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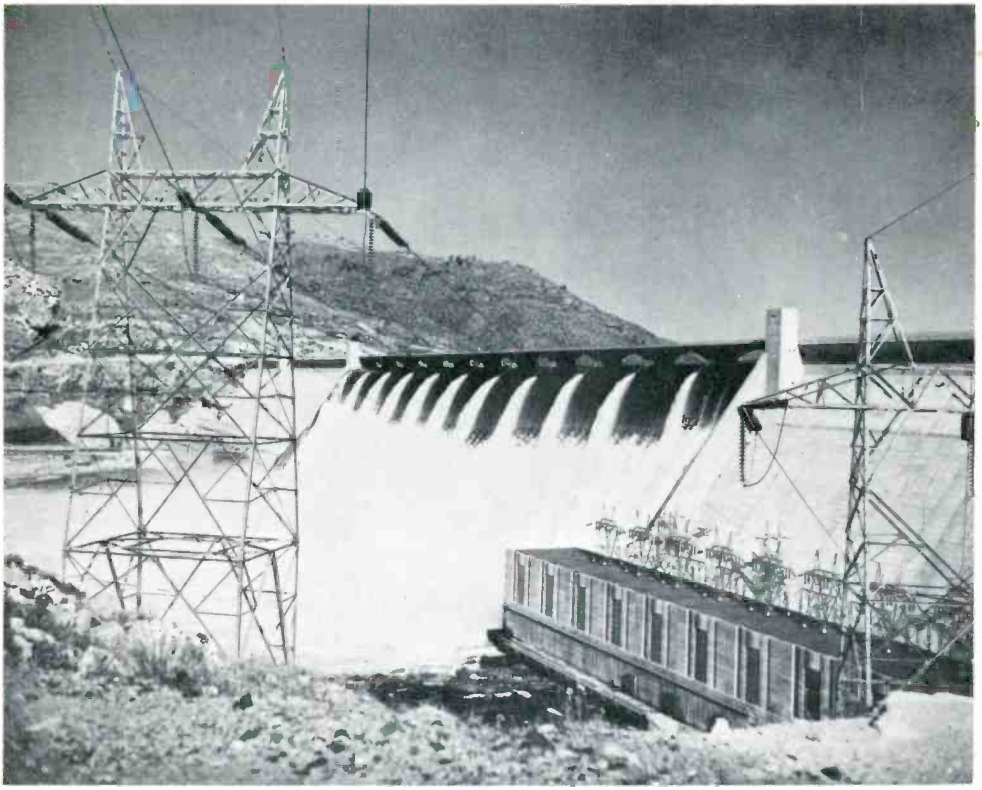

- DON'T LET COLOR PASS YOU BY
- THE CONAR MODEL 280 SIGNAL GENERATOR
- THE 'HAMS' AND THE OSCARS

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FEATURES

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ON OUR COVER

The Grand Coulee Dam, shown on our cover, is a major facility in a power network along the Columbia River Basin to be linked with a microwave communications system. Due for completion shortly, the system will provide facilities for voice and data communications, supervision and automatic control, and include 26 microwave relay stations extending between Portland, Ore., and Spokane, Wash. It will provide 72 communications channels initially, with an ultimate capacity of 600 channels. Lenkurt Electric Co., Inc., a subsidiary of General Telephone and Electronics Corp., is engineering and installing the microwave system under a $1.7 million contract for the U. S. Department of the Interior. Other substantial contracts awarded recently (a list is on Page 19 of this issue) mean new jobs in the burgeoning electronics field. We will continue to publish such lists from time to time.

DON'T LET COLOR PASS YOU BY

It's A Wise Serviceman Who Casts His Vote To Study Up On It

BY WILLIAM F. DUNN

In the late nineteen forties and early fifties, when black and white TV was still an infant, many radio servicemen who had been in business for years were reluctant to get into TV servicing. Some were afraid to tackle a TV set; others didn't want to make the effort to learn about TV. Those who decided not to go into TV servicing thought there would always be enough radio service work to keep them busy. There are very few shops today that do only radio work. In most radio-TV repair shops, the income from TV servicing far exceeds the income from radio servicing. Today the serviceman has a similar situation facing him. For years we've been hearing the statement that color TV is just around the corner. We've turned the corner; color TV is here. Whether you are in servicing on a full-time or a part-time basis, you can be sure you'll be called on to service a color TV soon, if you haven't been already. Once you tell a customer you don't do color servicing, or you can't service a color set, the chances are you've lost that customer forever. It's likely that when his black and white receiver or his radio needs servicing, he'll take it to the man who fixed his color set.

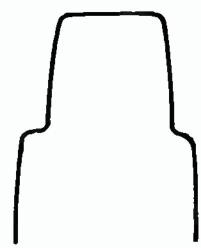
There is no reason why any technician who can service a monochrome TV receiver cannot, with a little study on his part, learn how to service a color set. If you are a student working on your NRI Course, you learn all you need to know about color TV servicing when you study the TV lessons in your course. If you are a graduate, perhaps you skipped over the color TV in your TV lessons; if you did, now is a good time to review to get ready for color TV.

THE COLOR SIGNAL

We won't go into detail about the color signal because it is described in detail in your lessons. However, briefly, the color signal contains the same signals present in a black and white picture transmission plus the color signal. The color information is transmitted on a subcarrier which has a frequency of 3.58 mc (approx.). This subcarrier modulates the picture carrier so it is transmitted in the TV channel at a frequency which will be 3.58 mc above the video carrier frequency and approximately .92 mc below the sound carrier frequency.

The 3.58 mc color subcarrier is both phase and amplitude modulated. The phase modulation determines the color, for example red, green, or blue and the amplitude determines the saturation, for example whether the color is a deep color or a pastel color.

In transmitting the color signal, only the sidebands are transmitted. The 3.58 mc subcarrier is suppressed. Thus the actual color signal that is transmitted will be the sidebands that vary in amplitude and are displaced in phase from the reference color subcarrier. To detect the difference in phase between the sidebands and the color subcarrier, the TV receiver must have some means of deter-



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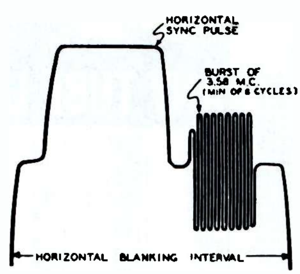


B

FIG. 1. A is the sync pulse transmitted for a black and white picture; B the sync pulse for color.

mining what the phase of the subcarrier is. To do this some reference signal is necessary. The reference signal is transmitted on the rear porch of the horizontal sync pulse. The sync pulse transmitted for a black and white transmission is shown in Fig. 1A. The horizontal sync pulse transmitted for color is shown in Fig. 1B. Notice on the rear porch of the signal there is a sine wave consisting of 8 cycles. This sine wave is called the color burst--it is used to transmit to the receiver information on the phase of the 3.58 mc color subcarrier so the receiver can determine any phase difference between the sideband it receives and the color subcarrier.

The color signal and the 8 cycle reference burst are the main differences between a color transmission and a black and white transmission. The video signal transmitted on a color broadcast is the same as the video signal transmitted in a black and white transmission. This is why a black and white TV receiver receives a black and white picture during a color broadcast. Both horizontal and vertical sync pulses are transmitted both during color transmissions and black and white programs. While the frequency of the pulses is slightly different for color broadcasts, this is of no importance either in understanding color or in the operation of the receiver. The sound transmission is the same in both color and monochrome.

THE COLOR RECEIVER

Basically a color TV receiver is a black and white TV receiver with some extra stages added to it. In fact, some of the late model color TV receivers have fewer tubes in them than some of the early model monochrome receivers.

Fig. 2 is a block diagram of a color TV receiver. The shaded stages are the stages which will also be found in a black and white TV receiver. As you can see, many of the stages found in a color set are also found in a black and white set. The defects encountered in these stages are the same as those found in monochrome receivers and for the most part their symptoms are the same. From a quick look at the block diagram you can see that if you can service a monochrome receiver you can service at least half of the stages in a color receiver.

Now let's briefly go through the stages that are found both in color receivers and monochrome receivers to point out differences between the stages, and later we will discuss briefly the stages found only in color receivers.

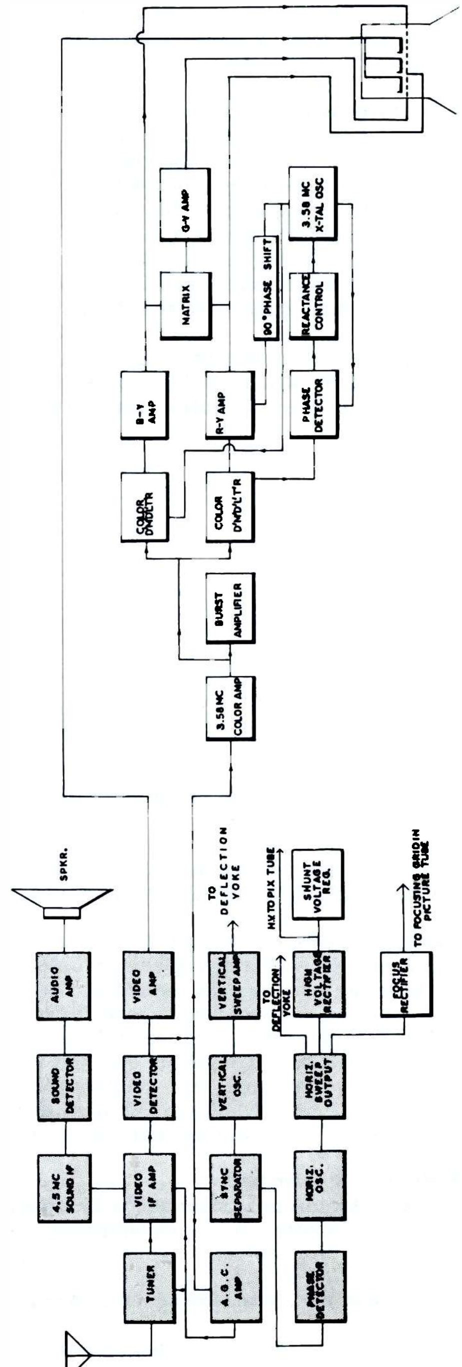


FIG. 2. Simplified block diagram of a color receiver.

The Tuner

The tuners used in color sets are identical to the tuners used in monochrome receivers. In fact many a manufacturer will use the same tuner in all the models he is currently manufacturing.

The Video Amplifier

The video i-f in a color receiver will usually have one more stage than the video i-f in a black and white receiver. In addition it is aligned to give a somewhat wider bandwidth. In a color receiver that has a 45.75 mc picture i-f and a 41.25 mc sound i-f the color subcarrier i-f will be 42.17 mc. To get color, the i-f pass band must pass this frequency.

The response curve of a typical video i-f in a color receiver will look like the response curve shown in Fig. 3. Notice that both the

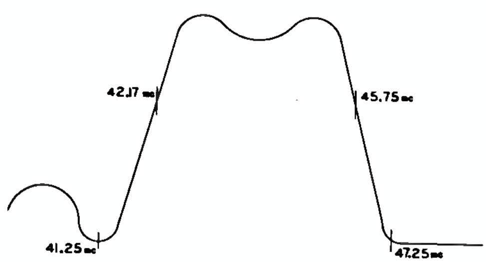


FIG. 3. Response curve of a typical video i-f in a color receiver.

45.75 mc picture i-f and the 42.17 mc color i-f are about midway up on the response curve.

The alignment of the video i-f in a color receiver does not present any special problem. If you have the instruments needed and know how to align a monochrome receiver you should be able to align a color set. Of course, you never align any TV set unless you are sure it needs alignment, nor should you try to align a TV if you do not have the alignment instructions and the required test equipment.

The Video Detector

The video detector in a color set is identical to the video detector in a monochrome receiver.

The Sound I-F, Detector and Amplifier

These stages are identical in both color and black and white. However, the 4.5 mc sound is usually taken off the last video i-f stage of a color receiver rather than at the video detector output as in a monochrome receiver. This is done to prevent the 4.5 mc sound from beating with the 3.58 mc color signal and producing a 920 kc signal which would put an interference pattern on the face of the picture tube.

The Video I-F Amplifier

The video amplifier in a color receiver is the same as the one in a black and white set with the exception of a delay line which is used in color receivers. This is used to delay the signal going directly through the video amplifier to the picture tube so it will arrive at the tube at the same time as the color signal going through the various color stages. A delay line is simply a combination of inductance and capacity that delays the signal for a fraction of a microsecond.

The Sync Separator

The sync separator stages in both types of sets are identical. They both perform the same function. At first glance at a color set you might think a more elaborate stage is used, but just as elaborate sync separators are often found in the more expensive black and white sets.

The AGC Stage

Most color sets use some form of keyed agc similar to that used in the better monochrome receivers. This stage, however, can be omitted from both types and a manual gain control substituted.

The Vertical Sweep

The vertical oscillator in a color set is usually the same as that found in monochrome receivers. The output stage is basically the same, however, provisions are made for convergence signals. We'll see why they are needed later.

Horizontal Sweep

The horizontal oscillator and oscillator control stages are identical in both types. Their purpose and operation are the same. The sweep output tube is a huskier tube in the color set because a much higher high voltage is required to operate the picture tube. Other than the huskier tube there is not much difference between the two types of sets.

In the horizontal circuit of a color set there are also convergence signals. We'll discuss these signals later.

High Voltage Supply

The high voltage for the color tube is obtained from a flyback type of supply as in a monochrome receiver. However, the high voltage in a color set is considerably higher than a black and white set--usually it is about 24,000 volts.

The high voltage in a color set is regulated by means of a shunt regulator that is not found in monochrome receivers. The purpose of the regulator is simply to keep the high voltage at a constant value so that the picture tube can be adjusted to give perfect color registration.

Also in the power supply of a color set you'll find a focus rectifier. The modern three-gun color tube uses electrostatic focusing. The voltage required to focus the tube is several thousand volts and this can best be obtained from a separate focus rectifier. It works just like the high-voltage rectifier in a monochrome receiver.

COLOR CIRCUITS

Up to this point we have primarily been pointing out the similarities and small differences in sections and stages of color and black and white sets that are similar in both sets. Now let's briefly look at some of the circuits found only in color sets. Remember detailed information on how they work can be found in your regular lessons. Here we are going to discuss them briefly and give a few examples of what happens when a defect develops in these stages.

Color Amplifier . . . .
The color amplifier is similar to an i-f amplifier tuned to 3.58 mc and having a band pass of from about 700 kc to 1.5 mc. The maximum bandwidth used to transmit color information is 1.5 mc. However, some receivers do not take advantage of all the higher frequency color information, therefore the amplifier bandwidth may be some what less than 1.5 mc.

If a defect develops in this stage that prevents the color signal from getting through, you'll get a black and white picture, but no color.

Burst Amplifier . . . .
The burst amplifier does just what the name implies--it amplifies the color burst on the rear pedestal of the horizontal sync pulse. This stage is biased beyond cut-off. A pulse from the horizontal sweep keys or turns the stage on by overcoming the bias. The color burst arrives at the stage when the bias is overcome so it is amplified by the stage.

If the burst amplifier fails to amplify the color burst, the set will give you a black and white picture, but no color. Also, if the horizontal oscillator in the TV set is incorrectly adjusted, the pulse used to key on the burst amplifier will not arrive at the stage at the same time as the color burst; the burst will not be amplified and again you'll be unable to get any color.

Defects in both the color amplifier and burst amplifier stages are easily isolated using a color bar generator and an oscilloscope.

The 3.58 mc Oscillator . . . . . .
The 3.58 mc oscillator is a crystal oscillator. A crystal is used to keep the oscillator frequency as close as possible to exactly the same value as the original 3.58 mc color subcarrier. The color subcarrier is needed for insertion into a color detector stage. You'll remember that the color subcarrier itself is not transmitted--only the color sidebands. To detect the color information, we must reinsert the subcarrier.

If the 3.58 mc oscillator fails to oscillate, you'll be able to get a black and white picture on the TV receiver, but no color. You can easily check to see if the oscillator is operating with an oscilloscope.

Phase Detector . . . .
This stage compares the frequency and phase of the color burst signal and the crystal oscillator. If the frequencies and phases are identical the output from the stage will be zero. If the frequency or phase of the oscillator signal differs from those of the color burst, the phase detector will develop a signal that is used to correct the oscillator frequency and/or phase.

Reactance Stage . . . .
The reactance or crystal control stage is used to keep the crystal oscillator operating at the correct frequency and phase. The tube varies the reactance in the oscillator stage and thus can make small corrections for any slight error in frequency and phase of the crystal oscillator. The signal which controls this stage comes from the phase detector.

A defect in either the phase detector or reactance stages will permit the crystal oscillator to drift from the exact required frequency. This will cause the colors in the picture to drift from one color to another. We call this loss of color sync. In some cases the drift is slow, while in others it occurs quite rapidly. Defects in these stages can usually be located with an oscilloscope and a vtvm.

Color Demodulator . . . .
There are two color demodulators in color receivers using the tri-color tube. Two color signals 90° out of phase are transmitted on the color sub-carrier. These two signals are recovered by means of the two color demodulators. In one demodulator the color signal is mixed with a signal taken directly from the 3.58 mc crystal oscillator and in the other demodulator the color signal is

mixed with a signal from the oscillator which has been shifted 90°.

If neither color demodulator is working you'll get a black and white picture, but no color. If only one is working, you'll get some color in the picture, but not all the colors. If the flesh tones (red-orange) are missing, the demodulator which takes the signal directly from the crystal oscillator is at fault, whereas if the blues are missing the other detector is at fault. The detector can easily be checked with an oscilloscope.

Matrix . . . .
The color information is primarily transmitted in the color signal. When the information from the color demodulators is mixed in the correct proportions with the black and white signal (usually called the Y signal), three separate color signals can be produced. This mixing is accomplished in the Matrix, which consists of a number of resistance networks. A defect in a matrix will result in some loss of one color. Such defects are quite rare and can usually be found with an ohmmeter. However, sometimes it is quicker to use a color bar generator and an oscilloscope to first isolate the defect to a small part of the matrix.

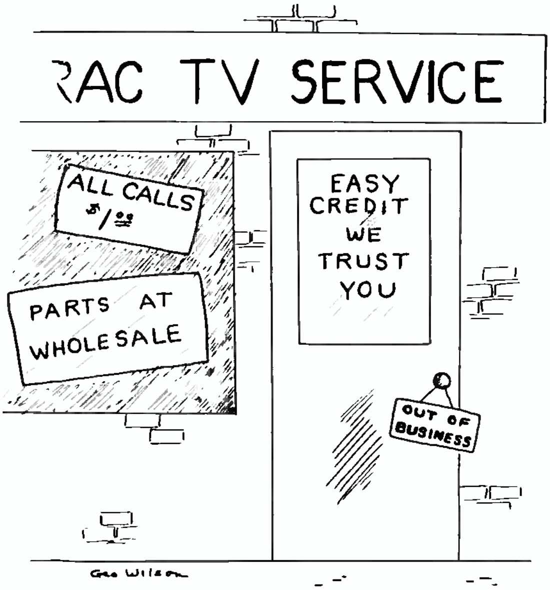
I, Q, X, Z, (R-Y), G-Y) Amplifiers . . . .
These are all names given to amplifiers used to amplify the color signals between the color demodulators and the picture tube. When used with the correct matrix they produce the required color signals to drive the color guns in the picture tube. They are almost identical to wide-band audio amplifiers and should present no servicing problem. A defect in one amplifier will affect the color gun driven by that amplifier.

The Tri-Color Tube . . . .
The tri-color picture tubes in current use are three gun tubes. Color phosphors are arranged in triangles of red, green, and blue dots. A plate (called a shadow mask) with one hole in it for each triangle of three colors is placed near the screen. Three separate guns, one for each color, are arranged in a triangle in the neck of the tube. The electron beams from the three guns pass through the holes in the shadow mask at slightly different angles. The phosphor dots are arranged so they will be struck by the electrons from only one gun. Thus the electrons from one gun strike the red phosphor dots, the electrons from another gun the green phosphor dots, and the electron from the third gun the blue phosphor dots.

When you set up a tri-color tube you make all the adjustments made on a black and white tube such as height, width, linearity, positioning, etc. In addition you have an adjustment called purity. This simply assures that the electrons from the red gun strike only the red phosphor dots, the green gun the green dots, and the blue gun the blue dots. Purity adjustments are usually not too difficult to make correctly.

There are far more difficult and time-consuming adjustments. These are the convergence adjustments. The purpose of these adjustments is to converge the three beams so that at any given instant they are going through the same hole in the shadow mask. Incorrect convergence adjustments will result in one or more colors being displaced so that parts of the picture will be fringed in the displaced color. TV set manufacturers give complete information on these adjustments, how to make them, and the order in which they must be made. It is almost a hopeless task to try to converge the beams in a color tube without these instructions.

This article is not intended to teach you color TV servicing, but only to arouse your interest in color and to show you that many of the defects you will run into will be the same defects you'll find in monochrome receivers. Defects in the color circuits are usually not too difficult to find. A color TV is more difficult to service than a monochrome receiver only because it's bigger and has more parts in it -- the circuits in the set are not much different from those found in black and white TV.



DEVICE OF THE MONTH

FIXED CAPACITORS

R. C. APPERSON, JR.

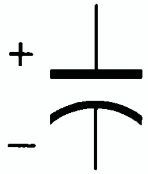
Fixed capacitors....simple subject, isn't it? Two metallic layers separated by a dielectric, used in circuits as bypasses and coupling devices; found as filters and in de-coupling networks, and used to tune resonant circuits.

Right. These are the jobs taken care of by capacitors, but do you know which type of capacitor to use in each instance? This is a point that a lot of technicians overlook. If a bypass of .005 mf is needed, a .005 μf capacitor of adequate working voltage is sought and placed in the circuit. In some cases, it makes no difference, but in other cases damage is done.

We will attempt to point out the various types of fixed capacitors and how they should be used. By proper use, time on the bench is saved. This is the mark of a good technician.

The most familiar types of fixed capacitors are electrolytic, ceramic, mica, and paper. These are categorized by the dielectric material used, each having certain characteristics applicable to special circuit considerations. After examination of each type, we'll then touch on the newer capacitors made available since the advent of the transistor and microminiaturization.

Let's examine the electrolytic capacitor first. It will be recognized schematically as this



and will always have one side designated as the positive and one as the negative lead. It is polarized and this dictates the applications in which it may be used. The dielectric is the product of an electro-chemical process and forms between the plates of the capacitor when a voltage is applied. This voltage is known as the forming voltage.

A word to the wise here could save grief later. Never connect a shelf-stored electrolytic into a circuit and apply full voltage. If the capacitor has been sitting for any length of time, the dielectric will have "gone back" into the metal and the capacitor appears as a short circuit—no better than the one which it replaced! Always apply a gradually increasing, forming voltage from a variable power supply to an electrolytic that has been stored. Although new from the wholesaler, it may have been on his shelf for some time. Don't take the chance.

HAS LARGE CAPACITY

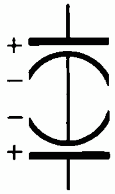
We all know one very important application of the electrolytic. It is the filtering device in most power supplies. The reason it is so popular is that a large capacity can be obtained in a relatively small package. If a low working voltage rating is required, the package for a large capacity, say 100 μf, will be not much bigger than a paper capacitor of 1 μf at 400 WVDC.

Therefore, we find electrolytic capacitors bypassing cathode resistors in vacuum tube amplifiers when low frequency response is a criteria. Here, again, we must note that the positive side of the capacitor connects to the side of the resistor which is tied to the cathode of the tube. Since current flows and voltage is dropped, the cathode will be positive with respect to ground.

USE AS SCREEN BYPASS

Electrolytics are also used as screen bypasses in certain wide band applications, so don't think that an error has been made when you find one in, say, a vertical amplifier of an oscilloscope. Again low frequency response is the deciding factor.

AC circuits are one place that electrolytics should never be used - as was stated earlier, they are polarized and cannot stand reverse voltage. A trick to keep in mind, though, for certain applications such as low frequency tuned circuits is a back-to-back arrangement, like this



which allows you to get big capacity, non-polarized. This should only be used in signal type circuitry, not where large voltages are present.

One important point to keep in mind when considering the mica capacitor for use in circuitry is its inherent low inductance. This makes mica one of the choices for interstage coupling in high frequency applications. This type of capacitor is also used to bypass screen grids. It may be used to tune resonant circuits, and is used in interference filters for both radio and television frequency interference (RFI and TVI). It is a good policy, in repair work, to replace a mica with another mica. The engineer probably had a reason for his selection.

Ceramic capacitors, both disc and tubular, also have low inductance characteristics, so ceramic and mica are used interchangeably in many places. High breakdown voltage ratings are available with ceramic capacitors, so consider this when replacing one. It is smarter to replace a mica with a ceramic than vice versa, unless peak circuit voltages are known.

Small packages with reasonably high working voltage ratings and capacities up to 1. µf are available in ceramic for transistor applications. one drawback is the tolerance allowed on most of these. They are +80/-20 per cent, and if used in a circuit such as an oscillator or one using feedback, the operation of the circuit can be hampered. Pulse circuits, where high frequencies are involved, are one definite problem area when capacitor replacement (using one of these ceramics) is involved.

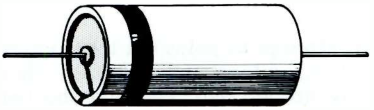
Trial and error is the best bet here. Don't be alarmed if you suspect a capacitor is bad and the replacement doesn't do what you think it should. Remember +80/-20 per cent is a 100 per cent capacity spread, so the stamped value need not be near what the actual capacity is.

Paper capacitors are found extensively where price is a deciding factor. There are good paper capacitors and some that are cheaper and not so good. Low frequency applications, where a larger capacitor is needed, press papers into service. If there is a malfunction in a circuit where one is used, experience has taught me to check the capacitor for possible leakage, especially on equipment that is a few years old. One oscilloscope, five years old, required changing every paper in it—since then, I suspect them!

As we said before, good paper capacitors are available and should be used whenever replacing a defective paper capacitor. They are molded plastic and do not spew wax and oil all over everything if they do malfunction. The few pennies' difference in price will pay off with longer and more dependable service.

Paper capacitors serve more purposes in common circuitry than any of the other types. They are used for coupling, decoupling, bypassing, and tuning low frequency circuits. Most buffer capacitors in vibrator supply automobile radios use paper.

A tubular paper capacitor has a marking on the case like this



and is marked in most instances "outside foil." This lead should be connected to the side of the circuit which is nearest ground potential. The capacitor is not polarized and cannot be damaged by ignoring this rule, but electrostatic and electromagnetic coupling will be minimized, saving much hum headache.

STABILITY'S A MUST

There are certain times when stability is a must and expense is entirely secondary. In these cases there are capacitors available, at a higher cost, that provide very good temperature stability. The glass dielectric capacitor is one and will be found in precision circuitry or military gear which has very stringent specifications to work by. They are close tolerance capacitors. Take a close look at the circuit and its function before replacing a glass with anything except a glass. The equipment in which they are used is expensive, so cost of the capacitor for replacement should not sway your decision.

Now for the very special type of temperature stabilized capacitor which will be found in most communications equipment with controlled frequency. It is the NPO capacitor.

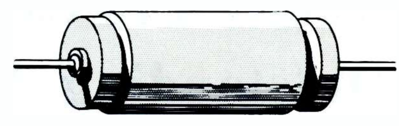
This type has an absolute zero temperature coefficient, and capacity stays constant over an extreme range of temperature. This is achieved by using two different types of dielectric, one having a negative coefficient, and one with a positive coefficient. The coefficients are equal in magnitude but opposite in sign, so that the sum coefficient is zero at all times. From this we derive the NPO (negative-positive-zero). If frequency drift is the problem, check first to see if NPO capacitors are used in the frequency affecting circuits. If not, use them. If they are, this is a sign that one of them has gone bad and needs another NPO in its place.

Another capacitor that is being used extensively today, especially in transistor applications, is the Tantalum type. By electrochemical means, a thin Tantalum oxide film is formed which has a higher dielectric constant, than any other material known today.

The Tantalum capacitor gives large capacity in a small space. This is essential in transistor applications. Since the resistive values are small in the circuits, capacity must be high to obtain proper rc constants. Then, with transistor applications being inherently compact, we need big capacity in a small area.

One thing to note is that these capacitors are usually polarized, as are electrolytics, and cannot stand back-voltage. In fact, they should have a dc component that exceeds the ac signal component at all times to avoid back-voltage. If you get one in backwards, it will let you know it because IT WILL BLOW UP.

The capacitors are available in non-polarized configurations also and can be spotted by

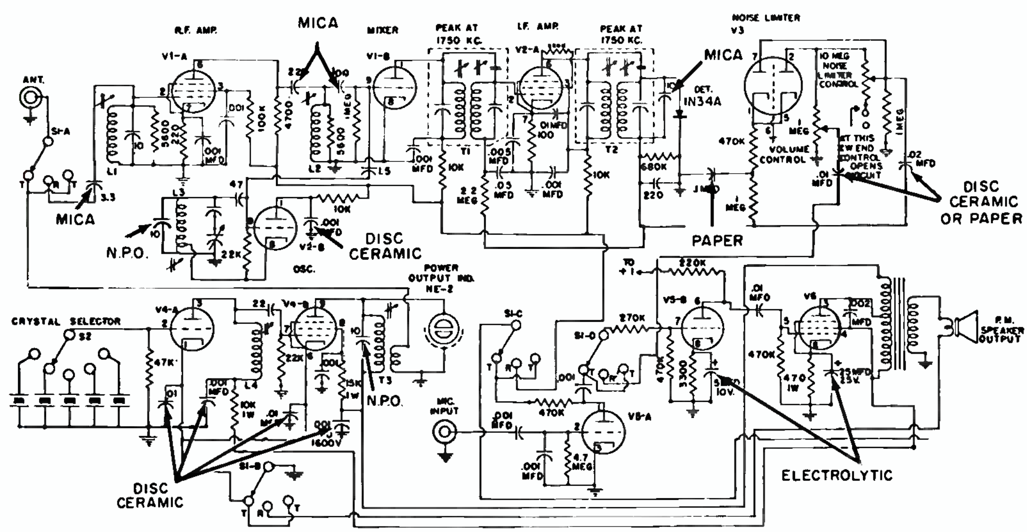


crimps on either end of their metal case. The polarized ones will have only one crimp and will be marked clearly with a + sign.

Since the discussion has been along application lines and we have talked about many different types of capacitors, I have taken a schematic of a unit in which most of the capacitors discussed are used and noted on the diagram which type of capacitor should be used in each application.

After looking it over, take a piece of equipment, be it TV or radio or even a test apparatus, and look at the actual components. Now take its schematic and figure why the engineer selected the capacitor he did to do his job.

We didn't cover all of the whys and wherefores of capacitors, but I do hope I have alerted you to the fact that there can be a difference in a .05 µf 500 WVDC capacitor, be it disc, ceramic, and/or inexpensive paper.



Courtesy RCA

Typical 27MC Transceiver showing use of various types of fixed capacitors.

The CONAR 280 Signal Generator

Precise Pre-Calibration Makes This Outstanding As A Kit Instrument

BY J. B. STRAUGHN

The handsome CONAR 280 Signal Generator is shown in Fig. 1. It is a fitting companion for the CONAR 230 Signal Tracer, and these instruments can be used separately or supplement each other.

The Model 280 is available in kit form or at a slight increase in cost can be obtained built and tested by the CONAR assembly section. Most service men hesitate to purchase a signal generator in kit form because either the signal generator has no means of being aligned for proper calibration or they do not have the frequency standards required for precision alignment.

Neither of these factors applies to the CONAR 280. The rf coils (except the highest band) have adjustable slugs and each coil is

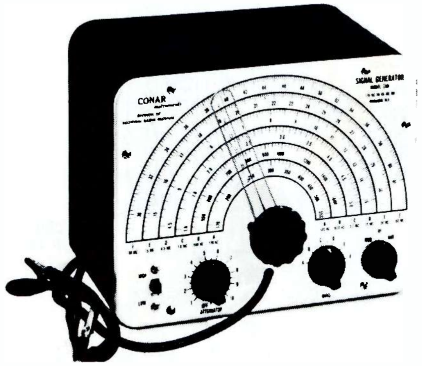


FIG. 1. The Conar Model 280 Signal Generator.

equipped with a trimmer. The coils and trimmers in each kit are adjusted precisely in the CONAR laboratories, using special jigs. Because the leads for all coils and trimmers are short and direct the distributed capacities do not vary from instrument to instrument and when assembled the accuracy is excellent, being in the neighborhood of 2%. This is better than the accuracy of many service type signal generators and is quite satisfactory for all types of service applications. The accuracy can be improved to about 1% by adjusting against known station signals, picked up on a communications receiver or with special standards, as is done in CONAR assembled instruments. The 280 manual contains full instructions for those who wish to check or recalibrate their Signal Generator. However, the improvement is a minor matter and, because calibration is excellent to start with, does not materially increase the worth of the instrument as a service tool.

Before going into the uses of the Model 280, let's take a quick look at its operation. A simplified circuit is in Fig. 2. Only a single rf coil is shown and the rf band switch has been omitted. This switch changes the connections to the coils and, on the last two bands, switches out variable tuning capacitor C2 and substitutes a smaller variable capacitor.

The Model 280 consists of a variable rf oscillator built around tube V1 and a fixed 400 cycle sine wave oscillator built around the right-hand section of V2 (pins 6, 7, and 8). All output signals are fed to the left-hand section of V2 and are taken from its cathode. The power supply is the conventional half-wave type using a selenium rectifier.

Tube V1 operates as a standard Hartley oscillator. The screen grid (pin 6) acts as the virtual plate and is kept at rf ground potential by capacitor C14. When tube V1 heats up, the cathode current flows from B- through the tap on the tuning coil and, in doing so, shock-excites the resonant circuit consisting of L1, C1 and C2. The resulting signal is applied through C3 to oscillator grid pin 1. A further change in cathode current, at the frequency of the resonant circuit, takes place and oscillation is maintained. Oscillator bias is developed across R1.

The plate current flows through the mixer grid (pin 7), the screen grid, and to the plate.

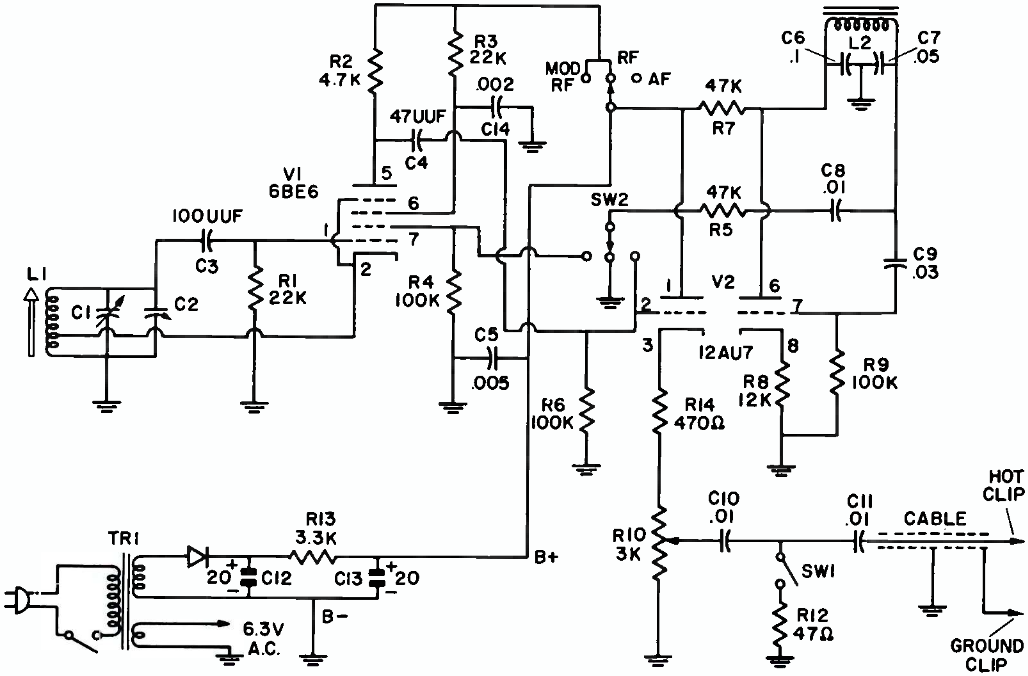


FIG. 2. Simplified diagram of the CONAR Model 280 circuit.

An rf signal is developed across plate load R2 and is fed through C4 to the grid (pin 2) of cathode follower V2.

The rf signal is developed across R10, which serves as the Fine Attenuator Control. By adjusting R10, any amount of the available signal across R10 is fed through C10 and C11 to the output cable and arrives at the hot and ground clips for any use desired. This is a pure unmodulated rf signal.

The 400 cycle signal is produced in the Colpitts oscillator circuit consisting of the right-hand triode of V2, choke L2, capacitors C6, C7, C9 resistors R7, R9, and R8. C8 and R5 are used to couple the audio signal from the oscillator circuit. In the position shown for SW2, R5 is grounded and there is no audio output.

In the af position, the upper section of SW2 removes plate and screen voltage from V1, killing the rf oscillator. The lower section connects R5 to the grid of the cathode follower and the audio signal appears at the output of the cable.

When SW2 is in the MOD rf (modulated) position R5 feeds the 400 cycle signal to pin 7, the mixer grid of V1. The rf and 400 cycle signals are mixed in the tube and the modulated rf signal is fed through C4 to the cathode follower.

This explains everything about the operation of the Model 280 except switch SW1. This is the coarse attenuator switch, and when closed connects a 47-ohm resistor from the junction of C10 and C11 to the chassis. This action causes a great reduction in the signal at the output of the cable. The signal is still controllable by adjusting R10. Note particularly the presence of C11 in the circuit. This is a high voltage capacitor and makes is possible to connect the hot probe to the plate of a tube in a receiver without danger of damaging the set or signal generator.

CONTROLS

You are already familiar with the Function Control which enables you to obtain unmodulated rf, modulated rf and af signals, and with the Fine and Coarse attenuator controls which govern the signal level at the output of the cable. The On-Off switch is ganged with the Fine Attenuator Control. The tuning control moves the pointer across the dial and adjusts the frequency of the signal generator over the band in use.

The band switch selects one of six sets of coils and trimmers, thus permitting a wide range of available frequencies. The bands cover the following frequencies:

Band A	170 kc - 550 kc
Band B	550 kc - 1600 kc (1.6 mc)
Band C	1.6 mc - 5 mc
Band D	4.5 mc - 15 mc
Band E	15 mc - 30 mc
Band F	30 mc - 60 mc

USES OF THE 280 SIGNAL GENERATOR

The most important questions to the prospective owner of a Signal Generator are "What do you use it for, and how do you hook it up to the receiver?"

The Signal Generator produces a signal which can be used to align the rf circuits in a receiver to their correct frequency. It can also be used to inject signals into the receiver at various points to verify the operation or non-operation of the receiver stages between the point of signal injection and the output of the receiver. In other words, in addition to receiver alignment it is used to localize trouble to a section and to a stage of a receiver.

The presence of output blocking capacitor C11 in Fig. 1 means that even if you make a mistake in connecting the signal generator you will harm neither it or the receiver.

Just how to connect the Signal Generator to a set depends on the injection point you have chosen. The manual for the Model 280 contains detailed instructions for alignment procedures, so we will only touch on them briefly here.

When aligning a receiver you need something other than your ears to check changes in output level which, on an AM set, should increase as the receiver comes into alignment. A VTVM is generally used as an output indicator although, if the set is an old one equipped with a tuning eye, you can make the adjustments for maximum closure of the eye. The output indicator may be a VTVM such as the NRI Model 2W or the later CONAR 211 (See Fig. 3). This may be used as a dc voltmeter and connected across the diode load resistor to measure AVC voltage (see Fig. 4),

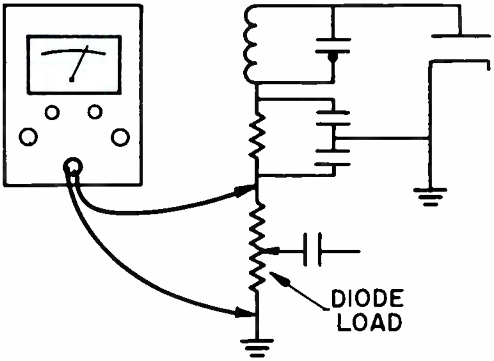


FIG. 4. Here the DC VTVM is connected across the volume control to observe the effect of the RF signal level at the detector output.

or as an AC voltmeter it may be connected from the plate of an output tube to ground or in push-pull transistorized outputs across the primary connections of the output transformer, as shown in Figs. 5 and 6. A less desirable connection, because less signal is available, is across the voice coil of the loudspeaker. When using the AC meter for output measurements a modulated signal is always required because you are observing the demodulated signal in the audio section of the receiver.

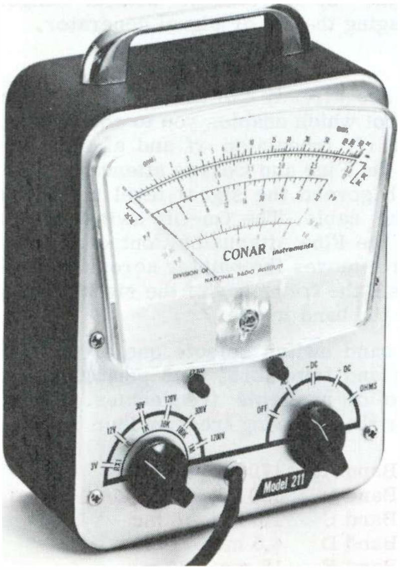


FIG. 3. The CONAR Model 211 VTVM.

A typical schematic diagram of an AC-DC broadcast receiver is shown in Fig. 7 and we will use it in our discussion of alignment and trouble shooting.

In this set we have two i-f transformers, T1 and T2, tuned by trimmers C5, C6, C8, and C9. Also, we have trimmers in parallel with the oscillator and rf tuning capacitors marked C1 and C2. These trimmers are not shown in the schematic. The first step is to align the i-f amplifier at its assigned frequency of 455 kc.

This calls for a decision whether to use a modulated or unmodulated signal. If the receiver is not extremely weak you can use an unmodulated signal. As a result, no sound will be produced by the receiver loudspeaker during alignment. This is appreciated by nearby workers. In such a case the output meter connection shown in Fig. 4 must be used. If the set is quite weak a modulated signal and full gain of the receiver af ampli-

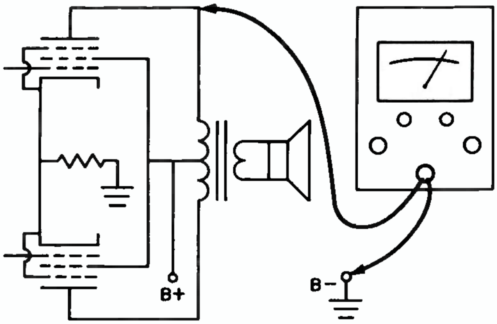


FIG. 5. The VTVM as an AC voltmeter may be connected from either plate to chassis. The sound from the loudspeaker can be kept fairly low with the attenuators.

fier may be required to give a discernible output. In this case, use the connections in Fig. 5. The sound from the loudspeaker can be kept fairly low with the Signal Generator attenuators, as a very large signal should exist at the primary of the output transformer even without excessive volume.

How to connect the Signal Generator to the receiver is somewhat a matter of preference

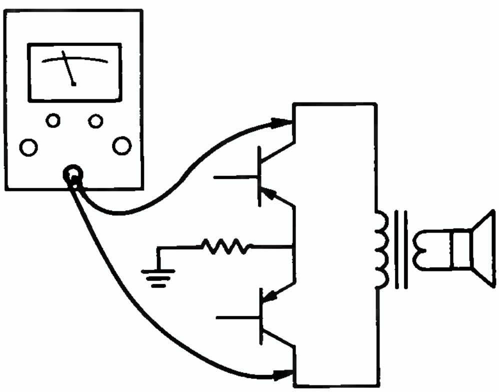


FIG. 6. The VTVM set for AC measurements may be connected to the collector leads of output transistors, or you can get by with a smaller signal from either collector lead to chassis.

and is also governed by the condition of the set. The object, of course, is to inject a 455 kc signal into the circuits to be aligned. In the case where the set is almost dead it might be best to clip the hot lead to pin 1 of tube V2 and clip the ground lead on B-. Tune the Signal Generator to 455 kc, found on Band A, and set the attenuators to give a reasonable output.

Stop the local oscillator by holding your finger on the rotor and stator of the oscillator tuning capacitor. This prevents undesired beat signals between the local oscillator and Signal Generator from being produced. The practice of killing the oscillator by slipping a small screwdriver blade of the set screw type between the plates is to be condemned because of the danger of bending the plates. A clip lead across the oscillator tuning capacitor is OK, but your finger will work fine. Now adjust C8 and C9 in any order for maximum output. Cut back on the Signal Generator attenuator settings as the output level increases.

You can now connect the Signal Generator to the receiver antenna and ground leads and, while still holding your finger on the local oscillator rotor and stator plates, adjust C5 and C6 for maximum output. Now go back over all four trimmers again (any order) to see if any improvement can be obtained. If you cannot get sufficient signal, tune the receiver to the low end of its dial and then the loop and its tuning capacitor, C1, will offer less rejection to the i-f signal from the generator. This completes the i-f alignment.

The case just described is extreme, where the trimmers had been badly misadjusted. Where volume is adequate you can make your original connection to the antenna and ground leads and adjust all four trimmers (any order) for maximum output. Again kill the local oscillator.

KILLS THE OSCILLATOR

Another method is to clip the Signal Generator hot lead to the stator of the local oscillator and the ground clip to the oscillator frame. This kills the local oscillator and also injects the signal (455 kc) into the circuit - again adjust all four trimmers.

The remaining adjustments are the oscillator and rf trimmers. Tune the receiver to the highest frequency shown on its dial and set the Signal Generator to produce the same frequency. Attach the Signal Generator leads to the antenna and ground terminals. Adjust the receiver oscillator trimmer to bring in the signal and then adjust the receiver rf trimmer for maximum output. This completes the alignment.

In some sets, particularly those using a loop-stick type of antenna, no ground and aerial connections are provided. A simple method of signal injection is to clip the hot and ground leads of the signal generator together. The resulting short causes a large rf current to flow in the cable and ground lead. The loop so formed can be placed over one end of the loopstick antenna. See Fig. 8.

This injection system can be used for i-f, rf, and oscillator adjustments.

ROCKING PROCEDURE

In many transistor sets an extra oscillator adjustment is provided for better tracking between the oscillator and rf sections. The adjustment is generally a variable slug in the oscillator coil, whereas in some very old tube receivers this adjustment was a variable padder (trimmer in series with the oscillator tuning capacitor and the oscillator coil). In both cases the adjustment procedures are identical.

The rf and oscillator trimmers are adjusted at the high frequency end of the broadcast band as previously described. The rf trimmer is not to be touched after this adjustment.

Next tune the receiver and Signal Generator to approximately 600 kc. Tune the receiver slowly back and forth across the 600 kc signal, taking care not to move the receiver dial far enough to lose the signal. While doing this, turn the oscillator slug or padder first in and then out. Stop tuning (rocking) the receiver and varying the receiver oscillator adjustment at the point of greatest output. Return the receiver and signal generator settings to the high end of the dial and readjust only the oscillator trimmer for maximum output at the correct dial setting. Repeat the low frequency procedure. Go back and forth from the low to the high ends of the receiver dial until no further improvement is noted. This will give perfect tracking and maximum receiver sensitivity. Disregard any slight inaccuracy in low frequency receiver dial readings.

Space does not permit the detailed discussion of all different ways in which the Model 280 Signal Generator might be used in servicing. The general technique to use is outlined in the following section. For additional information, refer to your NRI Lessons.

Let us take common receiver troubles and see how the Signal Generator might be used to find the trouble in the set.

Set Dead: When the set is dead, the Signal Generator is used to isolate the trouble to a specific stage. First, set up the Signal Generator so that an audio signal is obtained at the end of the test probes. Do this by turning the FUNCTION switch to the "AUDIO" position and use the FINE ATTENUATOR and COARSE ATTENUATOR controls to vary the output intensity. Turn on the receiver.

This audio signal is fed to the grid of the output tube. If a pentode or beam power output tube is used (this is most common in modern receivers), you should be able to hear a signal from the loudspeaker with the Signal Generator controls set for maximum audio output. If you can hear a signal when you place the "hot" probe of the Signal Generator on the grid of the output tube and the "ground" lead to the set chassis, then transfer

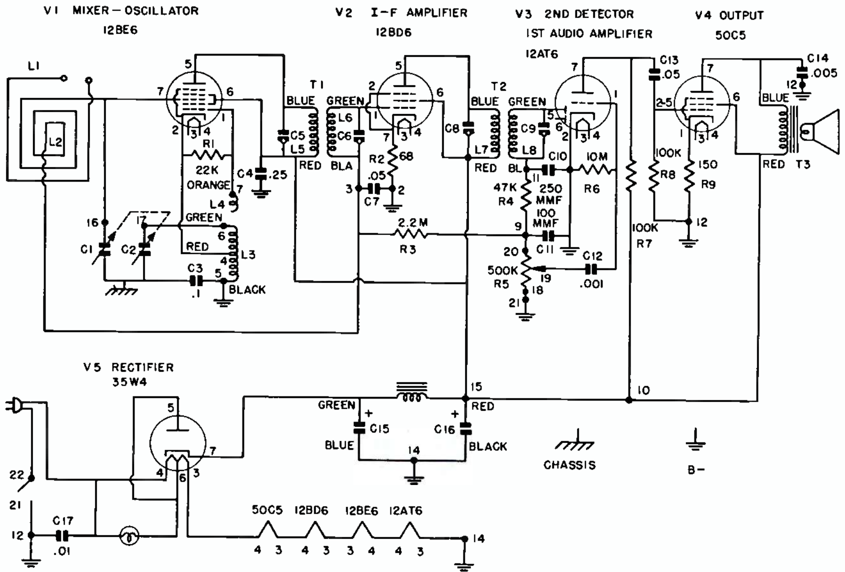


FIG. 7. Schematic diagram of a typical AC-DC radio receiver.

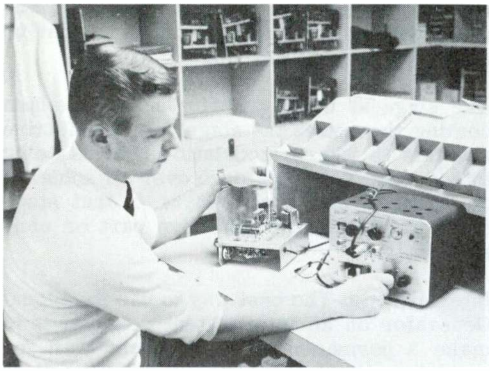


FIG. 8. Technician Jim Johnson of NRI's Quality Control calibrates an assembled 280 Signal Generator by beating its signals against a special crystal-controlled standard.

FIG. 9. Helen Gillespie of Assembly pre-adjusts the trimmers to be used in a CONAR 280 Signal Generator kit. Proper adjustment produces a circular pattern on the scope screen

the "hot" lead of the Signal Generator back to the grid of the first audio amplifier tube.

If you again hear the signal here, switch the Signal Generator to "modulated rf" output and adjust the frequency of the Signal Generator to the i-f frequency of the set. Touch the "hot" probe of the Signal Generator to the grid of the i-f amplifier tube. You should again be able to hear a signal from the loudspeaker.

Continue this test stage by stage until you come to the antenna end of the set. Then switch the Signal Generator from the i-f frequency of the receiver to a modulated rf signal within the broadcast band and try picking it up on the receiver.

INDICATES TROUBLE

When you first note that the signal fails to come through the receiver, it indicates trouble in that stage. For example, if you cannot get a signal from the loudspeaker when feeding the audio signal to the grid of the output tube, it indicates trouble either in the output stage, in the power supply, or in the loudspeaker itself. Check each item in turn. You can check each item in turn. You can check the power supply by checking for plate and screen grid voltages.

In making tests past the first audio amplifier tube and towards the antenna end, the volume control of the set should be in its maximum position. You can check the operation of the volume control by simply connecting the audio signal directly across the volume control and varying the position of the center arm to see if a variation in output intensity is obtained.

If you find that any particular stage is defective, you should check operating voltages and test the parts in that stage until you locate the defective part.

If you were able to get a signal from every stage on through to the antenna, but the set is still dead, there is a good chance that the local oscillator is not working. The conventional test is to check for dc voltage across the oscillator grid resistor. In some oscillator-mixer circuits, however, no oscillator grid resistor is present. Feedback may be obtained through plate and cathode circuits or between screen grid and cathode circuits. In a case like this, a check on the local oscillator operation can be obtained by attaching the antenna to the receiver and turning the dial of the receiver to a frequency of a local broadcast station. If the set is dead, nothing will be heard from the loudspeaker.

Then, tune the Signal Generator to a frequency equal to the frequency of the broadcast station plus the i-f of the set. The FUNCTION switch will be set to the "rf unmod." position and this unmodulated rf signal will be fed to the grid of the converter tube. If you can hear the broadcast station coming through now, you can be pretty sure that the local oscillator is not working.

You have actually substituted the oscillator of the Signal Generator for the local oscillator in the receiver.*

Weak Receiver: An approximate indication of stage gain can be obtained if the Signal Generator attenuator settings are left at a fixed

* If you have an NRI or CONAR VTVM you can set it for AC and measure the oscillator voltage directly across the oscillator tuning capacitor. This is frequently done in transistor sets.

position and the output level noted as the "hot" probe is transferred from amplifier stage to amplifier stage. As you pass each amplifier stage (working toward the antenna), the level of the output signal should increase - if it does not, signal strength is lost rather than gained in the particular stage. (This test does not apply to measurement of conversion gain.)

When making gain tests ahead of the second detector you should check avc voltage since, where avc is used, the gain of the receiver will tend to change as the avc voltage changes. Maximum avc voltage indicates maximum signal strength, although the audible signal output may not change appreciably.

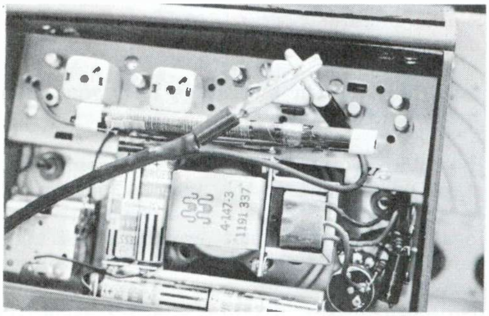


FIG. 10. Closeup showing how hot and ground leads of the 280 are clipped together and slipped over a loopstick in a transistor set.

Modulation Hum: A Signal Generator is quite useful for checking "modulation hum" in a set. You can recognize modulation hum by the fact that you hear a hum when tuned to a station but do not hear it when tuned off the station. To locate where modulation hum is introduced in the set, proceed as follows:

All tubes should be checked for heater-to-cathode leakage and grid circuits should be checked for opens. Either heater-to-cathode leakage or an open grid circuit might well cause hum modulation.

Then, pick up a station on which you get modulation hum. Measure the avc voltage developed. As you check from stage to stage in the following steps, adjust the Signal Generator output with the FINE ATTENUATOR and COARSE ATTENUATOR controls until at least the same avc voltage is measured. This will insure that the test signal has sufficient amplitude to cause modulation hum.

Feed an unmodulated rf signal into the receiver, starting at the last i-f stage and working toward the antenna end. Use an unmodulated signal which will feed through the set. For example, when checking the i-f stages, you should use the i-f of the receiver. The receiver, at this time, is tuned so that no station is being picked up.

The stage at which you first notice the hum coming through is the stage that is defective and this is where modulation hum is being introduced. You should go over all soldered connections and check parts in that stage until you locate the defective part or connection.

Intermittents: The best way to use the Signal Generator on an intermittent receiver is to make a permanent connection and wait for the intermittent to occur. (It is difficult to feed from one stage to another while the intermittent is in progress, as the surge due to connection might clear up the defect.) We will assume that the intermittent condition is one in which the set will stop playing for awhile - start, play for awhile and stop again.

To use the Signal Generator in servicing an intermittent set, feed a modulated rf signal through the receiver from the antenna, and connect a dc voltmeter to read avc voltage. Turn up the set volume control until the audio note can just be heard in the speaker.

Leave the set and Signal Generator on until the intermittent condition occurs. When the set goes dead, immediately check for avc voltage at the meter. If the avc voltage has not changed in value, the trouble is in the audio stages. If there is no avc voltage present, or if the avc voltage has changed, the trouble is in the rf or i-f stages. You have thus effectively isolated the trouble to one section of the receiver. Concentrate on the defective section. Inject the test signal at various points and again wait for the intermittent to occur. In this way the intermittent stage can usually be isolated. Suddenly increasing the output of the Signal Generator will frequently cause the intermittent to show up and may save much time.

You should precede any tests of this sort with the conventional "brute force" test. To use the brute force test, a pair of longnose pliers is used to wiggle each part and connection in the set until you find the particular part which will cause the intermittent condition to occur. That part is defective and should be replaced. If the defect is due to a loose connection, the connection should be resoldered.

All in all a Signal Generator is an extremely valuable service tool and is one of the first to be purchased by the newcomer to the service field.

EMPLOYMENT OPPORTUNITIES

Major contracts ($1 million or more) were recently awarded by government agencies or major contractors to the Electronics firms listed here. Such large orders frequently require the hiring of additional personnel. Those interested in possible employment should contact the companies.

Collins Radio Co., Dallas, Texas.
General Dynamics/Convair, San Diego, Calif.
Stelma, Inc., Stamford, Conn.
Beckman Instruments, Inc., Fullerton, Calif.
Sylvania Electric Products, Inc., Mountain View, Calif.
Emerson Electric Co., St. Louis, Mo.
Honeywell, Inc., Hopkins, Minn.
IBM Corp., Rockville, Md.
Fairchild Stratos Corp., Hagerstown, Md.
International Telephone and Telegraph Corp., Fort Wayne, Ind.
General Precision, Inc., Glendale, Calif.
Ling-Temco-Vought, Inc., Dallas, Texas.
American Bosch Arma Corp., Long Island, N. Y.
North American Aviation, Inc., Automation Div., Anaheim, Calif.
General Dynamics Corp., Pomona, Calif.
Univac Div., Sperry Rand Corp., St. Paul, Minn.
RCA Services Co., Camden, N. J.
Atlantic Research Corp., Duarte, Calif.
Martin Marietta Co., Denver, Colo.
Varo, Inc., Garland, Texas.
Sperry Gyroscope Co., Great Neck, N. Y.
FMC Corp., Minneapolis, Minn.
General Motors, AC Spark Plug Div., Milwaukee, Wis.
Bell Aerospace Corp., Wheatfield, N.Y.
Kollsman Instrument Corp., Elmhurst, N. Y.
Nortronics Div., Northrop Corp., Palos Verdes, Calif.
Bell Aero Systems Co., Buffalo, N. Y.
Maxson Electronics Corp., Scranton, Pa.
ITT Federal Laboratories, Nutley, N. J.
Fairchild Space and Defense Systems, Syosset, N. Y.
Sperry Rand Corp., Washington, D. C.
General Electric Co., Schenectady, N. Y.
Collins Radio Co., Richardson, Texas.
Westinghouse Electric Corp., Pittsburgh, Pa.
Aerospace Corp., El Segundo, Calif.
Interstate Electronics Corp., Anaheim, Calif.
Collins Radio Co., Cedar Rapids, Iowa.
General Atronics Corp., Philadelphia, Pa.
Geotechnical Corp., Garland, Texas.
Defense Electronics, Inc., Rockville, Md.
General Electric Co., Philadelphia, Pa.
Model Engineering and Mfg. Corp., Huntington, Ind.
Texas Instruments, Inc., Dallas, Texas.
Hughes Aircraft Co., Los Angeles, Calif.
Philco Corp., Palo Alto, Calif.
McDonnell Aircraft Corp., St. Louis, Mo.
Bendix Corp., Teterboro, N. J.
Scientific Data Systems, Inc., Santa Monica, Calif.
General Precision, Inc. Aerospace Group, Pleasantville, N. Y.
Bendix Corp., Radio Div., Baltimore, Md.
Electronics Associates, Inc., Long Branch, N. J.
Hughes Aircraft Co., Culver City, Calif.
Raytheon Co., Norwood, Mass.
Ladoie Laboratories, Morganville, N. J.
Martin Company, Baltimore, Md.
Bogue Electric Mfg. Co., Paterson, N. J.
Carrier Corp., Syracuse, N. Y.
Northrup Corpis Ventura Div., Newbury Park, Calif.
Sylvania Electric Products, Inc., Waltham, Mass.
General Precision, Inc., Binghampton, N. Y.
Philco Corp., Philadelphia, Pa.
Aero Geo Astro Corp., Alexandria, Va.
Philco Corp., Aeronutronics Div., Newport Beach, Calif.
Energy Systems, Inc., Palo Alto, Calif.
Electronic Communications, Inc., St. Petersburg, Fla.
Western Devices, Inc., Burbank, Calif.
Ryan Aeronautical Co., San Diego, Calif.
Sperry Rand, Salt Lake City, Utah.
Brown Engineering Co., Huntsville, Ala.
General Telephone and Electronics Corp., Williamsport, Pa.
TRW-Technology Laboratories, Inc., Redondo Beach, Calif.
Western Electric Co., New York, N. Y.
Western Electric Co., Burlington, N. C.
Cutler-Hammer, Inc., Deer Park, N. Y.
Sperry Rand Corp., Great Neck, N. Y.
Giannini Controls Corp., Durarte, Calif.
Eitel-McCullough, Inc., San Carlos, Calif.
Kellsman Instrument Corp., Syosset, N. Y.
Sylvania Electric Products, Inc., Williamsport, Pa.
Radio Corporation of America, Moorestown, N. J.
Reynolds Metals Co., Richmond, Va.
Lundy Electronic and Systems, Inc., Glen Head, N. Y.
Burroughs Corp., Detroit, Mich.
Radiation, Inc., Melbourne, Fla.
Westinghouse Electric Corp., Baltimore, Md.
General Precision, Inc., San Marcos, Calif.
Raytheon Co., Bedford, Mass.

george finds a transistor checker can be a

LEAKAGE LIFESAVER

BY JOHN POTTER SHIELDS

It was just a bit after 5:30 on a snappier than usual late October afternoon that found George Bensen easing his little foreign car into the garage after a day of instructing at the Gateway Electronic Institute.

"It's a good thing that I don't have any anti-freeze problem with the air-cooled engine in this little buggy," George mused, as he stopped to note that the mercury in the thermometer mounted on the garage door was slipping rapidly below the freezing mark.

"Hey, George, did you get a chance to stop off at Electronic Emporium downtown?" hollered a familiar voice, as George turned to see his quite-a-bit-younger red-headed cousin come loping across the short back-yard that separated their two houses.

George, who was the senior electronics instructor at the tech school, held a number of operating licenses, both commercial and amateur. The combination made him a never-ending source of inspiration to his young cousin, who had just obtained his Novice License and who now worked, ate, and slept Ham radio.

"I sure did! This must be your day, as those 50-meter crystals that you had on order came in today. Come on into the lab and I'll separate them from the bunch of goodies which I picked up."

Harry eagerly followed George into the lab, which consisted of a converted bedroom equipped with an impressive array of test gear, a complete SSB Ham station, and perhaps most important to Harry, a larger than average junk box whose contents were a source of delight to him.

George set to unpacking the two cartons, while Harry perched himself on one of the nearby bench stools.

"Now, there's a gizmo I've never seen before. What are they?" queried Harry as he watched George checking a number of small socket-like items against the packing list.

"Transistor sockets, and you'll notice that they are of the 'universal' type which will accept either the inline or triangular lead arrangement," George pointed out as he handed one to Harry.

"Very nice, very nice, but why so many? I didn't know that you had hoarding instincts."

"No," chuckled George, "I'm building up a transistor characteristic demonstrator for my course in semiconductors which will be coming up in about a month."

"Hmmm, sounds interesting—tell me more," perked up Harry as he deserted the somewhat uncomfortable bench stool in favor of a nearby easy chair.

"Okay, you asked for it—and by the way, I'm pleased that you are showing some interest in semiconductors. Before you know it, our Ham gear will be loaded with them. As you know, right now they're finding wide use in DC to DC convertors in mobile rigs as well as modulation stages in low-power rigs. Well, back to the project at hand," continued George, as he picked up a scratch pad and pencil, "Here's the dope on this little project.

"What I'm building up are units that will demonstrate relative gain and leakage of various transistors. I'm going to mount the universal transistor sockets, toggle switch, potentiometer and terminal strips on these pieces of peg board, like so." George sketched as he continued. "Now here's the schematic for these little units. The collector contact of the transistor socket goes to one meter terminal; the other meter terminal to one battery terminal and the other battery terminal to the emitter contact on the socket. The base contact on the socket goes to one terminal of the SPST toggle switch; while the other switch terminal goes to the arm of the potentiometer, which in turn is connected across the battery terminal."

"One question," broke in Harry, who was now watching intently over George's shoulder, "What kind of range meter are they going to use with these testers?"

"I plan to let the fellows use their multimeters which they completed last month," returned George.

"While the range will depend upon the particular transistor, I would say that the 0-20 or 0-50ma range will be used most often.

"Here's a unit that I made up as a model of the demonstrator. Would you like to see it in action?"

Harry nodded as George reached across the bench for a small pile of transistors. "First of all, before inserting a particular transistor in the socket it is necessary to determine whether it is a PNP or NPN unit," noted George as he picked up a transistor from the pile.

"Let's see now, if I remember right, the PNP transistor requires negative collector supply voltage, while the NPN requires a positive collector supply."

"I see you actually did glance through the transistor manual I loaned you," applauded George."By the way, an easy way to remember the correct battery polarity is by the middle letter. For example, in a PNP unit, the N can be figured as representing a negative collector supply while just the reverse is a NPN unit.

"Well, let's see how she works," continued George, as he inserted the transistor in the socket, connected a multimeter, switched to the 0.25 ma scale to the meter terminal and a 6-volt battery to the battery terminals. "First, we'll check the transistor's leakage by leaving the toggle switch open. This, of course, leaves the transistor's base circuit open or floating."

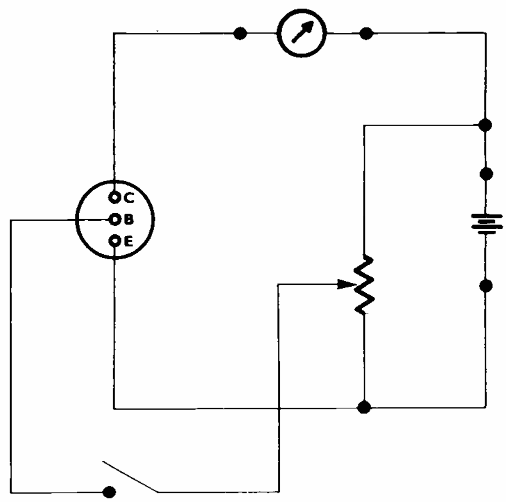
"Hm, don't see much action," commented Harry. "The multimeter's pointer hasn't edged up more than half a division or so."

"Yeah, that's a pretty good unit. Very low leakage. Now let's get some idea of its gain." George flipped the toggle switch to the closed position and slowly advanced the potentiometer. As he did so, the multimeter indicated a sharp increase in collector current.

"Looks like you've got a live one there. I notice that you've just barely turned the potentiometer and the meter's reading full scale."

"That's right," George answered. "You can get a pretty good comparison of the gain of various transistors of the same type by using a unit you know is good as a reference. Simply use a calibrated scale around the potentiometer and note the setting of the potentiometer which produces, say, half-scale reading on the meter with the reference transistor, and note the meter reading.

"Isn't this gadget useful then as a simple transistor checker?" queried Harry.



GEORGE'S TRANSISTOR CHECKER

"That's right; in fact, almost all of the inexpensive transistor checkers on the market use the same principle."

"What's this I understand about the leakage of a transistor increasing as its ambient temperature increases?" quizzed Harry.

"Here, I'll show you." George rummaged through a drawer until he came upon a particular transistor. "Here's one that I've been intending to return to the manufacturer. It's a new unit, but its leakage is a shade higher than the specs call for. I picked it for this little demonstration because its increased initial leakage current will make the meter reading a bit easier."

George inserted the transistor in the demonstrator's socket and applied operating voltage.

"Notice that the leakage current is about 1 mill. Now watch as I grasp the transistor between my fingers."

"I'll be darned," exclaimed Harry. "The ole needle is really climbing up scale."

"It sure is," commented George. "This little demonstration vividly illustrates a fundamental property of transistors that must be taken into consideration when designing circuits around them. Unless suitable precaution such as bias-stabilizing networks and sometimes temperature-compensating resistors are employed—especially in power output stages—a condition known as thermal runaway can occur.

"That is, as the transistor's temperature increases, its leakage current will increase. This increased current flow through the transistor will cause further heating, which in turn will cause more leakage current to flow. The whole thing continues in a vicious circle, with the end result that the transistor can be destroyed.

"It looks like all is not lost. I actually learned something today," Harry grinned. "I'll have to keep that in mind when I get around to some actual transistor circuit designs—with your help.

"Say, by the way George, I picked up a bunch of bargain transistors when I was downtown last week. Could I borrow that little demonstrator to check them out this evening? One small point, though, my multimeter is back at the factory getting some new bearings."

"Sure thing, Harry. Only one problem, I'm going over to troubleshoot an electronic triplate counter at the plant near the school tonight, and I'll have to take the multimeter with me. I have an idea though. If you'll settle for a 'go, no go,' setup, I can fix you up so that a bell will ring if a particular transistor that you're testing is excessively leaky. This will at least let you separate the wheat from the chaff."

"Ha, automation at last," chuckled Harry. "Sure, that will be fine. I can at least tell the ones that are too leaky to be on any value, and then later check out the others whose leakage is low enough not to ring the bell."

George walked over to a small cabinet and pulled out a drawer marked Relays. After fumbling about for a few minutes, he pulled a small relay out of the drawer and placed it on the workbench.

"Here's just the ticket. It's a small sensitive relay of the type used in model plane radio control works, and designed to pull in at about 2ma. We'll substitute it for the meter in the collector circuit of the demonstrator, so that it will pull in if one of the transistors which you are testing has more than around 2ma leakage. All that remains is to connect this small door bell and drycell in series across the relay's normally open contacts so that the bell will ring when the relay closes."

Harry left the lab and trotted across the yard into his own home and down to his den basement lab.

Rummaging through his considerably less pretentious junkbox, Harry assembled a small pile of transistors on his workbench and set up his "automation" transistor checker.

Somewhat later he had completed his task, the checker operating in great form. The transistors were now neatly grouped in two piles; unfortunately the larger pile contained the bell ringers due to excessive leakage. Somewhat reluctantly, Harry filed this pile in the trash can.

It must have been around 3 a.m. that Harry awoke to the sound of a bell ringing someplace. At first, he couldn't quite make it out, but as he became wide awake, he realized that it was his transistor checker in the basement. Hurriedly, he grabbed a robe and rushed downstairs to silence the gadget before it awoke the whole household.

As he neared the top of the basement stairs, he stopped as a touch of panic gripped him. Curls of smoke were coming from beneath the cellar door and it was hot to the touch. Knowing that it is foolhardy to open the door as the hot smoke and gasses behind it could quickly suffocate him, he raced to waken his father, who immediately called the local fire department.

After the smoke and excitement had cleared it was found the damage had been confined to a small closet under the basement stairs. Apparently the fire had been started by the spontaneous combustion of some linseed oil soaked rags which Harry's father had been using in painting and had tossed in the small closet. Harry was considerably relieved to find that his section of the basement had been spared with the exception of a bit of water damage.

As he walked over to his bench he found his checker, which now was silent. As he stared down at the little gadget, it finally dawned on him what had happened. In his somewhat sleepy state before retiring, he had forgotten to remove the last transistor which he was testing. Although at the time he was testing it its leakage was low enough so as not to ring the bell, the heat of the fire had caused its leakage current increase to the point where the relay was actuated, ringing the bell. "Well, I guess you might be called a 'leakage lifesaver'", grinned Harry, patting the gadget.

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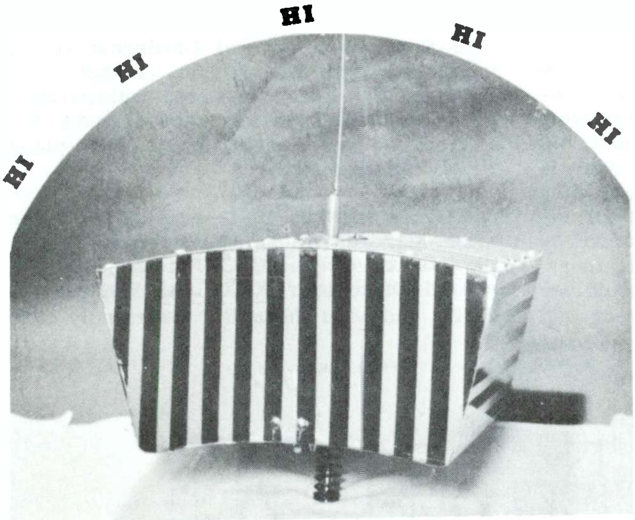
'Hams' And The OSCARs Reviewed



The incredible excursions in the field of space technology over the past seven years have happened so fast that there has been little time for reflection: first, Sputnik, then lunar probes, manned orbital flights, the Mariner series, Tiros satellites, and active and passive communications satellites.... other than those directly involved in their plannings and launchings, who has had time to ponder?

But now that a plateau has been reached, with all of the experimental firsts launched, it seems time to consider and review what has been done, as well as where we're going.

In line with this, Stanley Leinwoll, Radio Frequency and Propagation Manager for Radio Free Europe, has made it easy for us with his new book, "Space Communications." The book is concise and informative, and since it's based principally on fact and data sheets released by National Space and Aeronautics Administration, quite authoritative.

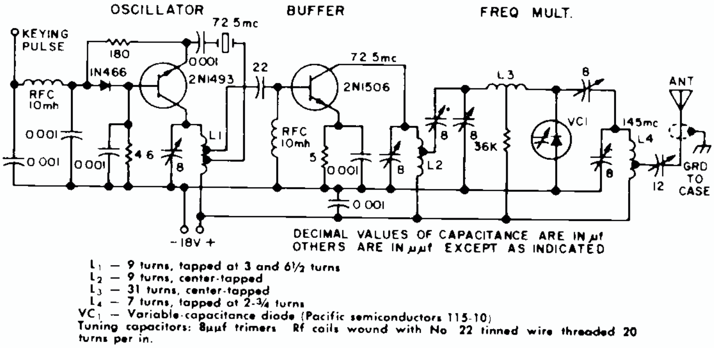
It covers, step by step, the processes and operations involved in all U. S. launchings from our Sputnik follow-up through early 1964, with results and effects, in comprehensible and readable terms that make the whole thing seem almost as simple to the nontechnical layman as a two-egg cake recipe to the seasoned housewife.

His launching pad for the book--the reasoning as to why the communications satellites especially are so important--evolves around the overcrowded shortwave (high frequency) portion of the radio spectrum in the range from 3 to 30 megacycles, with its steadily increasing usage, and concurrent diminishing spectrum space due to the nadir of sunspot activity, which in turn determines the range of frequencies the ionosphere will reflect. (Talk about population explosion--it's frightening to think about all these little microwaves bumping into each other!) There are many good approaches to the problem of conservation and reduction of interference, also increasing, in progress. Leinwoll concurs with most communications experts in the opinion that the final solution lies in communications satellites, plus improved conditions in shortwave bands.

The book, he says, is not intended primarily for technical people in the field, who presumably are already aware of the conditions in this International Year of the Quiet Sun (IQSY), and are working on remedies. Instead, he says, the book is meant to be one of practical interest to the nontechnical layman, the radio amateur, and the shortwave listener; in short, anyone interested in knowing more about space communications in a world where it is becoming more and more important. As such it is a valuable compilation of events that seem to have occurred almost daily.

Perhaps it's not fair to Leinwoll to give short shrift to all this, but of particular interest to this reviewer were the chapters on the role of radio amateurs and their "piggyback" satellites, the OSCARs (Orbiting Satellite Carrying Amateur Radio). He tells the story in detail, aided by records of organizations and individuals who helped the project to get off the ground.

The role was indeed a massive one, considering that it was done entirely on the hams' free time from regular jobs (he estimates a conservative 40,000 hours) and financed entirely by them, at no cost to the government. But then, as Leinwoll says, so has their role always been. "From the time of Marconi to the beginning of World War II, every major advance in long-distance wireless communication was discovered by radio amateurs. During that period all the great laboratories and research centers of the world were only able to refine the work of these adventurous hobbyists."



The OSCAR transmitter circuit.

And in the space age, the hams, whose hobby is the only one provided for by international treaty, have kept pace, as is evidenced by the story of the OSCARs.

It started with an article in CQ Magazine, in which the author, Don Stoner, queried: "Can anyone come up with a spare rocket for orbiting purposes?"

A ham, Fred Hicks, W6EJU, asked for more details, started talking it up to other hams, and eventually wound up as chairman of the preliminary Project OSCAR Committee, composed mainly of hams from several of the large radio clubs on the West Coast.

It took thousands of letters, phone calls, door-knockings, buttonholing of government officials. Backing of the American Radio Relay League, in March, 1961, probably helped most to secure interest and approval of the necessary government agencies, which finally happened in September.

Meantime, the hams had to design, build, track, compute orbits, etc., to be sure of success. Many exhaustive tests were held, including those for shock, pressures, temperature, and the like, and the package was also flown over several California areas, monitored from the ground. So that other amateurs throughout the world could participate, the committee was reorganized to the Project OSCAR Association, and its plans widely disseminated.

On December 12, 1961--exactly 60 years after Marconi transmitted a signal across the Atlantic Ocean--OSCAR I was launched aboard Discoverer XXXVI at Vandenburg, Calif., and soon thereafter its friendly "HI" was carried throughout the world, for a total of three weeks.

OSCAR I statistics:

Apogee of orbit (point farthest from earth): app. 268 miles.
Perigee of orbit (point closest to earth): app. 153 miles.
Orbital period: began at 92 minutes, ended at 89.
Maximum doppler shift: 7.5 kc.
Distance traveled while in orbit: more than 20 million miles.
Range of signal to radio horizon: app. 1400 miles on overhead passes.
Internal temperature: average temperature within satellite 127°, corresponding to a HI rate of 10 per 6.5 seconds.
Power supply: three 18-volt mercury cells in parallel, with estimated life period of three weeks.
Dimensions: canister, 12 in. × 10 in. × 8 in. (Shown on Page 23.)
Weight: 10 lbs., low-weight magnesium alloy. (Container was plated with gold to reflect the most heat of the sun, partially painted to maintain heat balance.)

Launching vehicle: launched as ballast in Agena-Discoverer satellite, boosted into orbit by Thor. (Attached by explosive bolt holding an ejection spring under compression, mounted on an adapter near rocket's motor housing.)
Transmitter: transistor crystal oscillator on 72.5 mc (constructed on glass epoxy printed wiring board), transistor amplifier and Vari-cap diode doubler on 145 mc. Keyer of transistor multivibrator and counters of diode logic. Oscillator keyed in base circuit. Entire internal structure encapsulated in epoxy foam for thermal insulation.
Orbit: North/South, 81.2° inclination to Equator.
Frequency: app. 144.983 kc.
Power output: 100 mw.
Antenna: 1/4-wave monopole, 19 in. long.
Modulation: C. W., keyed with series of HIs in Morse Code.
Call sign: None for satellite. Ground station control assigned W6EE. Tracking and reception reports received: 5200 from observers in 25 countries.

In June, 1962, OSCAR II, utilizing information gained from the first one, was also launched successfully, with even better reception, world-wide interest and support.

OSCAR III, an active satellite, and the next logical step for the hams, will be launched this winter. It will be a vhf translator satellite with storage batteries charged by solar cells, expected to orbit for several months, and designed to enable many more amateurs in the 2-meter band to participate.

In the Washington area, OSCAR East, a similar project for the East Coast, is projected for 1965 under the direction of Capt. David J. Veazey (USN). He feels that there is "so much wonderful talent" in this area that a coordinated group of hams could rival or surpass what has been done by the West Coast. (He and several others here worked on the West Coast OSCARS.)

Capt. Veazey and the others who are contemplating the do-it-yourself project feel that it would result in a tremendous amount of knowledge and experience gained, and that there are probably many opportunities---dead-load space available----in which such a vehicle could be launched. Yet the project is somewhat in a dormant stage.

What is needed most now, though, he says, is someone "to take hold of the program full-time," coordinate the efforts of those who are extremely interested but are hampered by lack of time away from their employment.

.....**ALLENE MAGANN**

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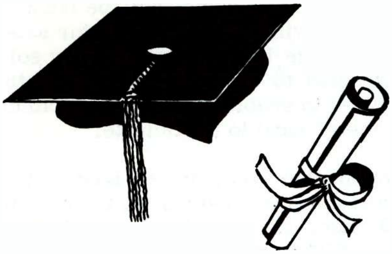

ALUMNI NEWS

J. Arthur Ragsdale............................President
Howard Tate ....Vice President
Frank Zimmer............................Vice President
Eugene DeCaussin......................Vice President
Jules Cohen..............................Vice President
Theodore E. Rose....................Executive Sect.

It was known from the beginning that the bid for the Presidency of the NRIAA for 1965 would be a hotly contested race, when two such strong and popular members as Dave Spitzer of the New York City Chapter and Howard Tate of the Pittsburgh Chapter were the contenders for the office. Dave Spitzer finally squeezed through as the winner.

Three old-timers are back on the slate of officers as National Vice-Presidents. They are the ever-popular and dynamic Jules Cohen of the Philadelphia-Camden Chapter; F. Earl Oliver of the Detroit Chapter, who has been elected to National Office more often than any other member of the Alumni Association; and Joseph Stocker of the Los Angeles Chapter, who was a Vice-President in 1957 and the chief organizer of the Los Angeles Chapter in that year. We have one new member who is serving as a National Officer for the first time and he is fully deserving of the honor. He is James L. Wheeler, Chairman of the Pittsburgh Chapter. Our congratulations to these successful candidates for National Office.

Born in Brooklyn, N. Y., in 1908, President-Elect Dave Spitzer completed courses at the Mechanic's Institute in draftsmanship and mechanical drawing, but never worked at it because he did not like sitting at a desk. Instead, even as a child, he was interested in anything pertaining to electricity. He built one of the first crystal Radio sets in his neighborhood. Until Radios became common, his house was the meeting-place for friends

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SO

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.

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Previous Address ______________________

City & State ______________________ How long at this address? ____________

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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 ______________________ Highest Credit ________
(Name) (Address)

Credit Acct. with ______________________ Highest Credit ________
(Name) (Address)

Dave Spitzer is your new president.

and neighbors anxious to see the "box" and hear what came out of it.

Spitzer's chief occupation is as a heating Engineer specializing in oil heat. He took the NRI course only as a hobby at first, graduated in 1950, but has been doing Radio-TV Servicing as a sideline ever since. He joined the NRI Alumni Association while still a student and has been one of the most active and industrious members of the New York City Chapter. He was elected to the Executive Board for two years, then served as Secretary for two years, and is now in his fifth year as Chairman. He was also a National Vice-President of the Alumni Association for two years.

In addition to his responsibilities and activities in the New York City Chapter of the Alumni Association, he is an Officer on the Executive Board of the Coney Island Rod and Gun Club, and does quite a bit of deep-sea fishing. He has still another hobby, photography.

Current National President J. Arthur Ragsdale will vacate his office on January 1, 1965, whereupon Dave Spitzer will take over.

CHAPTER CHATTER

DETROIT CHAPTER's first meeting of the year was taken up exclusively by a discussion on programming for the season. All members of the Chapter are earnestly requested to submit any suggestions they may have. Here is an opportunity for all members to do something about getting the kind of programs they want. Take advantage of the opportunity; send in as many suggestions as you like.

FLINT (SAGINAW VALLEY) CHAPTER's program was a full one in September. First, the Chapter was invited to attend a meeting held by General Electric, which was devoted to the servicing and repair of the GE 11-inch TV set. Then, on September 14 B and K staged a meter check at one of the leading local electronic supply houses, Taylor Electronics. Many members of the Chapter brought their VOM and VTVM for checking on the Electronic standard calibrator check.

Following this, the Zenith Company invited the Chapter members to Utley Town Hall at Burch Run, Mich., for the introduction of the new Zenith receivers and Stereo. This was followed by a supper and floor show, truly an enjoyable evening.

HACKENSACK CHAPTER is one of those Chapters that continued with its meetings right through the summer. More power to you, fellows! The meetings were given over primarily to the repair of sets brought in by members and there was general agreement that this was time well spent in spite of the hot weather.

Harold Jenkins demonstrated using a B and K Television Analyst on a set that was out

A hello-to-fall picnic was held jointly by the Detroit and Flint Chapters at Kensington Park. At one table were, from right, seated, Mr. and Mrs. James Kelley and their daughter and Mrs. Andrew Jobbagy; standing, John Nagy and Mr. Jobbagy.

of sync. The members derived a great deal of benefit from this demonstration. It was the first time most of them had seen the instrument used for this purpose.

SOUTHEASTERN MASSACHUSETTS CHAPTER has for some time been planning on the purchase of a color TV receiver for use at the meetings. The Chapter now has it, a 1964 Admiral. It will be used for troubleshooting and to give the average member confidence in Servicing color TV. This will add tremendously to the value of the chapter's meetings. Members can now get a wealth of practical instruction and help on servicing color receivers at the meetings.

The first demonstration was conducted by Manuel Figueiredo and Manuel Sousa on how to converge colored TV. The members present were highly pleased with this demonstration, particularly since each member had a chance to do it for himself.

The Chapter has adopted a program under which a special meeting will be held between regular meeting nights. Each of these meetings will be devoted to the different phases of color TV. All members who possibly can should avail themselves of this chance to learn all they can about servicing color receivers.

All members of the Chapter, please note: The December meeting would normally fall on December 25th, but since that will be Christmas Day, the meeting will be held on December 18.

The Chapter wishes also to call attention to the fact that it is in the market for a used 16mm sound projector. If you have one you'd like to sell, or know someone who wants to dispose of one, drop a line to the chairman, Mr. George Schalk, P. O. Box 1, Ridgewood, New Jersey, 07451.

LOS ANGELES CHAPTER has had all of its equipment up for sale. Presumably, by the time this issue of the Journal is published, some -- maybe all -- of it may have been sold. However, anyone interested should drop in at a meeting to see if any of it is left.

Graham Boyd is converting a 24-inch Packard Bell TV receiver from 24BP4 to 24CAP4. Harry Matsukane reported on his visit to Washington, D. C. He not only visited NRI but also the U. S. Senate.

Chairman Eugene DeCaussin gave a demonstration on his new B and K Television Analyser and promised additional demonstrations on the use of this instrument at future meetings.

PHILADELPHIA-CAMDEN CHAPTER members were much impressed with a talk given by a representative of the Philco Corporation on transistors. In this talk the speaker took an entirely new approach to the transistor, made it easier for the members present to understand and to work with.

The members were also scheduled to be guests of the Philco Corporation in Philadelphia for a tour of the factory, with special emphasis on seeing how the Television sets are made. This tour was in the making for a long time. The tour was to be made in the morning followed by luncheon as guests of the company.

The Chapter has had quite a few such tours and visits to factories and probably will continue to have them. All of them are interesting and instructive. Members should take advantage of this opportunity to get a first-hand knowledge of the "works" in manufacturing, broadcasting stations, etc. This is only one of the many benefits of membership in this large and very active Chapter.

SAN ANTONIO ALAMO CHAPTER Chairman Sam Dentler brought in some RCA Servicing Manuals that he ordered for the Chapter sometime ago. He let the Chapter members have them at cost. They served as the basis of an interesting discussion.

Harold Wolfe, who is an expert Auto Radio Serviceman, discussed the servicing of Auto Radios. Johnnie Noll, a Telephone Company repairman, was scheduled to deliver a talk on the telephone distribution system. Probably this lecture will have been delivered by the time this issue is published.

John Chaney has been preparing a lecture on the fundamentals of Radar. Though few servicemen work with Radar, it is very similar to Television and a talk on the subject should be interesting.

SAN FRANCISCO CHAPTER members were host to Guest Speaker Peter Wiwel, who has spent twenty-seven years in the Electronics business. He talked very freely to his audience about his experiences in Radio-TV. Among other things he told the group how important it is to listen carefully to customers' complaints and to adjust the complaints as nearly as possible to the customers' satisfaction. The members expressed their gratitude to Mr. Wiwel for his valuable talk and invited him to speak at another meeting in the future. He promised that he would.

At the very next meeting he offered his help as instructor to Chapter members in troubleshooting the tough dogs. The chapter accepted his offer with enthusiasm. He has scheduled a series of practical demonstrations on receivers.

Directory of Local Chapters

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

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

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

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month at 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: George Schalk, 471 Saddle River Rd., Ridgewood, N. J.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month at the YMCA in Hagerstown, 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 DeCaussin, 5870 Franklin Ave., Apt. 203, Hollywood, Calif., NO 4-3455.

MINNEAPOLIS-ST. PAUL (TWIN CITIES) CHAPTER meets 8:00 P. M., 2nd Thursday of each month, at the homes of its members. Chairman: Paul Donatell, 1645 Sherwood Ave., St. Paul, Minn., PR 4-6495.

NEW ORLEANS CHAPTER meets 8:00 P.M., 2nd Tuesday of each month 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: David Spitzer, 2052 81st St., Brooklyn, N. Y., CL 6-6564.

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

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

SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 3rd Wednesday of each month, Beethoven Home, 422 Pereida, San Antonio. Chairman: Sam O. Dentler, 329 Southcross, San Antonio, Texas. WA 2-8682.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: Peter Salvotti, 2543 Great Hwy., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month, home of Chairman John Alves, 57 Allen Blvd., Swansea, 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.

THE LONG AND THE short OF 'HORNS'

PAY OFF IN DB AND BROAD FREQUENCY RESPONSE GAINS

BY ARTHUR L. MUNZIG

Did you ever wish it was practical to use a "horn" antenna? The dimensions for a horn designed for TV low frequencies are almost prohibitive for mounting on a roof-top.

In Fig. 1 is shown a conventional design for a horn for TV-FM reception having "chicken-wire" netting as the conductor.

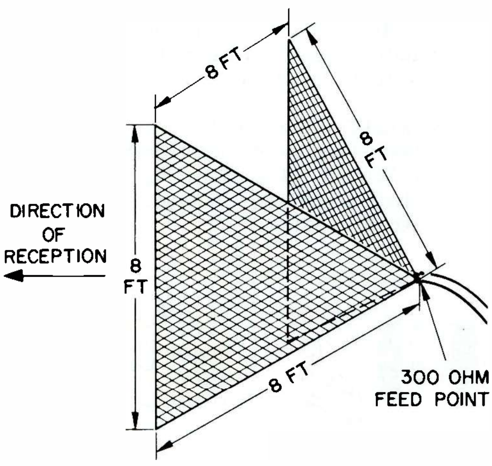

FIG. 1. Conventional design having "chicken wire" netting as the conductor.

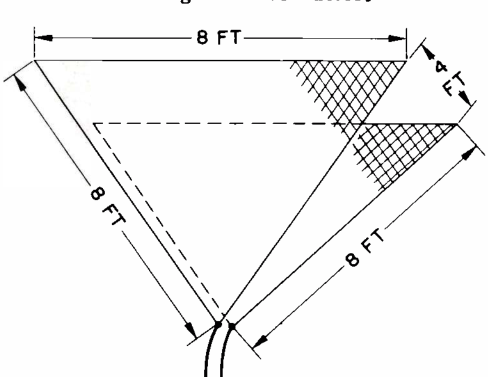

FIG. 2. Conventional horn rotated 90 degrees.

The gain of a conventional horn can be practically doubled if the horn (as shown in Fig. 1) is rotated 90 degrees, as shown in Fig. 2. The "long horn" now has an upper and lower plate but with an aperture (opening) of only 4 ft. The size is still impractical for mounting in an attic or on the roof.

However, this is now a thing of the past. Presented herewith is the author's version of a SHORT-HORN antenna designed for TV-FM reception having a flat frequency response from 54 mc to 890 mc, and a consistent 10 db gain. It can be mounted conveniently on your roof-top or in the attic.

Shown in Fig. 3 is a design for a short-horn antenna. It now has been shortened to 4 ft. and the aperture has been reduced to 2 ft. The short horn still has a flat frequency response from channel 2 through 83, and a consistent 10 db gain. However, the input resistance has been reduced to 150 ohms. This isn't too bad a miss-match, and can be tolerated with the high gain and broad frequency response advantages.

Mounting should now be a simple matter. The reader can easily improvise a frame out of dry wood, or reinforce the edges of the chicken wire by soldering to a narrow metal strap around the outer edges, and supporting with polystyrene strips for insulation.

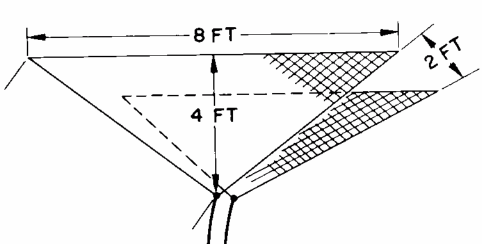

FIG. 3. Design for a "short-horn" antenna.

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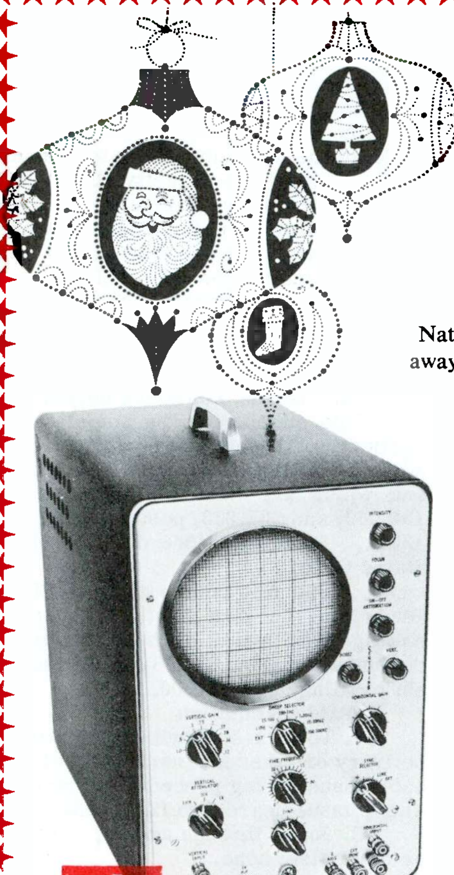
>
> Confucius.



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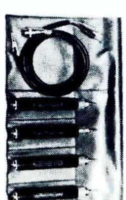

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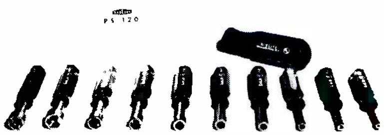

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