factors will be built in to insure control of traffic should the detectors or computer break down.

Enough integrated circuits to build three miniaturized computers fit easily into an ordinary thimble. The circuits were designed and manufactured by the Sylvania Electric Products, Inc. Each contains the equivalent of 24 components such as transistors, resistors, and diodes.

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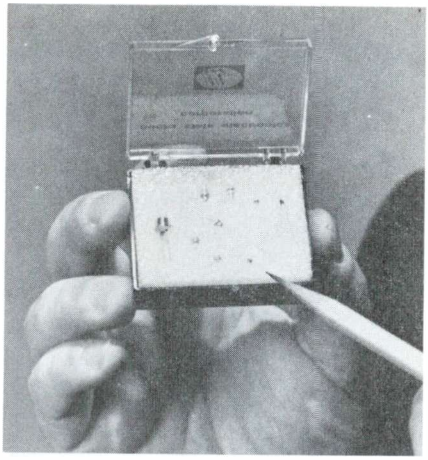


Typical space-age salesman's sample case is a jewel box that fits into a vest pocket. This one, from Raytheon, holds $5,000 worth of microwave diodes, other widgets. The salesman also carries a magnifying glass and tweezers in his pocket.

Four trade associations of television and radio repairmen have consented to an order prohibiting them from unlawfully conspiring to suppress competition, the Federal Trade Commission has announced.

The agreement containing the order is for settlement purposes only and does not constitute an admission by the associations that they have violated the law, the FTC said.

The groups are the Television Dealers Association of Delaware County, Television Service Dealers Association of Delaware, Allied Electronic Technicians Association, Inc., and Radio Servicemen's Association of Trenton, N. J., Inc.

The order would prohibit the groups from entering an agreement or carrying out any conspiracy or agreement that would "coerce any wholesale or other distributor of television, radio or electronic equipment or component parts (1) from doing business with or soliciting business from any class of customers, or (2) to engage in or refrain from engaging in any acts or practices relating to the conduct of his business (including hours of operation, window displays or advertising); or "black list" any wholesale or other distributor of television, radio or electronic equipment or component parts who sold, sells or offers to sell, or "white list" any distributor who refuses, has refused or does not offer to sell, such products to any customer or class of customers."

The FTC said all or most of the trade association members are engaged in repairing and servicing electronic devices and buy various supplies from wholesalers or distributors who also sell such supplies to nonmembers of the associations and to ultimate consumers.

"Animated maps" such as are used on high-speed Japanese trains are being used in at least two airplanes based at National Airport, both of them operated by the Federal Aviation Agency. Both are built by ACF Electronics Division, and consist of a foot-long box into which is inserted a map or strip of aeronautical chart. A small dot simulates position of the aircraft as it moves over the terrain. The system is linked into the plane's distance-measuring equipment and omni-directional radio. Research engineers say a large or multiple display of such a system is feasible in airliners for pinpointing position.

* * * * * * * *

Another CB system, HELP (Highway Emergency Locating Plan), is being established by the auspices of the Automobile Manufacturers Association. It allocates channels 22A and 22B, would use CB radio equipment in private passenger cars. Motorists in need of aid notify Channel 9, monitored around the clock within a 10 to 20-mile range of the equipment. Non-equipped motorists will ideally be helped out by motorists with the required equipment who broadcast on the unfortunates' behalf. Teams would include volunteer citizens, police agencies, road service stations, and hospital emergency rooms.

* * * * * * * *

'It's Bob—have you finished his TV installation book?'

* * * * * * * * * * * * * * * * *

SUCCESS STORY: EMILE POTHIER

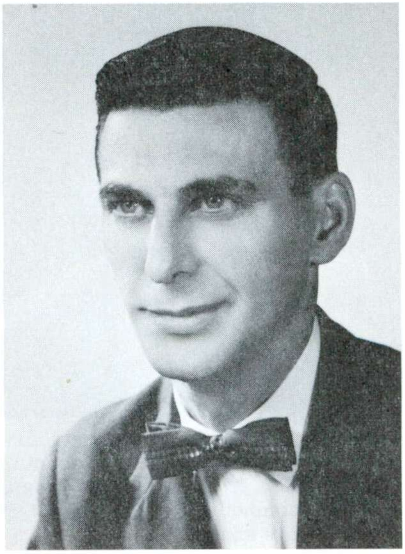
There's an old adage (isn't there?) about walking down a different street, or turning at a different corner, and changing the pattern of your life thereby. Perhaps it's overstating the question to say that Emile Pothier of Ottawa, Canada, will, because he took a different turning, always have good fortune and sunshiny days, but right about now that's about the way he feels about his NRI training.

Emile had been an employee of the Dominion Bureau of Statistics (Canadian Government) for 18 years, and by extreme diligence had worked his way up---but slowly, as government wheels are prone to grind: first to clerk 2, then clerk 3, then clerk 4, and finally to principal clerk, a supervisory position and top of the heap in his category. And there he bogged down.

Let him tell the rest in his own words...we're too modest to keep on saying it:

"As you know I took an NRI course and graduated...that diploma played an important role as you will see...

"Just four months later I entered a competition in the bureau for a technical officer position in an electronic computer programming unit. There were 23 applicants. The board, comprising three professionals,



Emile Pothier . . . . . "an NRI man for life."

questioned me at length about my NRI course and training.

"A week later I was declared the successful candidate.

"How can a man NOT be proud to be a graduate of the National Radio Institute?

"This promotion to technical officer meant a big increase in pay, but that is not all; it also gave me 'prestige'....a big change in my life and I am very grateful...an NRI man for life."

Other Grads: Where They Are, What They're Doing

James F. Jones, Guin, Ala. -- Service and Repair Mechanic, Minnesota Mining and Manufacturing Co.
Darmer McBride, Jr., Hillsboro, Ala. -- Electronic Development Technician, National Aeronautics and Space Administration.
Robert F. O'Brien, Concord, Calif. -- Audio Visual Repair and Serviceman, Mt. Diablo School District.
Yoshito Tanaka, Cypress, Calif. -- Electrician, Autonetics Division, North American Aviation.
Glen H. Beck, Gardena, Calif. -- Maintenance Electrician, Douglas Aircraft Co.
Gerald R. Turner, Monrovia, Calif. -- Electronic Technician, Dynametric, Inc.
Raymond J. Sieminskie, Saratoga, Calif. -- Test Operations Assistant, Lockhead Missiles and Space Co.
Francis H. Fingado, Denver 2, Colo. -- Senior Training Specialist, Air Training Command Support Group, Aerospace Division, Martin-Marietta.
Anthony Puccia, Bridgeport, Conn. -- Electronic Packaging Designer, Sikorsky Aircraft.
Michael N. Rosa, Stamford, Conn. -- Service Technician, Raytheon Co.
George Bachman, Stepney Depot, Conn. -- Radio-TV Repairman, R. L. Reed Appliances.
Raymond A. Donaldson, Washington, D.C. -- Mechanic, Potomac Electric Power Co.

Charles T. Frye, Washington, D. C. -- Technician, Communications Division, Metropolitan Police Department.
Elbert H. Jackson, Calhoun, Ga. -- Radio and TV Serviceman, Western Auto.
James C. Hefner, Forest Park, Ga. -- Electronic Technician, Federal Aviation Agency.
Gustav F. Moll, Altamont, Ill. -- Carrier Current Specialist, Illinois Power Co.
Samuel Allen, Forest Park, Ill. -- Supervisor, Sandia Corp.
John A. Striepling, Franklin Park, Ill. -- Teacher of Electronic Technology, Morton Junior College.
David S. Blackwell, Fort Wayne, Ind. -- Quality Control Manager, ITT Federal Labs.
Russell E. Chase, Des Moines, Iowa -- Engineer, Northwest Bell Telephone Co.
Morris J. Montgomery, Monticello, Iowa -- Technician, Collins Radio Co.
Dale A. Branson, Concordia, Kans. -- Transmitter Engineer, Station KFRM.
Russel L. Burns, Fort Scott, Kans. -- Signal Test Foreman, Frisco Railroad.
Ervin W. Young, Sterling, Kans. -- Communications Technician, Mid-Kansas Telephone Co.
Robert J. Booe, Wellington, Kans. -- TV Repairman, Schrag Radio and TV.
Pascal Keith, Bromley, Ky. — Industrial Electrician, Ford Motor Co.
Norman L. Wetzel, Lanesboro, Mass. -- Engineering Technician, Ordnance Department, General Electric Co.
Arthur Bell, Lawrence, Mass. -- Projectionist, Palace Theater.
Glen Connolly, Wilmington, Mass. -- Senior Engineer, Electrical Test Integration, Avco-Rad Co.
Clyde C. Vandervoort, Carleton, Mich. -- Switchboard Operator, Detroit Edison Co.
R. W. Squires, Pontiac, Mich. -- Equipment Installer, Western Electric.
Gaston Cellette, Minneapolis, Minn. -- Radio Electronic Repair, Northwest Airlines.
Leonard B. Izzo, Clark, N. J. -- Electronic Machine Builder, Hyatt Bearings Division, General Motors Corp.
Felix Malachowski, Demarest, N. J. -- Radio Officer, Department of the Navy.
David Melhado, Passaic, N. J. -- Pyrometer Technician, Wright Aero Corp.
Paul E. Bentz, Vineland, N. J. -- Draftsman, N. J. Bell Telephone Co.
Claud W. Longstreet, Westfield, N. J. -- Counterman, Union Television Parts Co.
Major Arthur Johns (Ret.), Nixon, N. J. -- Technician, Master Antenna Installation, ACA Nixon, Inc.
Andrew Cafuoco, Brooklyn, N. Y. --

CONAR ORDER BLANK

DIVISION OF NATIONAL RADIO INSTITUTE, 3939 WISCONSIN AVE., WASHINGTON 16, D.C.

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ADDRESS

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NRI STUDENT NUMBER

☐ CASH
☐ C.O.D. (20% Deposit required)
☐ EASY PAYMENT PLAN (10% Deposit)

Quantity	Model	Name of Item	Price Each	Total

If you live in Washington, D.C., add 3% sales tax. All prices are net, F.O.B. Washington, D.C.

TOTAL

ON TIME PAYMENT ORDERS please be sure to complete the Easy Payment Plan credit information form on the reverse side of this page and include 10% down payment with your order.

Radioman, New York Telephone Co.
Cecil J. Guinipero, Endicott, N. Y., -- Electronic Technician, General Electric.
Frank Rocco, Huntington, N. Y. -- Supervisor, Analog Computers, Flight Test Lab., Republic Aviation.
George H. Kam, Kenmore, N. Y. -- Senior Engineer, Sylvania Electric Corp.
Joseph H. Walenta, Queens Village, N. Y. -- TV Operation Engineer, National Broadcasting Co.
William F. Hilms, Jr., Lynbrook, N. Y. -- Installation Man, New York Telephone Co.
James L. House, Vestal, N. Y. -- Co-Ordinator, IBM.
William B. Asbury, Williston Park, N. Y. -- Instrument Wireman, American Bosch Arma Corp.
James C. Keener, Leaksville, N. C. -- Radio, TV and Electrical Appliance Serviceman, Western Auto.
Albert D. Blancett, Cambridge, Ohio -- Electrical Inspector, RCA.
George J. Miller, Cincinnati, Ohio -- Electronic Technician, Formica Co.
Steven K. Molnar, Elyria, Ohio -- Transmitter Engineer, Radio Station WHK.
Ernest L. Wilson, Hamilton, Ohio -- Instrument Man, Champion Papers, Inc.
Robert R. Miller, Allentown, Pa. -- Supervisor, Western Electric Co.
Leno Leo Laner, Youngstown, Ohio -- Transmitter Engineer, WFMJ Broadcasting Co.
Ivan L. Kelley, Tulsa, Okla. -- Laboratory Technician, Seismograph Service Corp.
Howard Donald Meyer, Bath, Pa. -- Maintenance Man, Western Electric Co.
John J. Finn, Jr., Drexel Hill, Pa. -- Foreman, Installation Department, Western Union Telegraph Co.
Elmer W. Cooper, Falls Creek, Pa. -- Counterman, Barron Radio Supply, Inc.
Herman C. Shoemaker, Mapleton Depot, Pa. -- TV Serviceman, Lewistown Appliance Centre.
Thomas B. Love, Burleson, Tex. -- Radio Repairman, Signal Maintenance, U. S. Army.
Harold F. Dry, Dallas, Tex. -- Engineering Technician, Texas Instruments Co.
Fred A. Stockton, Fort Worth, Tex. -- Electronic Technician, Federal Aviation Agency.
J. Dan Hightower, Harlingen, Tex. -- Manager Tester and Regulator, Western Union Telegraph Co.
Andrew W. Felt, Jr., Edmonds, Wash. -- Electronics Planner, Boeing Company.
John Hein, Nitro, W. Va. -- Instrument Mechanic, Monsanto Company.

CONAR EASY PAYMENT PLAN

TO

Note: Easy payment contracts cannot be accepted from persons under 21 years of age. If you are under 21, have this sheet filled in by a person of legal age and regularly employed.

Enclosed is a down payment of $______ on the equipment I have listed on the reverse side. Beginning 30 days from the date of shipment I will pay you $______ each month until the total payment price is paid. You will retain title of this equipment until this amount is fully paid. If I do not make the payments as agreed, you may declare the entire unpaid balance immediately due and payable, or at your option, repossess the equipment. Your acceptance of this will be effected by your shipment to me of the equipment I have listed.

Date ______ Your written signature ______

CREDIT APPLICATION

Print Full Name ______ Age ______

Home Address ______

City & State ______ How long at this address? ______

Previous Address ______

City & State ______ How long at this address? ______

Present Employer ______ Position ______ Monthly Income ______

Business Address ______ How Long Employed? ______

If in business for self, what business? ______ How Long? ______

Bank Account with ______ Savings ☐ Checking ☐

CREDIT REFERENCE (Give 2 Merchants, Firms or Finance Companies with whom you have or have had accounts.

Credit Acct. with ______ (Name) ______ (Address) ______ Highest Credit ______

Credit Acct. with ______ (Name) ______ (Address) ______ Highest Credit ______

Alumni News

Members Share Practical, Entertaining Suggestions

DETROIT CHAPTER members were intrigued with a demonstration by John Nagy in hooking up as many as 30 speakers to a transistor radio. A discussion then took place on Japanese FM-AM tube-type radios.

The next meeting featured the first of a series of Howard Sams lectures and slides on color TV. This series was continued for the next several meetings.

Mr. Charles Fouchey is the latest graduate to be admitted to membership. Congratulations, Charles!

FLINT (SAGINAW VALLEY) CHAPTER devoted another meeting to members' sharing of their unusual ideas: William Duncan showed an easy way to make a fence charger, used on farms, with an auto radio vibrator; Gilbert Harris made a three-transistor radio which could be worn as a wrist-watch; Henry Hubbard, by hooking two batteries to a transistor radio, demonstrated the effects of polarity. Professor DeJenko introduced a new UHF converter and a new long-distance high gain TV antenna, both available to members at factory cost; Andy Jobbagy's topic was the repair of a single-tube turntable phonograph motor. The single tube, 90-volt, 60-cycle motor was connected in series with tube filaments. He then told why you cannot use a 117-volt motor in place of a 90-volt motor. Ray Kitt showed how to outsmart loose tube sockets; George Martin explained that at radio stations, clocks are set to a universal time with a tolerance of 100th millisecond at a zero hour; Robert Poli suggested that when you discard an old TV set, you can make use of the speaker magnet and yoke ring magnet by gluing them to a board to hold tools; James Windom demonstrated a diode tester and how to use an ordinary No 47-dial bulb as an indicator. Charles Wotring talked about his new Guinea Pig Organ which reproduces the sounds of many different instruments.

These sessions of the chapter are not only highly entertaining but the members find they can make valuable practical use of the suggestions and ideas.

HACKENSACK CHAPTER has featured sev-

Former (and first) chairman of the Hackensack Chapter George Schalk relinquishes his gavel to new chairman Matty Rechner.

Cres Gomez, from left, administers oath of office to Ed Halvey, vice chairman; Matty Rechner, chairman; Frank Lucas, secretary; Paul Schaeffer, treasurer, at Hackensack Chapter installation meeting.

eral guest speakers lately. One of them was Mr. Larry Weaver, Delco Field Engineer. His subject was Delco Transistor Radios. He explained the design and construction of the receivers in great detail, also the improvements made in such receivers since the introduction of transistors, illustrating his talk with a slide projector and with blackboard drawings.

At the next meeting Chairman Matty Rechner brought in a dog set which Cres Gomez used as the basis for discussion. The set was repaired with the information and suggestions furnished by the members. George Shopmeier then gave a talk on his experience with a set which was not wired according to the schematic. Someone had installed an iron strap which was not needed. Results: no picture. It is demonstrations of this kind that the members find so helpful.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER'S former Chairman George Fulks demonstrated the value of the B and K 1074 Analyst. Using a scope to trace through the various test points in a properly operating color TV set to see how waveforms compare with those illustrated in the service information for the set, he employed the B and K to produce the signals used for these measurements.

Continuation of troubleshooting procedures in both black and white and color TV, using the scope, were scheduled for the next few meetings.

LOS ANGELES CHAPTER members were much interested in Kenneth Williams' exhibit of a metal locator and his explanation of how it is used. This was followed by a demonstration by Chairman DeCaussin on how to use the oscilloscope, for the benefit of those members who have not yet acquired the practice and skill to operate one.

Another meeting featured the reading and discussion of an article which appeared in the magazine Modern Electronic Service Dealer, published by the California Bureau of Electronic Repair Dealer Registration. The article dealt with the requirement that upon a replacement tube being installed in a television receiver, it must be labelled as either "new," "rebuilt," or "second-hand." At this meeting Jim Law supplied his television set for the chapter's practice session on TV troubleshooting.

The next meeting featured guest speaker Lloyd Mathiesen, who delivered a talk on how transistors are used in radio and television now and how they will be used in the future -- on how important it is for a service technician to study and keep up to date on them and also on color TV. Jim Law again brought in his TV receiver so the members could help him analyze the trouble with it. Chairman DeCaussin then demonstrated the use of the B and K Television Analyst.

NEW YORK CITY CHAPTER, like the Flint Chapter, used a recent meeting for talks and demonstrations on unusual techniques and devices. Ontie Crowe talked about the tools and aids he finds helpful for troubleshooting. He arrived wearing an apron-like tool kit and from it produced a number of accessories, many of them home-made but all of practical value and small size. Brother Bernard showed a gadget for limiting the enthusiasm of doorbell-pushers. It includes a timing mechanism to prevent the bell from ringing for more than 5-seconds or more frequently than 30-second intervals. Robinson Vargas told about servicing an all-band tuner that allowed broadcast band stations to interfere on two shortwave channels; Hank Lucas about a TV tuner that has to be cleaned with a standard product every four days; and Charles Williams about a set that turned out to lack a focus coil, which produced an effect similar to blooming.

Frank Lucas managed to simplify and give a clear talk on atomic physics with regard to semi-conductors and Willy Fox coupled helpful hints with an amusing talk on his experiences in servicing.

Not to be outdone by the Hackensack Chapter (see report in this issue), the New York City Chapter also welcomed Mr. Larry Weaver as a guest speaker on Delco auto radios. In this instance, however, Mr. Weaver accompanied his talk with the showing of a 35 mm film strip. At this meeting, Treasurer Sam Antman began the first of a short series of talks on the VTVM, for which he has done considerable study and research.

A warm welcome to the newest member of the Chapter, Mr. Joel Sloan.

PHILADELPHIA-CAMDEN CHAPTER members, or at least some of them, feel that they now have a nodding acquaintance with the laser. It is all due to a fascinating lecture and demonstration by Mr. Charles B. Moore, Supervisor of Customer Information for Bell Telephone. Secretary Jules Cohen says, "This was a demonstration that I'm sorry some members missed. It took Mr. Moore fifteen

Charles Moore of Bell Telephone gave a laser demonstration to Philadelphia-Camden Chapter members.

minutes just to set up the equipment and it was hard to believe when you saw it. This was a rare meeting that will be hard to beat. Mr. Moore has a few other subjects that he lectures on and we will have him back again in the near future."

At another meeting Bill Davis lectured on and demonstrated the B and K Television Analyst. The members were once again guests of the General Electric Company and George Walker gave another of his fine talks, this time on the GE All-Transistor Portable.

PITTSBURGH CHAPTER enjoyed a rare privilege: welcoming Mr. Glenn Mumper, Regional Sales Service Manager, Westinghouse Appliance Sales Company, Pittsburgh, and Mr. John Burn, Regional Service Manager, Westinghouse, Metuchem, as guest speakers at one of its meetings. After Mr. Mumper introduced him, Mr. Burn spoke on the development of recorders from wire to present hi-fi, on four-track stereos, and then the circuit and servicing of recorders. He illustrated his discussion with color slides and distributed service manuals on tape recorders, CB transceivers, and other Westinghouse products for 1965.

What was so special about these guests? They are both old-timer graduates of NRI. It was a real treat to the chapter to play host to two fellow-graduates who had achieved such goals in the Radio-TV industry.

SAN ANTONIO ALAMO CHAPTER'S change of meeting nights from the third Wednesday of each month to the fourth Friday has resulted in definite improvement. Apparently, Fridays are more convenient for most of the members.

Jesse DeLao and Chairman Sam Stinebaugh conducted a fine program containing a wealth of information on TV vertical circuits. Jesse, assisted by Sam, succeeded in covering the subject very thoroughly.

Ronald Smith, owner and operator of a radio and television service shop, gave a talk on all types of low voltage power supplies used in TV sets -- operation and troubleshooting.

The members feel that their current chairman, Sam Stinebaugh, has long been due a special tribute of thanks for his untiring efforts in behalf of the chapter.

The chapter has been pleased to welcome George E. Kelley, San Antonio, as its newest member. Congratulations, George!

SAN FRANCISCO CHAPTER was pleased to welcome an NRI student, not a member of the chapter, who brought in his CONAR VTVM, which he had built from a kit but which would not function properly. He had checked the wiring twice but did not locate the fault. The trouble was located for him by Andy Royal, Willie Hawkins, Pete Salvotti, and Phil Stearns. It turned out to be a "floating" grid.

The members have missed Peter Wivel, who has been assisting the members with technical advice and working with them on tough dogs. He has not been able to be present at recent meetings, his doctor having advised him that he must enter the hospital for a surgical operation. We're hoping the very best for you, Peter.

SOUTHEASTERN MASSACHUSETTS CHAPTER'S John Alves and Frank Sarro took the lead in a discussion on the article about color TV which appeared in the November-December issue of the NRI Journal.

Manuel Figueiredo showed members how easy it is to test a color TV picture tube and then proceeded to remove and replace the tube.

Ernie Grimes is making a giant size (4' by 8') schematic of the chapter's color TV to be used at future meetings. This should be very helpful.

SPRINGFIELD (MASS.) CHAPTER was highly amused at one meeting at which humor seemed to be the keynote for the evening. John Parks was assisting Norman Charest on tuner trouble in a Zenith TV Set when the set started to smoke. John said "I smell a rat." This of course is an old, well-worn figure of speech, but in this case if turned out to be the literal truth when John reached in and actually pulled out a dead mouse. However, John finally got down to more serious matters when he demonstrated the resistance-capacitance tester that he built from a kit which he purchased from the NRI CONAR Division.

DIRECTORY OF LOCAL CHAPTERS

DETROIT CHAPTER meets 8:00 P. M., 2nd and 4th Friday of each month. St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich., VI-14972.

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month at Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: Henry Hubbard, 5497 E. Hill Rd., Grand Blanc, Mich., 694-4535.

HACKENSACK CHAPTER meets 8:00 P. M., last Friday of each month, St. Francis Hall, Cor. Lodi and Holt St., Hackensack, N. J. Chairman: Matthew Rechner, 42 Campbell Ave., Hackensack, N. J.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month at George Fulk's Radio-TV Service Shop, Boonsboro, Md. Chairman: Francis Lyons, 2239 Beverly Dr., Hagerstown, Md. Reg 9-8280.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, 4912 Fountain Ave., L. A. Chairman: Eugene DeCaussin, 4912 Fountain Ave., L. A., NO 4-345.

MINNEAPOLIS-ST PAUL (TWIN CITIES) CHAPTER meets 8:00 P. M., 2nd Thursday of each month, at the homes of its members. Chairman: Edwin Rolf, Grasston, Minn.

NEW ORLEANS CHAPTER meets 8:00 P.M., 2nd Tuesday of each month at Galjour's TV, 809 N. Broad St., New Orleans, La. 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: Br. Bernard Frey, 213 Stanton St., New York 2, N. Y.

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

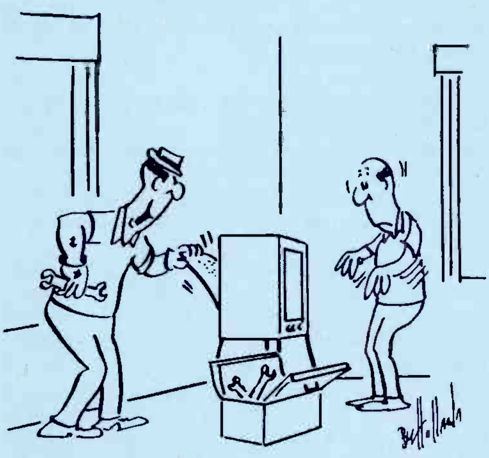
PITTSBURGH CHAPTER meets 8:00 P. M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: James L. Wheeler, 1436 Riverview Dr., Verona, Pa. 793-1298.

SAN ANTONIO ALAMO CHAPTER meets 7:00 P. M., 4th Friday of each month, Beethoven Home, 422 Pereida, San Antonio. Chairman: Sam Stinebaugh, 318 Early Trail, San Antonio, Texas.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: Isaiah Randolph, 523 Ivy St., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month. Chairman: Daniel DeJesus, 125 Bluefield St., New Bedford, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P. M., last Saturday of each month at shop of Norman Charest, 74 Redfern St., Springfield, Mass. Chairman: Steven Chomyn, Powder Mill Rd., Southwich, Mass.



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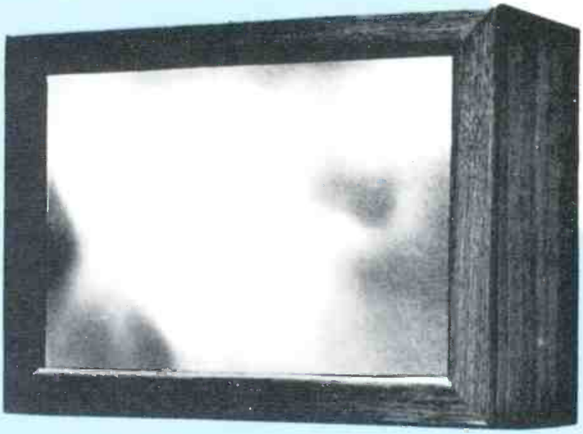

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