journal

July/August 1968 35 cents

J.B. Straughn Uses Oscilloscope as Training Aid

There are just 2 originators of color TV receivers in kit form in America. We are one of them. If you want the only color TV receiver totally engineered for training purposes, there's just one.

CONAR

ALL CHANNEL

CUSTOM 600

$366

$36.60 Down—$17 Month

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All Channel CONAR Custom 600

Color TV Kit

Complete with Cabinet—Nothing Else to Buy

SPECIFICATIONS

Picture Size
18" diagonal measure. 180 square inches of viewing area.

Tube, Transistor and Diode Complement
21 tubes, 20 diodes and 3 transistors. Includes 3 compactrons. Picture tube type RE19FMP22.

Tuners
Prealigned VHF tuner and transistor UHF tuner. Tunes Channels 2 through 83.

Video I-F Amplifier
Two stages. Uses high transconductance tubes and preset coils.

Video Amplifier
Three stages. D.C. coupled.

Sound Circuit
4.5 mc amplifier. Uses quadrature detector and beam power output stage.

High Voltage
22,000 volts, regulated.

Focus
Electrostatic with separate high voltage supply.

Loudspeaker
Front mounted oval type.

Front Controls
VHF tuner, UHF tuner, tint, color, horizontal hold, contrast, brightness, on-off and volume.

Dimensions
25" wide
19" deep
15¼" high

Cabinet
Wood grained vinyl clad steel.

Weight
Under 75 lbs.

Power-Requirements
120 VAC 60 cps—275 watts

NOTE TO TECHNICIANS: This kit, with minor changes to facilitate experimentation, is included in NRI's new Advanced Color TV home-study course. The complete course is available at a modest tuition cost. If you have training or experience in black-white TV and would like to consider this Advanced Color TV course, write CONAR for details.

Easier to build because it's designed for learning!

CONAR maintains its extraordinary leadership pace with another first—the all new Custom 600 Color TV Receiver Kit. Here's the first and only color receiver kit on the market engineered especially for learning. This means you'll find the Custom 600 tops for simplicity of design and ease of building. The Custom 600 is not a copy of an existing receiver "broken down" for rebuilding. It has been designed by CONAR engineers from the chassis up to provide the kit builder with a superb color instrument which will give years and years of enjoyment.

Its functional, modular design, combined with the knowledge you gain from building, will make it simple to make any needed repairs—and we're willing to bet you'll make mighty few, for the Custom 600 is the work of a project team selected from among our own engineers, technical writers and editors who spent literally years on engineering, design and testing.

The Custom 600 uses printed circuit boards for fast, easy assembly and every component is of first quality. Its design incorporates the latest advances in the art of color receiver construction. In addition to 21 tubes, this all-channel receiver incorporates a transistor UHF tuner, transistor noise cancellation circuit and sixteen solid-state diodes. The low voltage power supply contains three silicon rectifiers. Everything, but everything, is supplied. There is absolutely nothing extra for you to buy. The attractive bronze-toned cabinet with wood tone accents will enhance any room in your home. The receiver even includes separate gun killer switches which you will build in to aid you later in making maintenance and servicing easier and more convenient, and a built-in cross hatch generator makes it easier for you to adjust convergence so that you get true-to-life color.

Total learning design gives you a receiver kit with many circuit operations readily observable through easy-to-get-at test points of novel design. All hardware is engineered for accessibility. More important, circuitry not normally requiring maintenance is deliberately made accessible. No matter that you're not taking formal electronic training—just building the kit will give you enough experience so that you need never call a service man. Basically this is the same kit used to train NRI students.

Total learning design means, too, that instructions are written so that you can easily complete assembly. You do not need special tools or expensive test instruments. You'll be amazed at the Custom 600's performance—and yours.

ENJOY COLOR AND TAKE UP TO 2 YEARS TO PAY

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THE CATHODE RAY OSCILLOSCOPE AS A TRAINING AID

by j.b. straughn

The Cathode-Ray Oscilloscope is more commonly called a CRO or a Scope. We will refer to it as a scope in this article. The cathode-ray tube on which the waveshapes being viewed are displayed is referred to as a CRT.

It is universally recognized that a scope is necessary for TV service or laboratory work. This does not mean that you must wait until you start doing TV work or get a job in a lab before a scope will become useful.

You can begin to use and benefit from a scope early in your course. By using it as a training aid you can increase your rate of learning, and also build up your familiarity with the scope for later money-making activities.

In this article we will tie the scope in with some of the phase experiments in Kit 3YY.

With only a very few extra parts which can be obtained from a local supply house you can proceed further and demonstrate the action of R-L, R-C, and L-C circuits when nonsinusoidal signals are applied. If there is sufficient interest expressed, later articles will show how to use the scope in the study of rectifiers, power supplies, and the operation of more complex circuits - amplifiers, phase inverters, multivibrators, oscillators, clipper circuits, etc.

In this article are outlined a number of basic experiments that can be performed with a service-type scope, the material in Training Kit 3YY and the chassis in Kit 4WW, plus a few extra, inexpensive parts. Kit 4WW is in the Servicing course, but students enrolled in other NRI courses can use whatever chassis is available. The purpose of these experiments will be to demonstrate certain kinds of circuit operation and to enable you to become familiar with the uses and application of the scope. Since we will be concerned with demonstrations and basic study, the experiments will not be set up as those in the kits, nor will step-by-step instructions be given. If you have a scope, its Manual shows how to connect the leads, how to adjust the controls to obtain the desired pattern, etc.

You should also be able to use schematic diagrams, as pictorials are not available for any of these experiments described in this article.

The CONAR Model 250 Scope was used in proving out the experiments and is ideally suited for this work. If you successfully built your CONAR Model 211 VTVM, you should have no trouble with the assembly of the Model 250 Scope Kit. For those too busy to build their own, preassembled Model 250 Scopes are available.

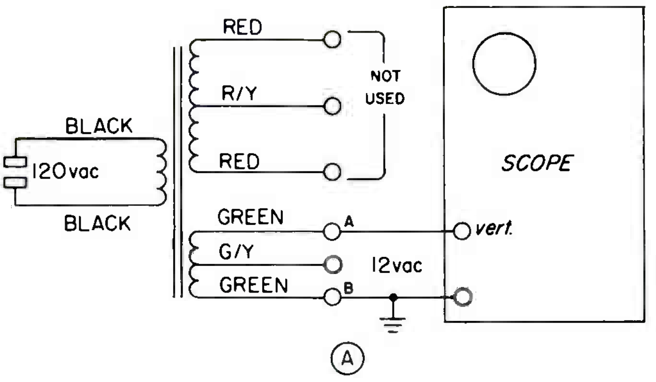


Fig. 1

We are not going to give all the experiments that can be performed with the circuits shown. You should try slightly different circuits and values whenever you can. This will help you become familiar with the use of your scope and the things you can do with it, and will also help you in understanding circuit operation.

An ordinary 60-cycle sine wave can be observed by connecting the "Vertical Input" terminal to the "1vP-P" test terminal.

Such a signal can also be obtained from an ordinary power transformer, as shown in Fig. 1A. The ground lead of the scope can be connected to the chassis or to terminal B, and the Vertical Input lead to terminal A. The Vertical Gain and Attenuator controls are adjusted for a deflection of 1 or 2 inches on the face of the CRT. The Sweep Selector and Fine Frequency controls are then adjusted until one, two, or three cycles of the sine wave are in view.

Fig. 1B shows one cycle, while Figs. 1C and 1D show two cycles. You may find that the scope sweep locks with the negative half of the observed signal so the waveshape looks like Fig. 1D. The exact number of cycles displayed depends on the adjustment of the Fine Frequency control, but the general appearance will be the same as that shown in the illustration.

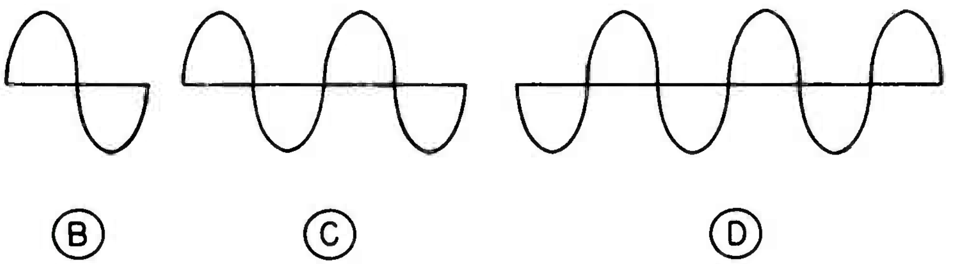


Fig. 1

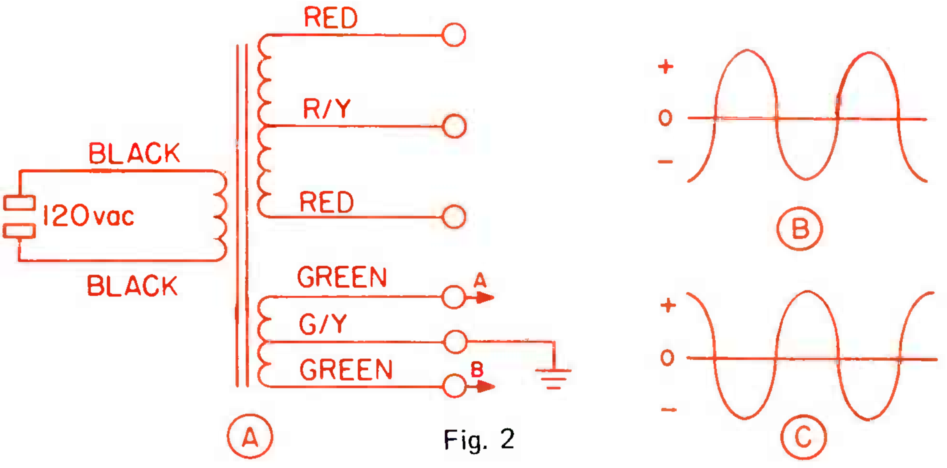


Fig. 2

Since the 60-cycle signal displayed has the same frequency as the power line voltage, the line can be used to sync the horizontal sweep. Prove this by setting the Sync Selector to the Line position and adjusting the Sync control for a steady pattern.

When internal rather than line or external sync is used, the amount of sync available depends on the amplitude of the signal displayed on the CRT. When the line sync is used, the sync level remains constant and sync is achieved regardless of variations in the amplitude of the signal under observation. This permits us to demonstrate a number of fundamental principles.

The signals obtained at opposite ends of a transformer winding are 180° out-of-phase with each other when compared to the center tap on the winding. To demonstrate this, disconnect the ground from one side of the 12-volt center-tapped winding and connect the center tap to ground as shown in Fig. 2A.

The ground terminal of the scope is still left connected to the chassis, and is therefore essentially connected to the center tap of the 12-volt winding. Now connect the vertical lead of the scope to one side of the winding and sync in a display of two cycles with the Sync Selector in the line position. The display may look like Fig. 2B or Fig. 2C.

Notice what happens when you transfer the scope vertical lead to the other end of the winding. If you originally connected the lead to terminal A in Fig. 2A, transfer the connection to terminal B. Note that the starting point of the trace has shifted.

The internal sweep of the scope is the same regardless of whether we look at the signal at point A or B. In the case of the images shown in Figs. 2B and 2C, one signal starts at the peak of the positive cycle and the other at the peak of the negative cycle. Thus you have proof that the signals are 180° out-of-phase at opposite ends of a transformer winding.

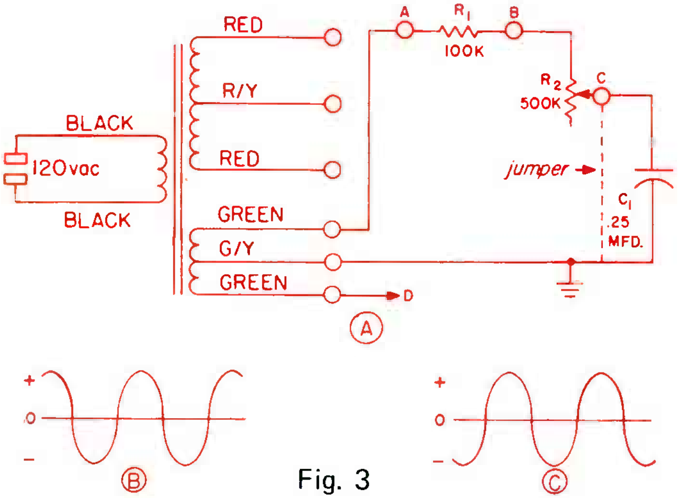


Fig. 3

Next we will show that there is a 90° phase shift in the voltage across the capacitor in a series R-C network compared to the source voltage or to the voltage across the resistor, and that the combined phase shift across both the resistor and capacitor is less than 90°, the exact amount depending on the comparative values of resistance and capacitance in the circuit.

To proceed, construct the circuit shown in Fig. 3. The jumper wire, indicated by the dotted line, is used to short out C in part of the experiment. With the jumper in place and R_2 adjusted for maximum resistance, observe the signal between the ground and point B. The image we obtained at NRI is shown in Fig. 3B. The scope is again synched with the line.

Now remove the short across C_1 and observe the signal from ground to point C. The image obtained at NRI appeared as shown in Fig. 3C. It will be necessary to adjust the Vertical Gain control so Fig. 3C has about the same amplitude as Fig. 3B.

The important thing to notice is that Figs. 3B and 3C have a shift of 90° in their starting points. Thus while the voltage with the resistor alone (Fig. 3B) started near the top of the positive peak, the voltage across the capacitor started near zero at the beginning of the positive peak.

To show that a resistor and capacitor together will produce a phase shift of less than 90°, transfer the vertical lead of the scope from C to B. Adjust the 500K-ohm potentiometer R_2, changing the setting of the Vertical Gain control to keep the image height about constant. Note that the point at which the image starts on the screen varies with the amount of resistance in the R-C circuit, which shows that the phase shift also varies.

With all the resistance in the circuit, the action is primarily resistive and the image is essentially the same as with the resistor

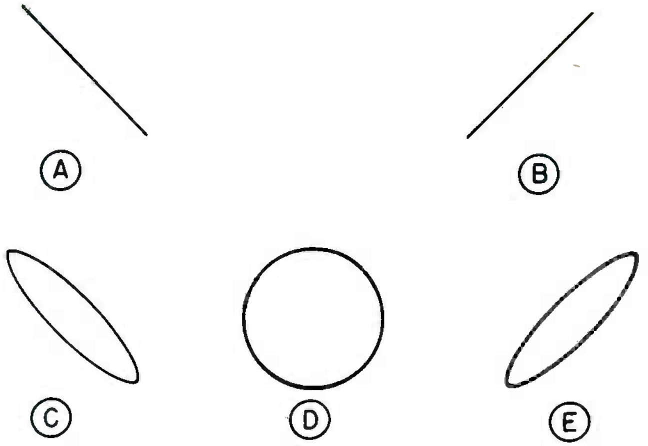


Fig. 4

alone. As the value of R_2 decreases, the starting point shifts towards that of the capacitor alone. In the experiment performed here at NRI it was possible to shift the pattern from that shown in Fig. 3B to that in Fig. 3C, by changing the value of R_2 and adjusting the scope Vertical Gain control to keep the image amplitude constant.

You have seen how the phase relationship of two voltages can be compared by viewing first one voltage and then the other. A more direct comparison can be made by feeding one of the voltages to be compared into the horizontal circuit while the other is fed into the vertical.

To do this, the Sweep Selector switch is turned to External and the horizontal sweep is provided by the signal fed to the Horizontal Input terminal. With the built-in linear sweep which we have used up to this point, we have been able to see the waveform of the signal connected to the Vertical Input terminal. With a sweep other than one which is linear, the resulting pattern is not a true time representation of the voltage under observation.

For the following demonstration we will use a sine wave for horizontal deflection and apply a sine wave of the same frequency to the vertical input.

To see what occurs, connect both the horizontal and vertical test leads to point A in Fig. 3, the scope ground lead being connected to the chassis. Adjust the Vertical and Horizontal Gain controls to give a picture of normal size. An image like that in Fig. 4A will be observed. (This is a slanting line on about a 45° angle.)

A very close examination and readjustment of the scope focus control for the sharpest image may show two lines rather than one. This is due to the slight phase shift between the two signals, introduced by the vertical and horizontal amplifiers in the scope.

This demonstration shows that when sine waves having the same phase and frequency are applied to both the vertical and horizontal inputs of the scope, we obtain a thin straight line sloping to the left. Using another scope, the slope may be reversed, as would all the slopes in Fig. 4.

Suppose that one of the sine wave signals was 180° out-of-phase with the other sine wave signal. What would happen? Check by switching the vertical lead from point A in Fig. 3 to point D. Now the vertical and horizontal input signals are 180° out-of-phase and the line, instead of slanting to the left, now slants to the right. To show that it does not matter which signal is applied to the vertical and which to the horizontal, interchange the horizontal and vertical test leads. The image will still slant to the right.

With a phase difference of less than 180° an ellipse will be obtained. If the phase difference is less than 90° the ellipse will slant to the left, as shown in Fig. 4C. If it is more than 90° but less than 180° the slope will be to the right as shown in Fig. 4D. Finally, if the two signals are exactly 90° out-of-phase an almost perfect circle will be obtained, as shown in Fig. 4E.

To produce these patterns, connect the vertical input lead to point B in Fig. 3 and the horizontal lead to point A. Adjust R_2 so its full resistance is in the circuit. The image in Fig. 4A will be seen. Now reduce the value of R_2 gradually, adjusting the scope Vertical Gain control to compensate for amplitude variations. An ellipse, as in Fig. 4C, will appear, and as you continue to reduce R_2 the full 90° phase shift across C_1 will be fed to the vertical input, and an almost perfect circle will be formed.

Leave all controls adjusted for the best circle, and switch the horizontal test lead to point D in Fig. 3. The circle should remain essentially unchanged. Now gradually increase the resistance of R_2 adjusting the Vertical Gain control to compensate for the increase in voltage at point B. The ellipse will again be formed, but this time slanting to the right, as shown in Fig. 4B. At this point the two signals are essentially 180° out-of-phase.

We will now investigate the actions occurring in resistive-capacitive, resistive-inductive, and capacitive-inductive circuits when the signal source has a nonsinusoidal waveshape. Such a waveshape is required because these circuits will not change the waveform of a sine wave, although the amplitude may be reduced considerably.

A point to bear in mind is that excessive reduction in amplitude of a sine wave may cause apparent change in its shape due to the introduction of noise and other signals picked up by the circuit. We can easily secure a nonsinusoidal waveshape for test purposes by producing a 60-cycle square wave.

A SIMPLE SQUARE WAVE GENERATOR

In this section we will show you how to build and use a simple square wave generator. Let's first examine the simple circuit in Fig. 5A. Here we have a series circuit consisting of a diode, switch, battery, and two equal resistors, R_2 and R_3. With SW closed, current will flow, and voltage drops having the polarity shown will appear across R_2 and R_3.

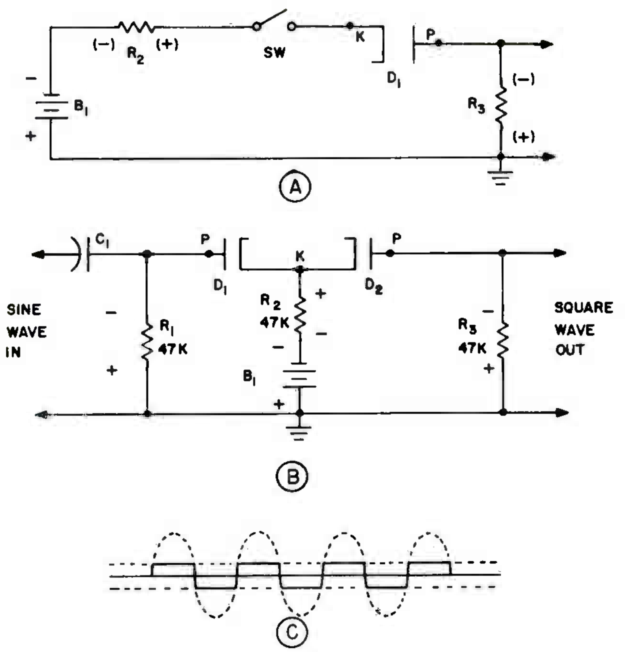


Fig. 5

Thus the plate-to-cathode voltage is the battery voltage minus the sum of the voltage drops across R_2 and R_3. If the voltage across R_2 was to exceed the battery voltage the diode would be reversed-biased and cease to conduct, and the voltage across R_3 would drop to zero.

On the other hand, if the voltage across R_2 was to drop to half its normal value, the plate current would increase and the voltage across R_3 would essentially double in value. The result would be a square wave across R_3. How can we trigger this circuit at 60 cycles?

Suppose we add another diode, as shown in Fig. 5B. With no sine wave applied to the input both diodes conduct, and since all three resistors are equal in value, R_2, which carries the currents of both diodes, has twice the voltage of R_1 or R_3.

Now, if we apply a sine wave signal greater than B_1 to the input of Fig. 5B, what will happen?

With the sine wave going in a negative direction, as shown in Fig. 5C, D_1 ceases to conduct as soon as the applied signal makes its plate negative with respect to its cathode. The resulting decrease in voltage across R_2 makes diode D_2 conduct more heavily and there is a corresponding increase in voltage across R_3.

On the next alternation of the sine wave signal, the plate-to-cathode voltage of D_1 increases and this diode conducts heavily. As a result, there is a large increase in voltage across R_2, cutting off conduction in D_2, and dropping the voltage across R_3 to zero. Thus, the sine wave in Fig. 5C can be used to produce a square wave at the output of the clipper circuit in Fig. 5B.

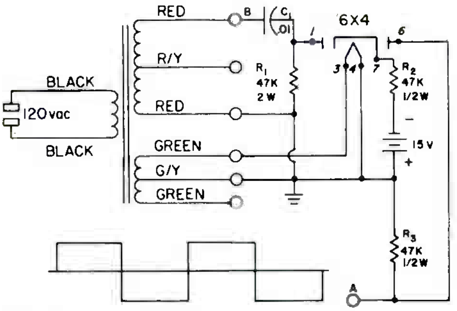


Fig. 6

The actual circuit you will construct is shown in Fig. 6. Capacitor C_1 should be rated at 600 volts; R_1 should be rated at 2 watts, while R_2 and R_3 may be ½-watt each. The 15-volt battery and its holder are NRI parts BA3 (81¢) and CL20 (32¢).

T_1 is the transformer supplied with Kit 3YY and the high voltage winding produces about 120 volts ac. The rectifier tube is a type 6X4.

R-C CIRCUITS

A simple R-C circuit consisting of a capacitor and resistor in series is shown in Fig. 7A. Before connecting this R-C circuit to the output of the square wave clipper, connect your scope to the clipper output (point A in Fig. 6) and examine the shape of the square wave obtained. Set the scope sweep selector to the 15-100 cycle range (on the CONAR Model 250 Scope) and adjust the sweep frequency control to produce two or three cycles of the square-wave signal.

As you carry out this set of experiments, it will be necessary to adjust the vertical gain control to compensate for variations in amplitude of the signals for various values of capacitance. Because of the resulting change in amplitude, the built-in sweep may tend to lose sync. This can be avoided by using the line sync position of the sync-selector switch. Once the image is properly synched in, the sync and frequency controls should not have to be readjusted.

To see how an R-C circuit changes the waveshape of a square wave, connect the circuit shown in Fig. 7A to the output of the clipper in Fig. 6, with the scope across the 120K-ohm resistor.

In Fig. 7B waveshapes produced by various size capacitors are shown. Note that as the value of the coupling capacitor is reduced, the waveshape changes from a fairly good square wave to a sharp pulse. The charge and discharge current of the capacitor, of course, flows through the 120K-ohm resistor and produces across it the voltage waveshape, so we are also looking at the current waveshape of the circuit. The smaller the capacitor the less time it takes for it to charge and discharge through a given resistor.

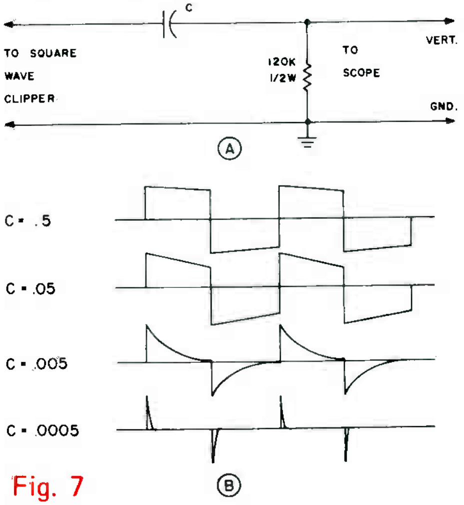


Fig. 7

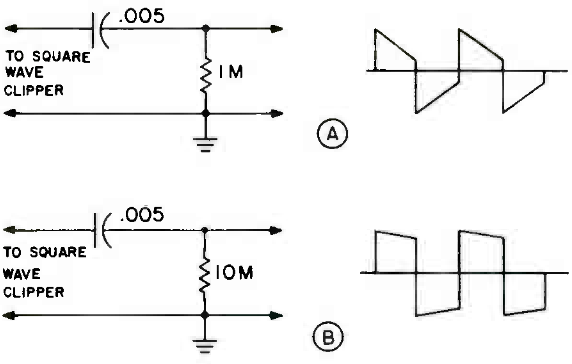


Fig. 8

With the .005-mfd capacitor we just have pulses of charge and discharge current. The capacitor does not stay charged for any appreciable length of time. In other words, this circuit will not pass a low frequency square wave without some distortion. The amount of distortion depends on the size of both the capacitor and resistor. As the value of either is reduced, the time constant becomes shorter and the distortion more apparent.

In high-fidelity circuits, where complex signals must be transmitted with little distortion, a large R-C time constant is used between stages. The circuit shown in Fig. 7A is that used in resistance-coupled amplifiers. Think of the resistor as the grid resistor of the following stage, and C as the coupling capacitor between the plate and grid of the two tubes.

Figs. 8A and 8B show what happens when we use the .005-mfd capacitor and increase the 120K-ohm resistor to 1 megohm and to 10 megohms. The latter value is frequently used in audio work as a grid resistor. Restore the circuit by replacing the 10 meg with the 120K-ohm unit.

Where the time constant of the R-C circuit is small compared to the time duration of the cycle, a very sharp pulse is obtained. Such a circuit is called a differentiation circuit, since it will pick out a high-frequency portion of a complex signal for transmission. This circuit is widely used in the sync systems of TV

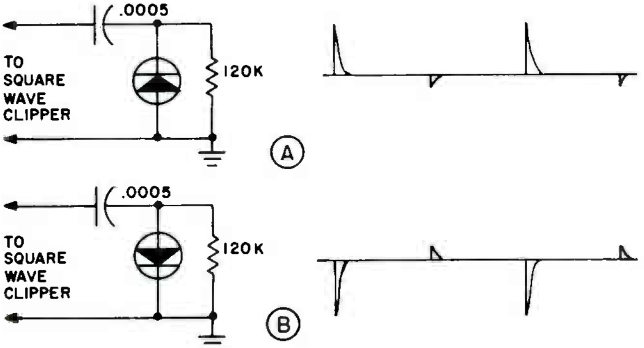


Fig. 9

receivers to obtain the horizontal sync pulses to feed the local horizontal oscillator circuit.

Why is there a change in waveshape? Our 60-cycle square wave actually contains the fundamental and odd harmonics. Thus, the square wave is actually a source of multiple sine waves, all of different amplitudes. The circuit in Fig. 7A acts like a high-pass filter, attenuating the lower frequencies so only the high frequency harmonics of the square wave are present at the output, with little or not attenuation.

If a sine wave is applied to the circuit shown in Fig. 7A, there will be no essential change in the general waveshape when the R-C values are varied, or if the frequency of the sine wave is varied. The only change will be in the amplitude of the signal across the resistor.

With a reduction in the time constant, the loss in signal may be large enough so that noise or hum pickup may become apparent. However, where stray pickup is low, a small coupling capacitor can be used without any change in the sine wave across the resistor.

Prove this by using the .005-mfd capacitor in Fig. 7A and connecting C to the ungrounded red lead of the power transformer (point B in Fig. 6). Remove C_1 in Fig. 6 temporarily and check the waveshape across the 120K resistor - also try other capacitor values in place of the .005-mfd unit. Note the change in amplitude without a change in waveshape.

Now reactivate the square wave clipper in Fig. 6 and connect the R-C circuit of Fig. 7, using the .0005-mfd and 120K-ohm resistors to the clipper output. The waveshape produced by this circuit has bidirectional pulses in which equal amplitude pulses are obtained in both positive and negative directions.

For some applications only positive or only negative pulses are desired. A slight modification will make this possible. A rectifier connected across the resistor can clip off the undesired pulse. For this purpose a 1N34 germanium diode can be used.

Prove this by connecting your scope across the 120K resistor so the signal with the bidirectional pulses is displayed. Next shunt the diode across the resistor, first in one direction and then in the other. With one connection you will obtain the waveshape in Fig. 9A, and with a reversed connection the shape shown in Fig. 9B.

INTEGRATING CIRCUITS

If we reverse the position of the resistor and capacitor in Fig. 7A we have what is called an integrating circuit which will pass low frequencies, but which attenuates high frequencies. The differentiating and integrating networks are used for separating and gathering the horizontal and vertical sync pulses in TV receivers.

To see the operation of an integrating network when a square wave signal is applied, construct the circuit in Fig. 10A and connect it to the output of the square wave clipper. Note how the waveshape at the output varies as different values of capacity are substituted. Fig. 10B shows the results obtained at NRI.

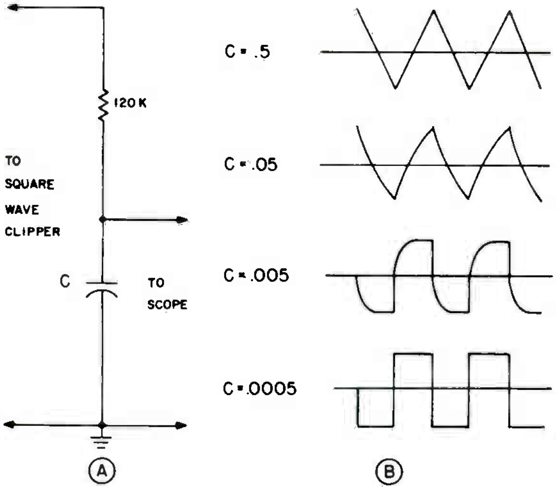


Fig. 10

Just as in the differentiation circuit, a sine wave will be passed through an integrating circuit without any change other than amplitude. Changing either the value of the resistor or capacitor will affect both the amplitude and waveshape when a square wave is under examination. However, it is the R-C time constant that determines the output waveshape of a complex signal.

Differentiation, as shown in Fig. 10A, with a resistor and capacitor, can also be secured with an inductance substituted for the capacitor, but as you might suspect the positions of C and L must be reversed. Try the two circuits in Fig. 11 to see which will produce a differentiated output. Choke L is furnished in Kit 3YY and is NRI part number CO26 ($1.04).

R-L-C CIRCUITS

In addition to the simple R-L and R-C circuits we have examined you can also investigate R-L-C circuits. Some of these with the resulting voltage and current waveshapes are shown in Figs. 12 and 13.

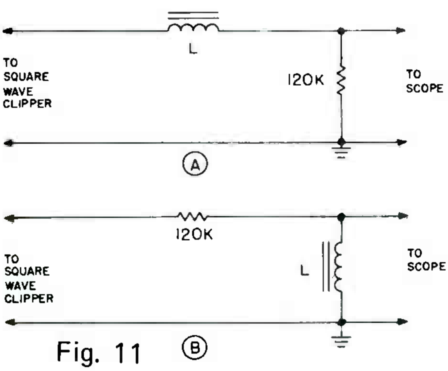


Fig. 11

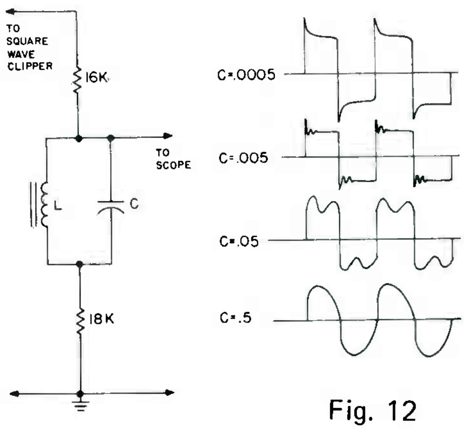


Fig. 12

In both figures the choke and capacitance form a resonant circuit which is shock-excited by the square wave. The oscillation is damped out by the resistance in the circuit, so only a few cycles are present with values of C from .0005 mfd to .05 mfd. With the .5 mfd value, however, L-C resonates at 60 cycles. A fine 60-cycle sine wave will be found across L-C, which can almost be deduced by an examination of C = .5 in Fig. 12.

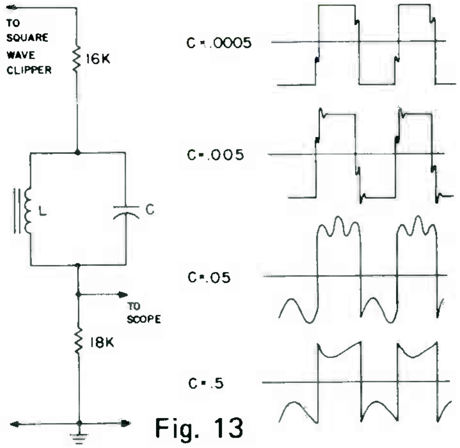


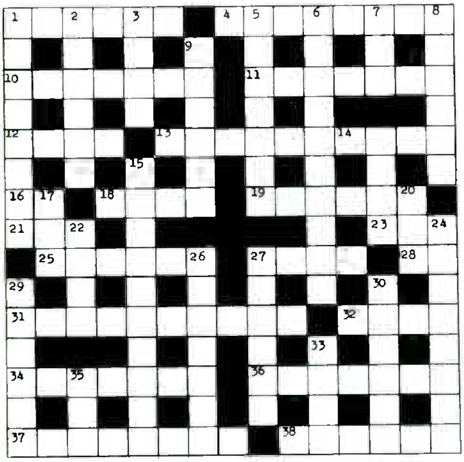
Fig. 13

The use of the scope in studying circuit operation is by no means limited to the few examples we have discussed here. If we receive enough requests we will prepare additional experiments which can be used in the study of oscillators, rectifiers, filter circuits, amplifiers, multivibrators, etc. Let us hear from you on this.

J.E. Smith Visits Florida Institute of Technology

NRI's founder, J.E. Smith, recently visited the Florida Institute of Technology and inspected the school's new engineering laboratory named in his honor. In 1966, Mr. Smith received an honorary doctorate degree in Space Education from FIT. Other recipients of this award included Astronaut Gus Grissom and Dr. Wernher Von Braun.

ELECTRONICS CROSSWORD PUZZLE



By Michael Kresila

(Solution on page 32)

down

1. A device used for reception of radio waves.
2. A wave propagated through space without being reflected.
3. One.
5. Electrical equivalents of physical quantities.
6. The degree shown by a graduated instrument such as a meter.
7. A cravat.
8. To have recourse.
9. The track inscribed in a record by the cutting stylus.
14. A sudden, quick movement.
15. A solid-state device made from semiconductor materials.
17. Capable.
20. Pen point.
22. A short shirt.
24. A band of frequencies on either side of the carrier frequency of a modulated radio signal.
26. A schematic.
27. Short range navigation aid.
29. Mechanism used on switches to give positive indexing.
30. A body that attracts iron and steel.
33. A short projection.
35. Suffix meaning resident of.

across

1. The distance from the center of a circle to any point on the circle.
4. That part of an antenna system from which radio waves are emitted.
10. A wave suitable for being modulated.
11. Information (usually a number) which designates a particular location in a memory storage device.
12. A measure of length.
13. In color TV transmission, an apparatus for generating color picture signals from camera signals and chrominance subcarrier. (2 words)
16. Each. (abbr.)
18. To release or disengage.
19. The second largest planet in the solar system.
21. Revolutions per minute. (abbr.)
23. It is. (poetic)
25. Coated with solder.
27. Noise in a TV picture.
28. A prefix meaning two.
31. A device that replaces batteries as a source of current and voltage.
32. Oxide coated strip used for recording.
34. One of the end sections of a transistor.
36. Device for radiating or receiving radio waves.
37. Statements in mathematics based on related mathematical formulas or propositions.
38. Subsided.

SPACE IS "THROWING ROCKS" AT MISSILES, SCIENTISTS SAY

Washington, D. C. --- More hard rock may be flying freely in space in the form of speeding meteoroids than scientists previously believed.

Meteor research in a high-temperature wind tunnel at the National Aeronautics and Space Administration's Ames Research Center, Mountain View, Calif., may revise present theories about the composition and abundance of meteoroids in the solar system.

If indications prove correct, that rock-like debris occurs more often in space than previously calculated, plans for space missions extending into many months may need revision.

Greater protection against these high-speed rock projectiles would be necessary on long missions where the probability of a meteoroid hit would be highest. Such added precautions would be reflected in the design of spacecraft and in protective space suits for men in space.

Millions of objects enter the Earth's atmosphere every day, most of them minute in size. For every pound-sized meteoroid, there are tens or hundreds of ounce-sized entering projectiles, and millions of smaller bodies.

Nearly all of this entering space debris burns up in the atmosphere. These particles are often visible at night as meteors. A few stone and iron meteorites (fallen meteors) reach the Earth's surface.

Measurements of light emitted by meteors, plus studies of their trajectories have suggested that most meteors are loose aggregations of sand-like material which rapidly disperse as they strike the atmosphere. Such sandy meteorites have never been found on Earth, since they cannot survive entry into the atmosphere.

The quantity of light emitted by a meteor shows the rate at which it loses mass. Its velocity can be measured by a camera with a rotating shutter, its density by calculations based on these measurements.

Observations suggesting that meteors are sand-like, combined with studies of meteor and comet trajectories, have also indicated that most meteors are remains of broken-up comets. This fits the current theory that comets are like "dirty snowballs" made mostly of ice, frozen ammonia and methane, with some rock and sand.

Recent Ames wind tunnel experiments suggest that this space snowball theory doesn't fit all meteoroids. While most meteors rapidly become five or ten times less dense after entering the atmosphere, some of them lose density initially and then seem to become more dense again.

Research by a group of scientists headed by H. Julian Allen, Director of Ames, provided new evidence. Other Ames experimenters included Charles Shepard, Howard Stine and Barrett Baldwin.

While running ablation (melting) studies of spacecraft heat shields, these scientists noticed that light emission from heat shield vaporization were much like those from meteor entry. The group decided to study meteor entry conditions by simulating them in the wind tunnel.

In subsequent experiments, the researchers conducted ablating tests on one stony meteorite and a number of samples of gabbro, a common, meteor-like Earth rock, at simulated speeds up to 35,000 mph, within the meteor speed range.

The tunnel tests showed that the heat of entry into the Earth's atmosphere melts the surface of these rocks, boils off what little water they contain, and expands their other gases. This expansion, ten to 1,000-fold, converts the exterior rock layer to foam.

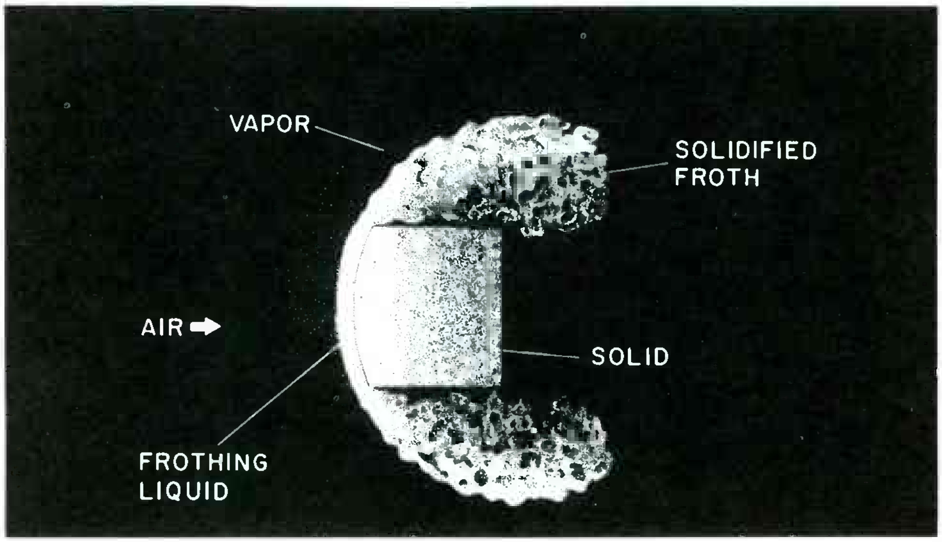
The frothing rock forms a king of blunt heat shield which flows around the sides of the rock, eventually breaking off.

The rock foam is two to twenty times less dense than the unheated rock. Thus, each time a piece of froth breaks off, the average density of the remaining rock projectile rises radically. This frothing and breaking-off of many meteors (about 15 per cent) appears to account for the rapid loss and later abrupt rise in density.

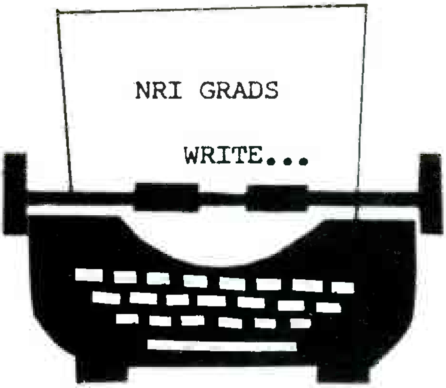
The Ames researchers further believe that many other rock meteors retain their froth during visible flight and therefore show a reduced average density. Hence, they believe a majority of meteoroids may be composed of hard rock.

The scientists speculate that, contrary to old theories, many more meteors originate in the rocky asteroid belt, or that material in the luminous clouds of comets contains much more solid rock.

Based on this new information, the probability of meteoroids puncturing spacecraft is about six times greater than previous estimates from observation of meteors. This means that extra protection from small meteoroids may have to be provided for large spacecraft on future long-distance space missions. This discovery does not affect the measurements of meteoroid puncture rates made from satellites.



This artist's sketch illustrates how a block of meteor-like rock (gabbro) reacts to a blast of superheated air in wind tunnel tests simulating the 35,000 mph speeds of meteors. Intense heat on the face of the block exposed as the "leading" surface ablates (melts) the rock, which congeals around the sides into a solid froth material of much lower density than the rock itself. When the froth breaks off from an incandescent rock meteor in the Earth's atmosphere, the entering body changes in density as indicated by changes in the light it emits. Tests simulating meteor entry into the atmosphere were made in NASA's Ames Research Center Hypervelocity Planetary Gas Tunnel in Mountain View, Calif.



Larry Soughan
2711 Hobson Rd.
Fort Wayne, Ind.

"I am the Project Engineer for General Telephone of Indiana in Education Television. I am responsible for system design, ordering of equipment, installation and testing, and acceptance of the system for Gen. Tel. of Ind. Also I am responsible for design of systems involving Data Communications for our company. Both fields are rapidly expanding and thanks to my NRI course my future is secure."

Craig D. Sparks
283 Windsor St.
Cambridge, Mass.

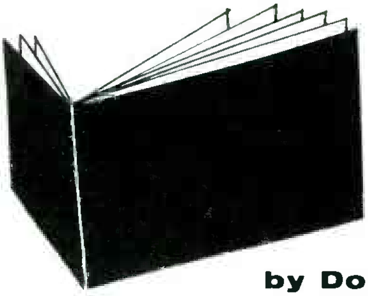
"I have been hired by the American Telephone and Telegraph Company in their Long Lines Department as a communications technician. I believe that because of my NRI training I was hired. I was also given credit for 18 months experience because of your course. As a result, my starting pay was raised considerably. My employers were very much impressed that a correspondence course could train someone well enough to obtain a 1st Class ticket, because of this I will not have to be sent to school in order to get my license. My duties will involve maintaining and servicing Microwave Radio Relays and coaxial cable carrier systems."

what's new

Wrist watches that will tell not only the time, but have voice, visual, and recording capabilities will be standard in the year 2000, predicts Waltham Watch Co. president H. B. Aronson. He's sure enough of it to have sealed the information in a time capsule under the company's new building in Elgin, Ill.

Now nonsecret are three DoD tactical night vision devices used by front-line forces in Vietnam. The devices utilize starlight or moonlight rather than the infrared sources of previous equipment, intensifying it some 40,000 times within the scope's target area. A three-stage image intensifier tube combined with precision optics provides amplification.

Pioneering in solid-state electronic devices for automobiles is Ford Motor Co., which will introduce a skid-control system (optional) in its 1969 Thunderbirds and Mark Threes. In the system, a tiny computer beneath the glove compartment reads signals from sensors on the rear wheels and transmits the information to a vacuum-powered actuator in the engine for regulation of pressure. Also planned for 1969 models are a solid-state speed control system, an interval selector windshield wiper, and a sequential turn-signal.



NEW BOOKS

by Donald A. Smith

EDITOR'S NOTE: Mr. Smith, an instructor in electronic technology at Walter Johnson High School in Montgomery County, Md., is himself the author of three books, "The ABC's of Electronics", now in its second printing; "Medical Electronics Equipment Handbook", and "The ABC's of Vacuum Tubes", all published by Sams. He is a frequent contributor to electronic trade magazines, and a graduate of NRI's Radio-TV, Communications, and Appliance courses.

Transistor Substitution Handbook
by the Staff
Howard W. Sams & Co.
Indianapolis, Ind.
128 pp, $1.95

This is a book which no electronic serviceman should be without. The student doing part-time service work needs it even more! With the great number of transistors in use today, it would be impossible to stock each one. The cost alone, if all were even available, would run into the thousands of dollars. The tremendous quantities of foreign equipment now being sold in this country, each with its own types of transistors, makes the supply problem even more complex.

This "Transistor Substitution Handbook" lists many thousands of transistors, including Japanese and other foreign types. The substitutions for each transistor type were selected by computer, making the substitution information much more reliable. The book also contains sections on "How to Make Substitutions," the Theory Behind Substitutions," a "Key to Transistor Manufacturers'" and a very helpful section on "Transistor Terminal Guides." The price of this book could be saved the first time it is used.

ABC's of Ham Radio
by Howard S. Pyle
Howard W. Sams & Co.
Indianapolis, Ind.
144 pp, $2.50

Howard Pyle's ham radio book will appeal to almost every student and graduate. It explains amateur radio in a clear, interesting style which makes reading it a pleasure. Some chapters give basic theory which is well covered in all NRI courses.

Other chapters, however, give specific information needed to become an Amateur. One such chapter deals with "The Radiotelegraph Code." Mr. Pyle gives methods and ideas which make the learning of Morse Code possible, even if he can't make it easy, as no one can.

Also included are chapters concerning the operation of an Amateur station, some of the legal aspects of adjusting and operating transmitters and a very interesting chapter on "Assembling Your Station." (Notice the CONAR transmitter shown on page 99.) Also discussed are the various types of equipment which the beginner might purchase and some of the other associated equipment and supplies needed.

The author guides the newcomer to Amateur Radio with the advice of an "old timer" of Ham Radio. Mr. Pyle has been an Amateur for over 60 years! I think you will find, as I did, real enjoyment in reading this book.

---

49 Easy Transistor Projects
by Robert M. Brown and Tom Kneitel
Howard W. Sams & Co.
Indianapolis, Ind.
64 pp, $1.75

Most students (and, yes, graduates too!) never seem to get enough projects and experiments to do. Even with the large number provided with NRI courses, the average student would like to "experiment" more. This little book is sure to provide that opportunity. As its title states, it contains "49 Easy Projects" which are simple, inexpensive, and fun to build.

Instructions are given to build everything from a head-set-to-speaker adapter to a supersonic eavesdropper. One of the best parts about building these circuits is that many of the parts used in one project can be used in another. The number of different transistor types is small and restricted to inexpensive ones. Most parts, if not all parts, can be found in a discarded television set, radio, etc.

The book has instructions for building a small two-transistor receiver for the vhf band (80 to 150 MHz) for less than $4.00. I built the little unit and was really surprised at how well it performed. I only needed 7 parts (plus earphones) to build the receiver! It works so well that I now use it as a monitor receiver for the 2-meter Ham Band!

Many other interesting projects are included, all inexpensive and all interesting. Several that I particularly liked were the audio frequency meter, the transistorized electronic timer, a sensitive geiger counter and a minature FM radio. Maybe you should get two copies. You'll wear the first one out!

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1956 GRADUATE R. M. Baker, 3611 Squire Lane, Orlando, Fla. 32806

Has a collection of several hundred tubes, many types -- from OIA's, 2A3, 24-1 to 84-4's, UX171A, etc., all in working condition. Good for the man who needs a "hard to get" tube.

NRI HONORS PROGRAM AWARDS

For outstanding grades throughout their NRI course of study, the following March and April graduates received Certificates of Distinction along with their NRI Electronics Diplomas.

WITH
HIGHEST HONORS

M. Arehart, Auke Bay, Alaska
Michael D. Beekman, Sacramento, Calif.
Thomas E. Bodine, Warrenton, Va.
Angel G. Garcia, Tularosa, N.Mex.
Edward F. Golden, Bremen, Ga.
James M. Hess, Middletown, Md.
Hugh C. Isaacs, Montreal, P.Q., Can.
David M. Janis, Spenard, Alaska
David H. Johnson, Tallapoosa, Ga.
Charles M. Koch, Duncanville, Texas
Francesco Parente, Philadelphia, Pa.
Blyde A. Perkins, Sonoma, Calif.
William A. Poist, Savage, Md.
Harvey Rennie, Clearfield, Pa.
Juan P. Salazar, Tularosa, N. Mex.
Carolyn K. Snow, Hopewell, Va.
Ralph B. Stoll, Tucson, Ariz.
Lloyd W. Stone, Osawatomie, Kans.
L. Eugene Tucker, Houston, Texas

WITH
HIGH HONORS

Joseph A. Ambrose, Stafford, N.Y.
Theodore Antolik, Painesville, Ohio
Andrew B. Avans, Idabel, Okla.
John C. Barnes, Red Bank, N.J.
M.O. Beck, Poulsbo, Wash.
Jimmie Belle, Boise, Idaho
Frederick W. Bishop, Brown Summit, N.C.
J. Marshall Bowen, Philadelphia, Pa.
Adolfo Calderoni, Hidalgo, Texas
Matthew Cavanaugh, Saint John, N.B., Can.
Arthur J. Crawford, Gulfport, Fla.
Benton F. Crawford, Honea Path, S.C.
Vernon A. Davidson, Palisade, Colo.
Salvian P. Douglas, North Bay, Ont., Can.
Daniel D. Dusing, Indianapolis, Ind.
Joseph Fasceski, Edison, N.J.
William A. Fish, Redlands, Calif.
James B. Fleming, Livingston, Mont.
Beckham Franzell, Jr., Caneyville, Ky.
Renford A. Gagnon, Granby, Conn.
James C. Garraghty, Forest, Va.
Dr. N.G. Gaston, Monroe, La.
Frank H. Ginac, Schenectady, N.Y.
John K. Grant, Muncie, Ill.
Francis G. Hammerle, Fort Worth, Texas
Lawrence C. Henke, Elk City, Okla.
Ira P. Hill, Cocoa, Fla.
Samuel T. Jacks, Ocean Park, Maine
Elwoode Jankowski, Milwaukee, Wis.
Richard C. Johnson, Chicago, Ill.
John C. Jones, Bad Axe, Mich.
C.A. Kersey, Macon, Ga.
Ilyoul Lee, Los Angeles, Calif.
Raymond L. Miller, APO New York
Terry O. Miller, Gaspe, P.Q., Can.
Hugh R. McDermott, Baker, Oreg.
Richard L. McElroy, Kimberton, Pa.
John Meo, Van Nuys, Calif.
Calvin E. Moore, Beaufort, S.C.
Richard M. Mullins, Great Falls, Mont.
Ross D. Nord, Iron Mountain, Mich.
Bernard James Oxenham, Rome, Italy
Steve V. Palladino, Mitchell, Ind.
Madison C. Peters, Elizabeth, N.J.
Raymond E. Pokrandt, Oshkosh, Wis.
George D. Pope, Huntsville, Ala.
Donald N. Ramey, Germantown, Tenn.
Raymond D. Reddick, Lufkin, Texas
Hobart G. Reeves, Brownsburg, Ind.
Lewis B. Riley, Portland, Oreg.
N.P. Schindeler, Aruba, Netherlands Antilles
Dean C. Shaw, Laramie, Wyo.
William R. Shomber, Kansas City, Kans.
Lester R. Snowden, Barksdale AFB, La.
Hershel D. Standard, Biloxi, Miss.
Donald H. Stebbins, Buffalo, N.Y.
Harold L. Theriot, Gretna, La.
Ronald E. Walker, Montgomery, Ala.
Raymond S. Walters, Edwards, Calif.
George H. Watrous III, State College, Pa.
Jack Wong, Dallas, Texas

WITH HONORS

Nathaniel Abram, Washington, D.C.
Roy R. Anderson, San Francisco, Calif.
Ronald C. Applebach, Rome, N.Y.
Edward F. Appleby, Baltimore, Md.
Charles W. Aylor, APO New York
Henry Bauer, Phoenix, Ariz.
Anthony J. Bednarz, Lincoln Park, N.J.
Russel J. Bianchi, Fort Lauderdale, Fla.
John Paul Brochu, S. Brewer, Maine
Robert N. Caler, Elvins, Mo.
Norman Dean Cares, Parsons, Kans.
Jay Kenneth Carlson, Blackfoot, Idaho
Ernest L. Carr, Tifton, Ga.
Patrick J. Chick, Mayfield Heights, Ohio
Walter Conway, Cincinnati, Ohio
D.W. Courter, Vincennes, Ind.
Murray J. Cusack, Chipman, N.B., Can.
John L. Demmons, Clarenville, Nfld, Can.
James A. Diaz, Bayamon, Puerto Rico
Marion J. Drew, Summerville, S.C.
James O. Edmonds, Sylvan Grove, Kans.
James C. Falcione, Pittsburgh, Pa.
Edward F. Falkowski, Allen Park, Mich.
G. Finn, Dollard Des Ormeaux, P.Q., Can.
James H. Garrett, Dallas, Texas
Robert E. Gideon, Mechanicsburg, Ill.
Kenneth R. M. Gillespie, Takoma Park, Md.
Leo A. Girard, Woonsocket, R.I.
Baldemar Gonzalez, Mission, Texas
Joseph P. Hawkins, Jr., Niceville, Fla.
Walter M. Holden, Jr., Middleboro, Mass.
Herman R. Holderbaum, Cuyahoga Falls, Ohio
Kenneth A. Huffman, Aberdeen, Wash.
Horace M. Johnson, Marysville, Calif.
Paul R. Johnson, Moline, Ill.
John P. Kendra, Culpeper, Va.
Gaetan G. Lajoie, Montmagny, P.Q., Can.
Donald E. Lightner, Petersburg, Pa.
John C. Lotze, Beltsville, Md.
William H. Love, Great Falls, S.C.
Robert J. Mangassarian, Lindinhurst, N.Y.
Fred H. Marheine, Mt. Morris, Mich.
El Eng. L. Marosvary, New York, N.Y.
Cletus J. Matthews, Jr., Washington, Ind.
Willard W. Mayes, Lock Haven, Pa.
M.G. McCoy, Jr., Santa Susana, Calif.
Eugene Y. McKay, Alexandria, Va.
Frederick J. McWilliams, Leonardtown, Md.
Leonard D. Medaris, Allison, Iowa
Lawrence F. Mills, Fredericksburg, Va.
Carl E. Minor, Jonesville, Va.
Merritt A. Moores, St. John's, Nfld., Can.
Burley Morris, Baton Rouge, La.
Charles M. Munro, Chamblee, Ga.
Robert L. Nemeth, Paradise, Calif.
Abdul L. Nuaimi, Kirkuk, Iraq
Harold Oliveira, Daly City, Calif.
Fred O. Pearson, Jr., Wichita, Kans.
R.C. Persuda, Charleroi, Pa.
Glenn R. Ray, Anchorage, Ky.
David C. Rich, Napa, Calif.
Fred W. Robbins, Griffiss AFB, N.Y.
Richard P. Rosenberg, Holly Hill, Fla.
Francis R. Rotkiewicz, Santa Maria, Calif.
Alvin R. Shelledy, Eden Prairie, Minn.
W. Scott Sherman, Jr., Atlanta, Ga.
James Siddons, McKinleyville, Calif.
Frank W. Sievers, Lewistown, Pa.
Adarienne J. Stephens, Erie, Pa.
Roy E. Stephens, Oklahoma City, Okla.
Edward S. Struzinski, Everett, Mass.
Edward Stumpf, Cleveland, Ohio
Ralph A.Tafel, Detroit, Mich.
Danny R. Turner, APO New York
Stephen L. Vavrick, Arlington, Va.
Ronald A. Waldron, Ft. Devens, Mass.
Milton L. Wells, Sr., Colorado Springs, Colo.
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job-ops

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High-school graduates with ability to meet public and basic knowledge of electronics.

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Manager Recruitment & Training
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Springfield, Va. 22151
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Wheate's TV is looking for a NRI student or graduate for a Radio-TV servicing trainee. Applicants, preferably from Washington, D. C., must have experience with current electronic equipment.

Wheate's TV
151 Rollins Ave.
Rockville, Md.
20852

INDIANA STATE POLICE
need
COMMUNICATIONS OFFICERS

Need not be Indiana residents

BASIC REQUIREMENTS:
Age 19-35, physical and mental fitness, accredited high-school diploma, some knowledge of typing, good voice and character.

TECHNICAL REQUIREMENTS:
FCC Radiotelephone or Radiotelegraph License, Second Class or higher preferred; can obtain within reasonable period after employment.

Mr. Dennis Henning of 612 Gheers Ave., Louisville, Ky. is looking for a business partner for servicing shop.

Would prefer NRI graduate.

John D. Richards needs a good licensed radio technician in Alaska.

Write to:

John D. Richards
Communications Engineering Inc.
3350 Mt. View Drive
Anchorage, Alaska
272-3591

Positions available dealing with heavy duty industrial equipment, 2-way radios, closed circuit TV, and PA systems. Requires at least 2nd class FCC license.

CONTACT: Mr. W.D. Howard
District Service Manager
Motorola Communications And Electronics
8 Babson Park Ave.
Babson Park, Mass.
617-237-1215

P & W Electric Service is looking for a NRI graduate for a TV serviceman.

CONTACT:

Mr. Gordon Penhollow
P & W Electric Service
63 So. East Ave.
Amboy, Ill. 61310
857-2021

Bill May is in need of a student or graduate interested in doing TV service work.

call
or
write

Bill May TV Center
Stratford Hill
Richmond Va.
272-6548

APPLIANCE TECHNICIANS

apply:
Albert's Appliance Repair
113 North Eighth Street
Garland, Texas

Position available in maintenance of 2-way radio equipment for NRI Graduates or Students in Bismarck, N.D. area

See Mr. Ray Barnett
Dakota Communications Service
1916 East Thayer St.
Bismarck, N.D. 58501

MOSLER ELECTRONIC SYSTEMS DIVISION
1401 WILSON BOULEVARD
ARLINGTON, VIRGINIA
703-525-5700

Opening for a sales trainee. This is a permanent position by one of the nations leading manufacturers of security alarm systems.

Applicant should be under 30 years of age and acceptable for a security clearance.

Please phone for an interview.

Leutys Radio & TV is in need of a TV technician.

Call
or
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Leutys Radio & TV
110 S. Broadway
Salem, Ill. 62881
548-1111

DO YOU HAVE A SECOND/CLASS RADIO-TELEPHONE LICENSE?

WANTED: CLOSED CIRCUIT and COMMUNITY ANTENNA TECHNICAL MAINTENANCE MAN

Contact: Mr. James Grabenstein
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Electronic Technician Trainee for electronic systems installations and service. No experience necessary.
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ALTRON ELECTRONICS CO.
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Radio & TV Service
COLOR, BLACK & WHITE SPECIALTY

NRI STUDENT OR GRADUATE FOR PART-TIME SERVICING

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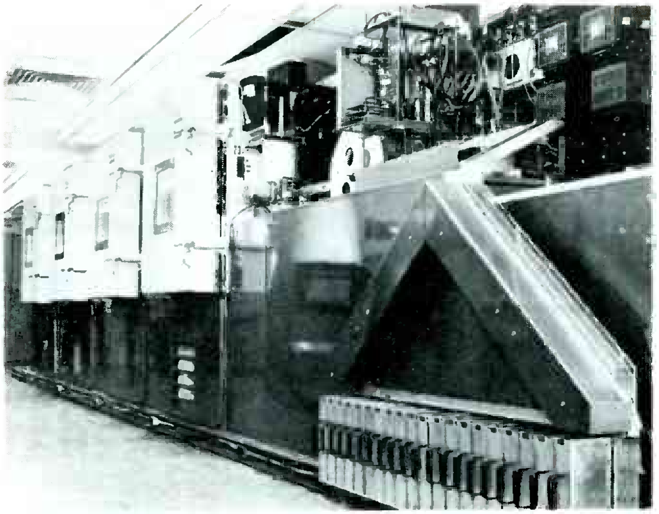
763 Folsom Ave.
Hayward, Calif. 94554 **782-2002**

WANTED: Electronic technician to assist electronic engineer with college av service. System includes CCTV, dial access retrieval, language and science labs, av equipment. Position, under state civil service, to be filled this summer. Salary and benefits competitive.

WRITE: V.A. Champa, Millersville, Pa. 17551



"MR. ATOMIC" TESTS INTEGRATED CIRCUITS

WOBURN, Mass.--By the time "Mr. Atomic" has finished with them, every integrated circuit made by Sylvania's Semiconductor Division here has undergone an unusually thorough environmental testing.

Despite the name, however, Mr. Atomic is not a person. It is, instead, an acronym for Multiple Rapid Automic Test of Monolithic Integrated Circuits. The system, which can handle well over 250,000 circuits a week, was designed by Sylvania engineers, and its environmental testing equipment was furnished by Tenney Engineering, Inc., of Union, N. J., a leading producer of such devices.

"In order to pass its final test," Sylvania engineers say, "each integrated circuit must operate in four consecutive temperature-controlled chambers operated at widely varying degrees of heat or cold while a computer records the parameters of each circuit. This makes it possible to put a much stronger guarantee on them than if they were tested only at room temperature."

In these Tenney-built units, which Sylvania engineers refer to as "torture chambers," the integrated circuits are automatically inserted in a wheel which rotates them to the testing point while they are stabilized at the test temperature.

Because Tenney chambers are constructed to operate within extremely close tolerances, the first one is maintained at a steady 75° C. The second is kept at an even 0° C, the third at a constant 125° C, and the fourth one is held at -55° C. In these four chambers in this ultimate testing equipment, as many as 100 dc tests can be performed automatically. Each input is individually tested.

After this has been completed, a fifth station, which is maintained at 25° C, tests anywhere up to 30 switching parameters accurately down to a few billionths of a second. Then when all of these exhaustive tests have been finished, Mr. Atomic directs the circuits to any of 20 bins, according to the computer's priority programs, where they are ready for installation in a wide variety of products.

NOMINATIONS OPEN FOR NATIONAL OFFICES IN NRI ALUMNI ASSOCIATION FOR 1969

It would be difficult, right now and in the immediate future, to turn on your TV or radio, go to the movies, read a newspaper or magazine, etc., without encountering some kind of harangue as part of this year's presidential campaign. The candidates rant and rave at and about each other, their supporters do likewise, and partisan citizens add to the general din.

Our NRI Alumni Association is also concerned with an election campaign at this time, for the officers of the Association for 1969. But in contrast to the hustle and bustle of the Democratic and Republican battle to elect the next President of the United States, our modest little campaign will be a quiet, friendly casting of votes without fanfare and bombast.

We will nominate two candidates for President, eight for Vice-Presidents. These nominations must arrive at NRI by July 25. The winning candidates will appear in the next issue of the Journal.

Only members of the NRI Alumni Association are eligible to vote or to serve as officers of the Association.

In considering whom to nominate, members should keep in mind the restrictions on the re-election of incumbent and past officers, as set forth in Article VI, Section II of the Constitution quoted below:

"The President shall not be eligible for re-election until after expiration of at least eight years following his last term of office and, further, may be a candidate for Vice-President only after expiration of at least a year following his term of office as President. Vice-Presidents may not serve more than two consecutive terms; when re-elected for a second consecutive term they shall not thereafter be candidates for Vice-President until after expiration of at least three years following their second term of office."

Of the present officers only the President, John Pirrung, is affected by the restrictions quoted above. He is ineligible as a candidate for either President or Vice-President this year.

You may nominate any NRIAA members you wish. If you have no preference in nominating a candidate for President, we would like to point out that Walter Adamiec has long deserved this honor for organizing the Southeastern Massachusetts Chapter in 1957 and for his work with the Chapter since then. Other members, selected geographically, are given under "Nomination Suggestions" and the ballot is on Page 31.

NOMINATION SUGGESTIONS

Earthel Fleming
Mobile, Ala.

J. E. Hulsey
Birmingham, Ala.

Robert C. Boory
Phoenix, Ariz.

C. S. Adkins
Clifton, Ariz.

Norman Baxter
North Little Rock, Ark.

T. J. Taylor
Pine Bluff, Ark.

Joe A. Reyes
Barstow, Calif.

James T. Parker
Citrus Hgts., Calif.

Earl A. Leonelly
Central Valley, Calif.

Ralph Knight
Fowler, Colo.

Ralph D. Moers
Denver, Colo.

William D. Warner
Stanford, Conn.

Reynolds P. Nickless
Norwalk, Conn.

Dallas J. Holt
Wilmington, Del.

William H. Clarke
New Castle, Del.

Eugene E. Thornton
Washington, D. C.

Andrew E. Bowen
Washington, D. C.

Frank G. Laventure
Ft. Lauderdale, Fla.

Henry G. Gocio, Jr.
Crescent City, Fla.

Francis K. Smith
Atlanta, Ga.

Joseph L. Knight
Warner Robins, Ga.

Henry T. Farrington
Ashton, Idaho

Lewis G. Elmer
Boise, Idaho

George Hobby
South Holland, Ill.

T. J. Bennett
Moline, Ill.

William H. Lester
Indianapolis, Ind.

Gerald S. Birum
Union City, Ind.

Victor E. Bartling
Grand Mound, Iowa

Harold Thorington
Cedar Rapids, Iowa

Bernard Schultz
Leavenworth, Kans.

Robert F. Marcy
Cherryvale, Kans.

Carl A. Gastinger
Louisville, Ky.

Frank E. O'Donnell
Ludlow, Ky.

Bobby J. Willard
Harvey, La.

Edward M. Schaff
New Orleans, La.

Gerald J. Boudreau
Waterville, Maine

Kelvin Higgins
Oakland, Maine

Delbert E. Clark
Ellicott City, Md.

Russell H. Summers
Boonesboro, Md.

Frank R. Abbruzzi
Watertown, Mass.

Erwin S. Trask
Plymouth, Mass.

Elton Murphy
Austin, Minn.

Aloysius J. Lehn
Hopkins, Minn.

W. S. Tatum
Hattiesburg, Miss.

Merle M. Mowery
Pass Christian, Miss.

James D. Klelamp
Slater, Mo.

Lou Taranto
St. Louis, Mo.

Earl F. McCracken
Great Falls, Mont.

Robert W. Petrick
Hingham, Mont.

Dale Standley
Minatare, Nebr.

Frank John Zpevak
Omaha, Nebr.

Michael Kuchman
Las Vegas, Nev.

George R. Squire
Las Vegas, Nev.

Robert J. Chouinard
Greenville, N. H.

Harvey St. Jean
Hudson, N. H.

Lester Heitsche
Hamburg, N. J.

Horace O. Pease
Dover, N. J.

George Martinez
Los Alamos, N. Mex.

Dale L. Byard
Albuquerque, N. Mex.

Joseph F. Corr
Jackson Hgts., N. Y.

J. T. Bolden
Winston Salem, N.C.

McDewey Sigmon, Jr.
Greensboro, N. C.

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Mylo, N. Dak.

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Hurdsfield, N. Dak.

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Warwick, R. I.

Horace Simmons
Newport, R. I.

James B. Winchester
Columbia, S. C.

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Newberry, S. C.

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Anderson Williams
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Brownsville, Texas

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Newport News, Va.

John Tarsia
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Sidney Pierce
Whiting, Vt.

Robert F. Smith
Burlington, Vt.

George W. Ice
Seattle, Wash.

Frank W. Street
Pullman, Wash.

John T. Crawford
Morgantown, W. Va.

John J. West
Huntington, W. Va.

Elwood W. Jung
Manitowoc, Wis.

Harry G. Peterson
Eau Claire, Wis.

Gerold L. Conley
Eden, Wyo.

Lawrence T. Allen
Cheyenne, Wyo.

Theodore Sidor
Chugiak, Alaska

Charles T. Staples
Victoria, B. C.

Timothy L. Szobody
Honolulu, Hawaii

Paul Donylo
Winnepeg, Man.

James P. Murphy
St. John, N. B.

Patrick J. McGrath
St. Johns, Nfld.

Russell Long
North Sydney, N. S.

John E. Andrews
Ottawa, Ont.

Elmer Katchuck
Southey, Sack.

Varoujan V. Tashdjian
Montreal, P. Q.

Leslie Hutchinson
Wetaskiwin, Alba.

CONAR EASY PAYMENT PLAN J1

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

John Pirrung . . . . President
Franklin Lucas . . . . Vice-Pres.
James J. Kelley . . . . Vice-Pres.
Arthur Howard . . . . Vice-Pres.
E. J. Meyer . . . . Vice-Pres.
T. F. Nolan, Jr. . . . . Exec. Sec.

DETROIT'S AGENDA INCLUDES COLOR TV SERVICING

DETROIT CHAPTER Chairman Jim Kelley constructed a demonstration board with a plug-in transistor and variable controls so the voltages on the transistors could be varied and these voltages and currents read on the meters inserted in the circuit.

At the next meeting Gil Sager brought in an auto radio. Also at this meeting Mr. Payton displayed an oscilloscope he had built from a kit. The members present helped him to align it.

The chapter plans to undertake color TV servicing and also to continue with its present program on solid-state servicing.

SAFE SERVICE GUIDELINES PRESENTED AT FLINT

FLINT-SAGINAW VALLEY CHAPTER gave rapt attention to guest speaker James Burke, General Electric Field Service Manager, when he delivered a talk on "Guidelines To Safe Service Practice."

He outlined the proper service procedure for technicians and emphasized the precautions required to avoid possible x-ray exposure to one's self and to co-workers and customers.

Discussed at considerable lengths were joint-chapter picnics such as those held in past summers by the Flint and Detroit chapters getting together for such occasions.

FAIRER SEX IS BOUND TO BOOST MORALE

LOS ANGELES recently welcomed two new members, Mrs. Beverly Miller and Mrs. Ruth La Chance. These members of the gentler sex are doubly welcome. Their mere presence at meetings should do much to boost the men's morale.

SAN FRANCISCO WELCOMES NEW MEMBER

SAN FRANCISCO also reports a new member, Mr. Thomas A. Roberts. Our congratulations, Tom!

John Parker demonstrated the calibration of a sweep generator with a quartz crystal oscillator and a signal generator.

WIDE VARIETY OF TOPICS DISCUSSED AT N.Y. MEETINGS

NEW YORK CITY CHAPTER'S latest member is Gilberto Sinclair, a recent graduate. Welcome to the ranks, Gil.

Stephen Kross gave a most interesting talk on the mechanical side of tape recorders, supported by actual instruments as well as diagrams on the blackboard. He has a gift for explaining these things simply and with great clarity.

Lionel Williams amplified a previous mention of methods of making voltage measurements with a scope. He emphasized the flexibility of calibrating the scope, but the absolute necessity of not touching the gain control once this had been done, since this would disturb the calibration.

Pete Carter gave a wonderful talk on power supplies. This was primarily occasioned by his bringing in a supply he had made out of parts he had picked up on the street. However, he branched out into a discussion of the function of each component in both half-wave and voltage doubler type supplies. As he is an excellent speaker, much was learned from his talk.

Jim Eaddy spoke a few words on the problems of static convergence of Motorola sets.

NORTH JERSEY CELEBRATES FIFTH ANNIVERSARY

NORTH JERSEY CHAPTER'S Frank Lucas led a discussion on horizontal circuits, function of component parts, and troubleshooting.

George Kitchen had a Philco tough dog TV problem, a lot of which was caused by the two mounting boards. Short cuts and suggestions were offered by the members for repairing the set. Transistor radio repairs were also discussed.

The chapter celebrated its fifth anniversary on May 24, the exact date on which it was organized in 1963. Our congratulations to the chapter!

PHILADELPHIA-CAMDEN ATTRACTS TWO MORE

PHILADELPHIA-CAMDEN CHAPTER, through its apparently never-failing attraction for new members, reports two more. They are James M. Bowen, Philadelphia, and William R. Watkinson, Aldan, Pa. A warm welcome to you, gentlemen!

Once again Norman Roton generously contributed his knowledge and experience in conducting another program. He brought with him the necessary instruments to use in servicing color TV receivers and he went through the whole procedure. The members got a good insight on the proper tools to use in color TV servicing and how to use them.

At another meeting Bill Heath, Westinghouse Service Supervisor for the Eastern seaboard, brought with him Chuck Trout, Factory Representative for Westinghouse. In the words of Secretary Jules Cohen, they put on a wonderful meeting on the new Westinghouse TV color receiver. Using slides and one of the new sets as a demonstrator, they went over the features of the set, especially the fine tuning bar that is advertised so extensively. They distributed ball point pens, schematics, pads, three door prizes, and after the meeting served refreshments.

PITTSBURGH'S CHAIRMAN DISCUSSES USES OF SCOPE

PITTSBURGH CHAPTER Chairman Jim Wheeler delivered a fine talk on the many uses of the scope. At the same meeting Secretary George McElwain undertook a discussion of the GE M235 color TV.

The chapter is the owner of a television receiver into which eighteen different defects can be introduced. It, along with the scope which has proved useful, has been employed in various programs on troubleshooting.

SAN ANTONIO MAKES USE OF NEW HOME

SAN ANTONIO ALAMO CHAPTER wants attention brought to this important notice:

Meetings are now held at the Alamo

Heights Christian Church Scout House, 350 Primrose St., 6500 Block of North New Braunfels St. (three blocks north of the Austin Highway).

As a community project, the chapter has undertaken a series of projects to convert surplus electronic equipment to useful items for the Boy Scout Troop of the Alamo Heights Christian Church. This worthwhile project has a double purpose.

Besides benefiting the Boy Scouts, it will also give the chapter members valuable practical experience in all types of circuits, from home entertainment to commercial types of electronic equipment.

VIETNAM VETERAN WELCOMED AS NEW MEMBER

SPRINGFIELD (MASS.) CHAPTER enjoyed a presentation by Norman Charest on horizontal oscillators. He used a 21" television set to demonstrate various troubles that the service technician could eliminate by knowing the proper component to change. Norman used a blackboard with circuit shown and the parts numbered so one could follow his talk very easily.

A new member was introduced, George Bettencourt, an Air Force Sergeant just recently returned from Vietnam. He is a student of the NRI TV-Radio Servicing Course. The members look upon him as a fine addition to the chapter. Let us add our congratulations, George!

At the next meeting John Parks offered a presentation, complete with demonstrations, of waveshapes seen with an oscilloscope. He used an NRI black-and-white TV set for the demonstrations. He was ably assisted by Norman Charest.

Thomas F. Nolan
Executive Secretary
NRI Alumni Association
3939 Wisconsin Avenue, N.W.
Washington, D.C.

1969 NOMINATION BALLOT (Polls Close July 25)

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for '69.

MY CHOICE FOR PRESIDENT IS ______________________

City ______________ State ______________

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. ______________ 3. ______________

City ________ State ________ City ________ State ________

2. ______________ 4. ______________

City ________ State ________ City ________ State ________

Your Signature & Student Number ______________________
Your Address ______________________

DIRECTORY OF ALUMNI 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., VI1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 P. M., 2nd Wednesday of each month at Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: Arthur Clapp, 705 Bradley Ave., Flint, Mich. 234-7923.

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: Robert McHenry, RR2, Kearneysville, W. Va. 25430.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, at Chairman Eugene DeCaussin's Radio-TV Shop, 4912 Fountain Ave., L. A., Calif., NO 4-3455.

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: Samuel Antman, 1669 45th St., Brooklyn, N. Y.

NORTH JERSEY CHAPTER meets 8:00 P. M., last Friday of each month, Players Club, Washington Square (1/2 block west of Washington and Kearney Avenues), Kearney, N. J. Chairman: William Colton, 191 Prospect Avenue, North Arlington, N. J.

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 Wheeler, 1436 Riverview Drive, Verona, Pa.

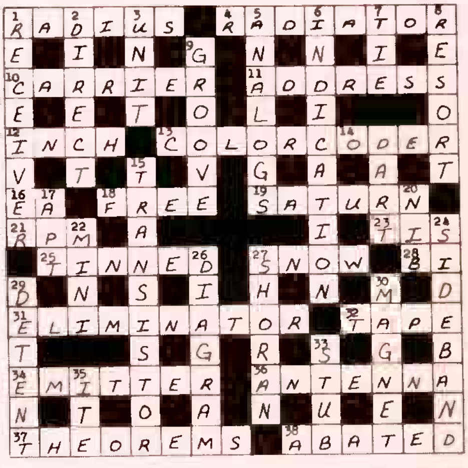
SAN ANTONIO (ALAMO) CHAPTER meets 7:00 P.M., 4th Friday of each month, Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 Block of North New Braunfels St. (3 blocks north of Austin Hwy.) San Antonio. Chairman: Sam Stinebaugh, 318 Early Trail, San Antonio, Texas.

SAN FRANCISCO CHAPTER meets 8:00 P. M., 2nd Wednesday of each month, at the home of J. Arthur Ragsdale, 1526 27th Ave., San Francisco. Chairman: Isaiah Randolph, 523 Ivy St., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month at home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Walter Adamiec, 109 Taunton St., Middleboro, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P. M., last Saturday of each month at shop of Norman Charest, 74 Redfern Dr., Springfield, Mass. Chairman: Br. Bernard Frey, 254 Bridge, St., Springfield, Mass.

SOLUTION TO PUZZLE



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