NRI news

February/March 1962

MISS ETHEL DUSTIN, AN NRI EMPLOYEE, ENJOYS THE CONAR MODEL 291 TRANSISTOR RADIO. READ ALL ABOUT THIS RECEIVER ON PAGES TEN AND TWELVE.

ALSO IN THIS ISSUE

NRI NEWS

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Editorial: HOUSE CALLS

Many of us can remember the family doctor of years past. No matter what ailments beset us, he came to the house and administered to our needs. He was a busy man but never too busy to go out of his way - at any hour of the day or night - when summoned. He didn't make much money because he spent a great deal of his time in travel between his patients.

Today, the modern doctor seldom makes a house call except in an emergency. His travel time is limited largely to the hospital and to his office. He has found that it is more profitable and time-saving for his patients to come to him. And he can do a more thorough job because he can use better techniques and equipment in diagnosing an ailment.

Many radio and TV service technicians have educated their customers to bring portable TV sets, home radios and hi-fi components to their shop. They have convinced their clients that a better repair job can be done at lower cost than in the home.

The benefits are shared by both. The technician saves travel time and gasoline and the customer saves money. Why not give it a try?

J. M. Smith
President

DID YOU KNOW

NRI is one of the few home study schools that has the distinction of being "Recommended by Good Housekeeping."

To earn this recognition, we had to submit a complete sample course, including kits, to the Good Housekeeping engineering laboratories. Their engineers examined our kits and written material, and found them "entirely acceptable."

The Director of the magazine's School Department also reported that excellent letters were received from the NRI graduates to whom they wrote, and that their Electronics Consultant spoke favorably about the National Radio Institute.

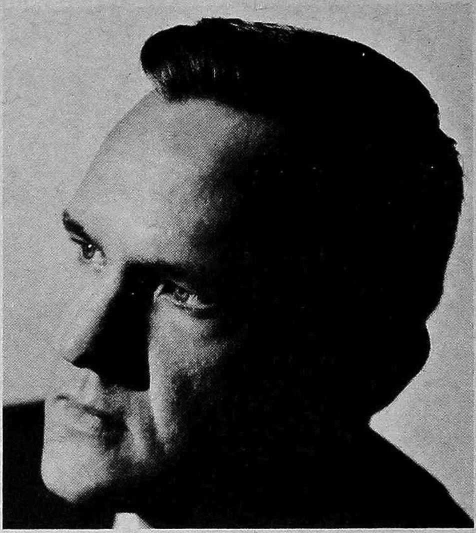
NRI is proud to add this Good Housekeeping "Seal of Approval," which is universally accepted as a mark of high quality, to the many endorsements already received for the excellence of its course material and the satisfaction of its trainees.

HOW TO CHECK---

Compactrons, 10 pin, 12 pin and other new type tubes in your present checker. See page sixteen.

Sweep Alignment of Video and Audio I-F Stages

By
Ed Beach
Technical Editor



Ed Beach

Have you ever had a customer bring in a TV set for repair who complains, "The picture just doesn't seem clear and sharp anymore"? Or the "do-it-yourself" man who says, "I touched up a couple of the adjustments inside the set but the picture is worse than before." If you haven't heard these plaintive cries, you may rest assured that sooner or later you will.

Both of the above customer complaints can give many headaches to the serviceman if he is not prepared and equipped to handle them. Complaint number two is reminiscent of the man with the five tube ac-dc table model radio who "tightened all the screws inside the radio." Right away you know you are in for a realignment job. In all probability the TV with the adjustments "touched up" will also require realigning as will the set whose picture is no longer clear and sharp. However, aligning a TV set is a far cry from the fifteen minute peak-the-i-fs-tune-in-the-station radio alignment job.

Broadcast radios normally have one or two overcoupled i-f stages tuned to the same frequency. The bandwidth of the i-f is usually between 3-kc and 8-kc wide, determined mostly by the degree of overcoupling in the individual i-f transformers. If the i-f transformers are not way off frequency the radio may be aligned using only received signals from broadcast stations. At the most, a signal generator and vtvm are required.

Aligning a TV receiver is another matter; there are normally two, three, or four single tuned i-f stages as well as several trap adjustments in a TV receiver. The bandwidth is in the vicinity of four megacycles (four times the width of the entire broadcast band) and each i-f stage is tuned to a different frequency; not quite so simple to adjust as an ac-dc radio receiver. In addition, the i-f is usually around 45-mc in the TV receiver as compared to 455-kc in a radio. It is very difficult if not impossible to accurately obtain the higher frequency TV i-f signals from most service signal generators designed for radio work. (The NRI Model 90 and CONAR Model 280 signal generators are notable exceptions because of their stable oscillator circuitry and large, easy to read dial scales.)

The frequency response of an amplifier is a plot or graph of voltage amplitude or gain as a function of frequency. As shown in Fig. 1, the X-dimension is frequency and the Y-dimension is voltage gain. Fig. 1A shows the frequency response of a typical i-f from a broadcast receiver. Fig. 1B is the response of a typical TV receiver i-f. Note that the TV i-f response is not symmetrical and there are bumps and wiggles outside the passband. The problem in aligning a TV receiver is first to obtain the shape of the i-f response, as shown in Fig. 1B, and second to get the frequencies 1, 2, 3, and 4 to fall in their correct positions. This can be done in one of two ways. Only one, the quickest and most reliable, will be discussed in this article.

In order to get a graph of gain versus frequency we could use a signal generator and vtvm. By measuring the dc voltage developed at the diode detector for several distinct frequencies applied to the input, enough data could be obtained to plot such a graph. This, however, is impractical. Each time an ad-

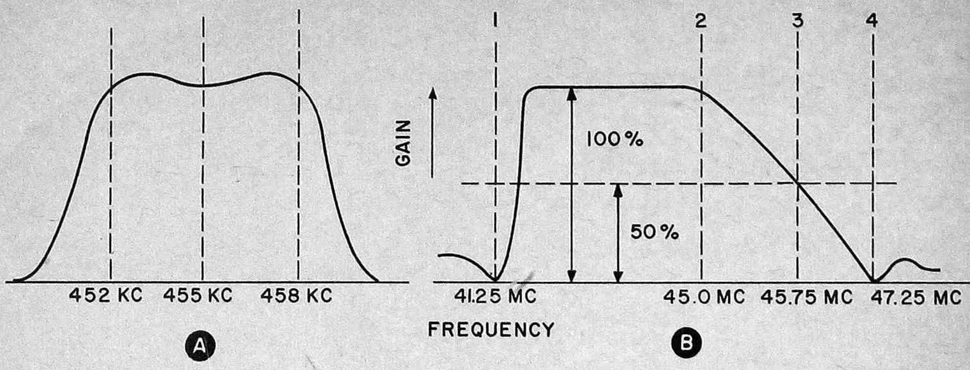


FIG. 1. I-F response of (A) broadcast receiver; (B) television receiver.

justment is made in the i-f tuning we would have to repeat the whole process. A much faster method of obtaining such a plot is that using a sweep generator and an oscilloscope.

SWEEP GENERATORS

A sweep generator is similar to other generators in its basic circuitry. It differs, however, in that the frequency produced is caused to change from a low frequency to a high frequency and back to a low frequency. This "sweeping" back and forth over a range of frequencies occurs at a specific rate, usually 60 cps for convenience. Just how this sweeping takes place is not important here; there are numerous ways in which this may be accomplished. As the frequency sweeps over the selected range of frequencies it is very important that the amplitude of the signal remain constant. Otherwise, if the output amplitude increases at low frequencies, for instance, the response of the circuit under test would appear to fall off at the higher frequencies.

AUXILIARY EQUIPMENT

To display the response curve a very sensitive voltmeter is used; the oscilloscope. For best results, the trace on the scope should move from left to right at exactly the rate the frequency of the sweep generator increases from low to high frequency. This is usually accomplished by using the same signal to sweep both the scope trace and the sweep generator. Most sweep generators have terminals for connecting to the horizontal amplifier of the scope.

The vertical amplifier (our voltmeter) is connected to the diode detector. Sometimes, as we shall see shortly, we want the response of only part of the i-f system. In this case we must connect a special diode detector to the point in the circuit to be observed so a dc voltage will be available for the scope. A demodulator or signal tracing probe may sometimes be used with the scope instead of using a special detector.

A bias box such as that in Fig. 2 or a special battery eliminator such as the NRI or CONAR Model 2 will be needed to defeat the AGC.

Another instrument needed for sweep alignment is a marker generator. This is merely an accurate, stable signal generator. In the better marker generators there is usually provision made for checking the calibration against a secondary frequency standard. A marker generator is needed to identify the various portions of the response curve. Since the job of the sweep generator is to produce a constantly changing frequency we cannot and should not take its calibration as absolutely accurate.

SWEEP ALIGNMENT

How do we know if the set that has been "adjusted" by the customer or the set which is no longer "sharp and clear" needs i-f alignment or work on the video amplifiers? There are several ways of determining this. The picture itself is usually a good indicator. If, when the fine tuning is adjusted there are ghosts which come and go or trailing or smeared whites which come and go then the i-fs probably need aligning. A low capacity scope connected at the video detector will also show the need of alignment. Rounded horizontal sync pulses or front and back

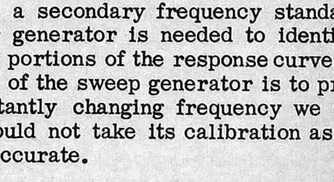


FIG. 2. Bias box suitable for use as "override" bias.

porches with ringing superimposed usually mean alignment is needed. And last, when you have become really familiar with the alignment technique you will find it no real chore to set up the equipment and make a quick visual inspection of the i-f response.

Fig. 3 is a schematic of the i-f portion of a representative TV receiver. In the procedure which follows we will refer to this schematic. Notice that most of the individual coils and traps have frequencies marked near them. Coils L_1 and L_2 do not have a frequency marked because they are adjusted together to broadly cover the entire passband.

We must first disable the local oscillator in the tuner to prevent any spurious beats from confusing the overall picture. This can be done in several different ways. The set shown in Fig. 3 has a Channel 1 or UHF position in which the plate voltage is removed from the local oscillator. Merely setting the tuner to this position disables the oscillator. Some tuners have an oscillator grid test point. This may be shorted to ground to kill the oscillator. One of the best ways to kill the local oscillator is to use a dummy tube; one with the oscillator plate pin clipped off. This used to be the standard method in the days when nearly all tuners used the 6J6 as the oscillator-mixer tube.

It is also a good idea to disable the horizontal sweep section during alignment. This is done for two reasons. First, large pulses from the flyback will be picked up by the scope and make the pattern difficult to interpret. Second, this removes the second anode voltage and eliminates the possibility of an uncomfortable shock. In sets which have parallel filaments (6.3V ac tubes), simply removing the horizontal output tube will accomplish the desired result. Series filament sets are more complicated. A dummy tube with the cathode pin cut off may be used or a suitable resistor may be bridged across the filament connections with the tube removed. The first approach is recommended because of its simplicity and convenience. Most everyone has an old tube with the correct filament ratings and connections to use as a dummy. It does not have to be the same tube type as long as the filament is the same as the horizontal output tube. Another method is to unsolder the lead from the cathode pin of the horizontal output tube. This will work in sets having either series or parallel connected filaments.

Next, the AGC should be disabled by connect-

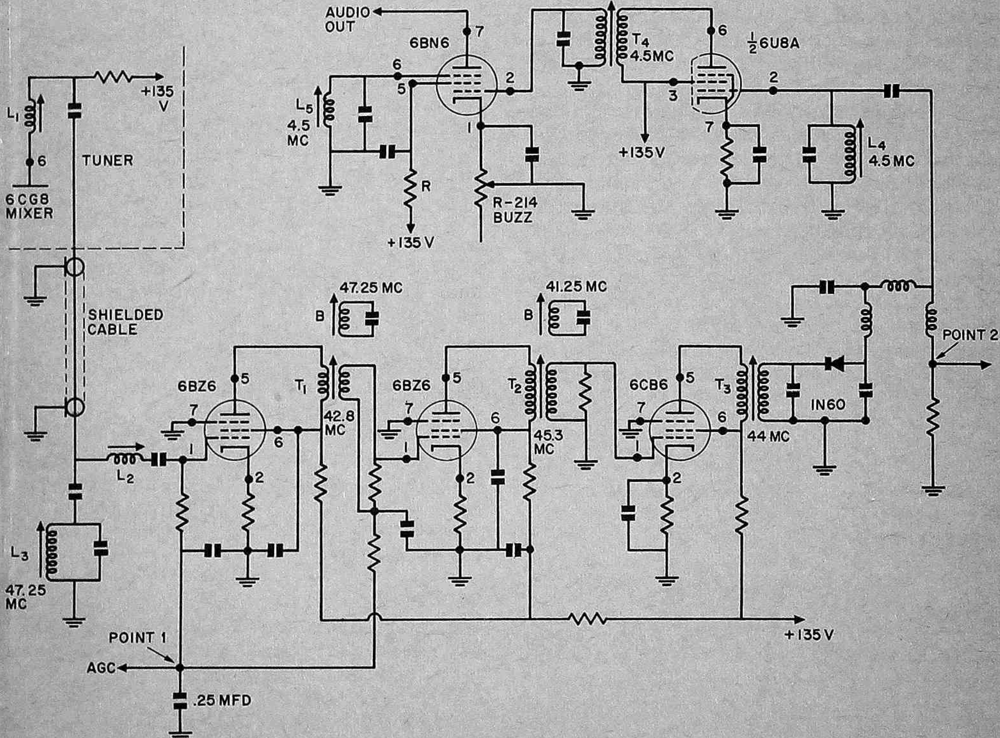


FIG. 3. Video and sound i-f section of a typical TV receiver.

ing the override bias; negative to point 1, positive to ground. A value of -3 to -4 volts is usually sufficient.

While these preparations are going on, the sweep and marker generators should be allowed to warm up so they will be stable when we are ready to use them. Connect the output of the marker generator to the marker input of the sweep generator. Loosely couple the output of the sweep generator to the mixer in the tuner. This may be done by clipping the hot lead of the generator to a tube shield allowed to "float" over the mixer tube without touching the chassis. Connect the ground lead of the generator to the chassis. In our case we will use a 10-mmfd capacitor with very short leads soldered directly to the grid of the mixer. This point is readily available with the tuner shield cover removed.

Connect a .01-mfd or larger capacitor to Point 2 and ground. Also connect the vertical leads of the scope between Point 2 and ground.

Connect the leads from the sweep terminals of the sweep generator to the horizontal input of the scope. Set the horizontal selector of the scope to Horizontal Input.

Fig. 4 shows in block diagram form how the equipment should now be connected. Set the sweep generator to about 44-mc, the approximate center of the i-f passband of Fig. 1B. Set the sweep width to about 10-mc. The generator will sweep from about 39-mc to 49-mc with these settings. Set the marker generator to the band encompassing the i-f frequencies, 41-mc to 48-mc. Turn on the TV set and the oscilloscope. If all is well, you should see a trace similar to that of Fig. 1B. If no trace is seen, increase the output of the sweep generator and the scope gain. If the trace is still not present, slowly change the center frequency of the sweep generator while watching the scope. At some point you will see the trace move onto the scope screen. Adjust the marker generator output and frequency so you may identify the frequency spectrum of the curve. As the marker frequency passes through the passband the marker "birdie" should move across the scope screen. If the trace distorts as the marker is brought into view, reduce the output of the marker generator.

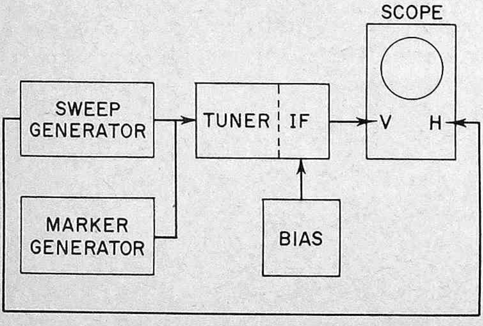


FIG. 4. Equipment connections for sweep alignment of TV i-f section.

There are more complicated and elaborate methods of mixing the sweep signal and the marker which do not produce interaction and circuit loading. However, these methods require additional equipment and will not be discussed in this article.

Now tune the marker generator to 42.8-mc. Adjust T_1 for maximum height of the marker. Disregard the rest of the curve and concentrate only on maximizing that portion occupied by the 42.8-mc marker. It should be noted that depending upon the diode detector connection and the type of scope used the response curve may appear "upside down" rather than "rightside up" as in Fig. 1B. Maximum deflection would then be downward rather than up as in Fig. 1B. As your adjustments proceed, you will probably have to reduce the output of the sweep generator to prevent overloading the i-f amplifiers.

You can check for overload by observing the trace as the sweep generator output is increased and decreased. If the shape of the response curve changes as you vary the output you are overloading the i-f tubes with too much signal. Make this check periodically as your alignment progresses. It may become necessary to increase the override bias slightly to prevent overloading.

After you are satisfied that the 42.8-mc transformer is properly adjusted, set the marker to 45.3-mc and adjust T_2 for maximum curve amplitude at the marker as before.

Set the marker to 44-mc and tune T_3 for maximum. Your curve should now be taking shape. Now adjust the two 47.25-mc traps. With the marker set to 47.25-mc, adjust the trap slug (B) of T_1 for minimum curve amplitude at the marker. It may be necessary to increase the output of the marker generator since this frequency falls so low on the response curve. Adjust L_3 also for a dip in the curve.

With the marker set at 41.25-mc adjust the B slug of T_2 for a dip in the response curve. The marker amplitude may again have to be increased for this adjustment.

By now the response curve should begin to look like Fig. 1B. Adjusting L_1 (on the tuner) and L_2 alternately, as well as touching up T_3 should bring the response curve to the correct shape. That is all there is to the job. You will be surprised how easily the job progresses once you become familiar with the technique.

SOUND I-F ALIGNMENT

To align the sound i-f connect the sweep and marker generators to Point 2 in Fig. 3. Set both generators to 4.5-mc. The sweep generator width should be about 1-mc. The vertical amplifier of the scope should be connected by way of a demodulator probe to pin 2 of the 6BN6. L_4 and T_4 should be adjusted for a symmetrical curve centered on 4.5-mc, as shown in Fig. 5. The quadrature coil, L_5, is best adjusted with the set tuned to a station. L_5 should be adjusted for maximum undistorted output.

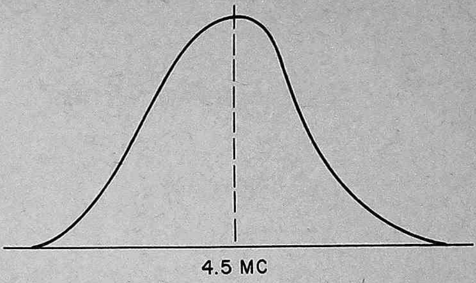
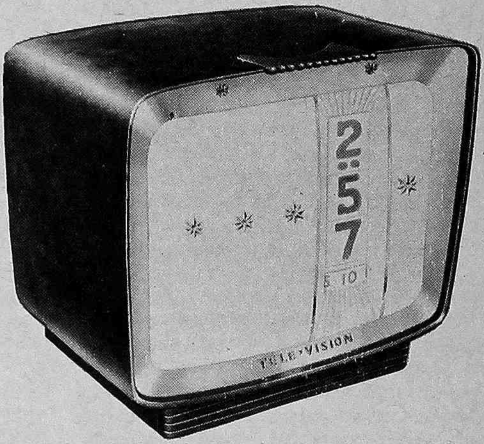


FIG. 5. Sound i-f response curve.

For reading outside your course regarding sweep alignment, see "Sweep and Marker Generators" by R. G. Middleton, a Gernsback Library publication and "How to Use Signal and Sweep Generators" by J. R. Johnson, a Rider publication. Both of the above volumes are available at most Radio-TV parts wholesale stores.



The Various Meanings of Grounds

By

Dale Stafford

NRI Consultant

Dale Stafford

In any piece of electronic equipment, ground is simply the point of zero potential. Potential, by the way, is just a five-dollar word for voltage - they both mean the same thing.

The term ground came from the early days of the ac radio. In those sets, it was customary to connect zero voltage points in the receiver circuits to the chassis. To make sure the chassis did not change in potential, a wire was run from the chassis to a metal rod driven into the earth. Thus, the name ground originally came from earth ground.

Later, it was found that the precaution of connecting the chassis to earth ground was seldom necessary. The metal chassis showed no tendency to change in potential when the receiver circuits were connected to it. For this reason, the connection to earth ground came to be omitted in a great many cases. However, the name ground was still used whether the chassis was actually connected to the earth or not.

When ac-dc sets came along, the practice of making connections to the chassis was no longer advisable. In fact, it was downright dangerous. Let us see why.

The ordinary ac receiver uses a power transformer with a center-tapped high-voltage secondary winding in a full-wave rectifier circuit. Fig. 1A shows the partial schematic of such an arrangement. To simplify the diagram, only the plate and cathode circuits of a single tube, the output tube, is shown.

Before we consider this circuit, however, let's stop for a moment to look at a phrase we will want to use - one you will encounter frequently in any discussions of electronic circuits. The phrase is "with respect to." What we mean by this is that we are making a comparison.

When we say that "the grid is negative with respect to the cathode," we mean that the voltage at the grid is negative in polarity when we compare it with the voltage at the cathode. If we say that "terminal A is positive with respect to terminal B," we mean that the voltage at terminal A is positive in polarity when we compare it with the voltage at terminal B. The phrase "with respect to" points out the particular point in the circuit that we are using as a reference point for our comparison.

Now, let's get back to our power supply. When the voltage across the secondary winding makes the upper end of the winding positive with respect to the lower end, the upper plate of the rectifier is positive with respect to the cathode while the lower plate is negative.

Electrons leave the cathode and travel to the upper plate and through the upper half of the secondary winding to the center-tap. From here, the path is through the chassis to the lower end of the cathode resistor, up through the resistor and tube, down through the output transformer primary and through the filter choke back to the cathode.

During the next half-cycle of the ac voltage across the secondary winding, the lower plate of the rectifier is positive while the upper plate is negative. Electrons travel from the cathode to the lower plate and through the lower half of the secondary winding to the center-tap. From here, the path is the same as during the preceding half-cycle.

Electrons leave the power supply at the center-tap and return to the cathode of the rectifier. Thus, we may consider these points the negative and positive terminals of our power supply much like the negative and positive terminals of a battery used for the same purpose. The grounded center-tap is the zero-voltage reference point for all the B+ voltages in the receiver.

In this power supply, we have a complete circuit through our power supply and the output tube that is isolated from the ac power line by the transformer. Things do not work out this way with an ac-dc set, however. Let's look at Fig. 1B.

The only way we can trace a complete circuit is from the cathode of the rectifier to the plate, to the filament tap, through part of the filament to the upper wire of the line cord and on to one prong on the plug. From here, the path goes along the ac power line, through the generator in the power plant, back along the ac line to the other prong on the line cord and through the on-off switch to terminal A.

From terminal A, the path is to the lower end of the cathode resistor of the output tube, through the tube and the primary of the output transformer to the filter resistor and to the rectifier cathode.

Since there is no other way to complete the circuit, we have to use one side of the ac line as the negative terminal of our power supply. If we made our ground connections to the chassis, we would have to connect the ac line to the chassis also by grounding terminal A.

One side of the power line is grounded to earth ground as shown. So long as the plug was always inserted in the position shown, everything would be all right. The chassis would be at zero potential.

Suppose however, that the plug is turned over so that terminal A is connected to the hot side of the power line. Then there would be a difference in voltage of 120 volts between the chassis and earth ground. If one touched the chassis and, at the same time, touched some grounded object, he could be badly or even fatally shocked.

This problem is solved by the use of a common negative circuit called B-, which is isolated from the chassis. One wire of the line cord is connected to one of the terminals of the on-off switch. From the other terminal, terminal A in Fig. 1B, a circuit leads to a series of insulated terminals throughout the receiver. Connections, which in an ac receiver would go to the chassis, go to these insulated terminals instead. In referring to this common negative circuit, we call it B-. When we speak of ground, we normally mean chassis ground or earth ground.

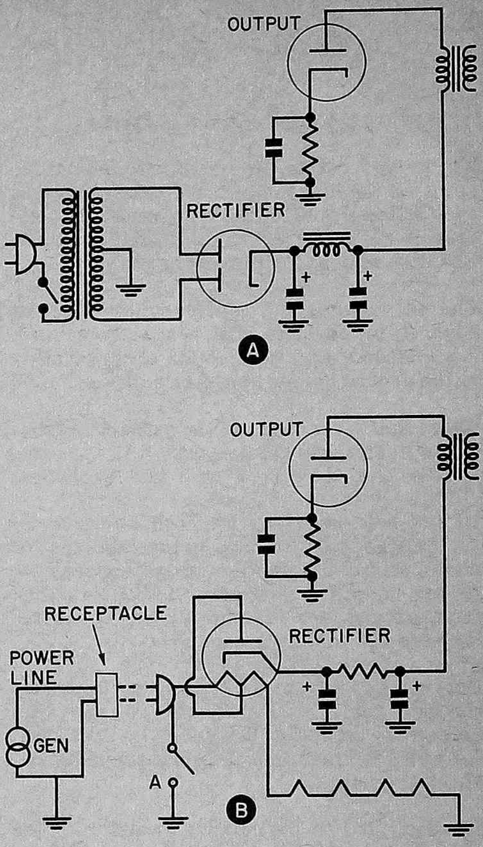


FIG. 1. Power supplies. (A) AC: (B) AC-DC.

The symbols used for ground connections are shown in Fig. 2. The one in Fig. 2A indicates a connection to the chassis. It is used on a schematic diagram when a few of the connections go to the chassis and the rest go to B-.

The one shown in Fig. 2B may stand for a connection either to chassis ground or to B-. When used on a diagram along with the symbol shown in Fig. 2B, it indicates a connection to B-. However, when all the ground connections go to the chassis, this symbol is used instead of the one shown in Fig. 2A. Thus, this symbol could stand for a connection to either the chassis or B-.

If you are working on a receiver, you can look to see how the connections are made. However, if you are just looking over a diagram and don't have the receiver, the easiest

FIG. 2. Ground connection symbols.

way to be sure what it means is to look at the notes on the diagram. On the schematic, you should find a note telling you whether the voltages were measured to the chassis or to B- (the note may say common negative).

The dc voltages in a receiver may be either positive or negative with respect to ground. It all depends on the direction of current flow in the ground connection. Let's look at Fig. 3.

Here, again, we have used only a partial schematic to simplify the drawing. It is the same as the one in Fig. 1 with this exception.

In this set, we'll say we need a source for a small negative voltage to provide bias for some of the tubes. For this purpose, the center-tap of the secondary winding was lifted from ground, and resistor R_2 was connected between the center-tap and ground.

Current flows from the center-tap to ground through resistor R_2 so the voltage drop across the resistor has the polarity shown. As you see, terminal C is negative with respect to ground.

Resistor R_1 is the cathode resistor of the output tube. In this resistor current flows from the chassis to the cathode. The voltage drop across resistor R_1 has the polarity shown on the diagram and terminal A is positive with respect to ground.

To show this more clearly, the two resistors have been redrawn in Fig. 3B. As you can see, the ground connection, terminal B, is positive with respect to terminal C but it is negative with respect to terminal A.

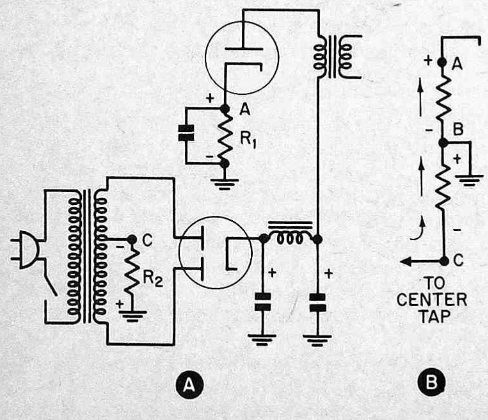


FIG. 3. DC potential.

Now, let's look at Fig. 4. Here, you see the grid and cathode circuits of a tube. As you can see, the lower end of the grid resistor goes to ground. There are two reasons for this. Let's take them one at a time.

First, we want any ac signal voltage appearing across the grid resistor to be applied between the grid and cathode of the tube. The lower end of the cathode resistor is grounded so we also ground the lower end of the grid resistor. The cathode by-pass capacitor bypasses the signal around the cathode resistor so that only the signal voltage appearing across the grid resistor is applied between the grid and cathode.

The second reason is that we want to keep the grid at the proper dc potential with respect to the cathode. The bias for the tube is provided by the voltage drop across the cathode resistor. Current flowing upward through this resistor makes the upper end positive with respect to the lower end. Thus, the voltage at the cathode is positive with respect to ground by the value of the voltage drop across the cathode resistor.

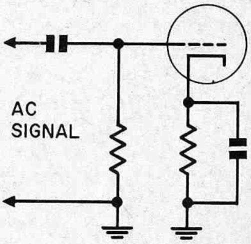


FIG. 4. Grid circuit.

When we connect the lower end of the grid resistor to ground, the grid will be at dc ground potential. The grid can't attract electrons from the cathode which is positive so no dc current will flow in the grid resistor. With no dc current flowing in the resistor there will be no dc voltage drop across it. Therefore, the dc potential at the upper end of the resistor will be the same as at the lower end.

Since the cathode is positive with respect to ground, it will be positive with respect to the grid, or to say it differently, the grid is negative with respect to the cathode.

We get into a different type of ground connection when we deal with rf ground potential or signal ground potential. The two phrases are used to describe the same thing.

When we say that some point in a circuit is at rf ground potential, we mean that it is at ground potential only so far as an rf signal is concerned. So far as dc is concerned, it may have any potential. Therefore, the ac signal must be grounded in a way that does not short out any dc voltage present.

Suppose, for example, we want to ground the lower side of the plate tuned circuit in the i-f amplifier shown in Fig. 5. We need a connection from the lower side of this circuit to the cathode. This is to complete that portion of the ac plate-cathode circuit that lies outside the tube and to prevent resistor R from being part of the signal plate load.

Since the cathode is grounded, we can complete the rf circuit by grounding terminal A. A direct connection to the chassis would short out the power supply. We can, however, use a capacitor.

The reactance of a capacitor is given by the formula

$$X_C = \frac{1}{2\pi fC}$$

where f is the frequency in cycles and C is the capacity in farads.

All we need to do is find a capacitor that has a much lower reactance than the ohmic value of resistor R at the frequency of the signal and connect the capacitor from terminal A to the chassis. By doing so, we ground the lower end of the tuned circuit for rf without shorting out our dc voltage.

In most inexpensive sets, this capacitor is omitted and the connection is made through the output filter capacitor.

Another way in which ground connections are used is in completing one side of a circuit (or a number of circuits). You know that, when electrical energy is to be used to operate any device, one must have a complete circuit from the source of our energy to the load and back to the source. This is true whether we are going to use dc or ac to operate the device. In many cases, we can ground one side of our source and one side of our load and complete one side of the circuit through the chassis. This greatly simplifies the wiring of a piece of equipment.

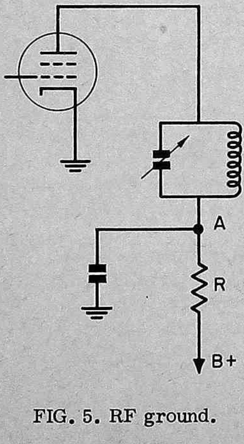


FIG. 5. RF ground.

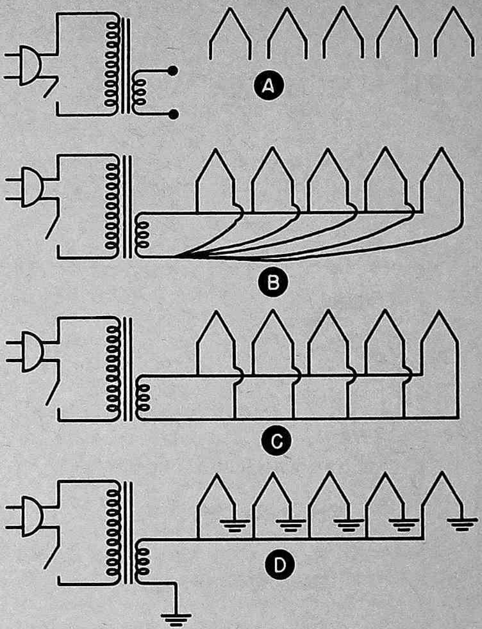


FIG. 6. Filament circuits.

Let's look at Fig. 6. Fig. 6A shows the filaments of five tubes that we want to operate in parallel from the filament winding of the transformer. To connect each filament individually to the filament winding would require a wire from the top of the winding to the filament and another wire from the other side of the filament to the lower end of the winding.

In Fig. 6B, we have simplified things a little by connecting one side of each filament to the top of the winding and running a wire from the other side of each filament to the lower end of the winding. However, things are still pretty badly cluttered up.

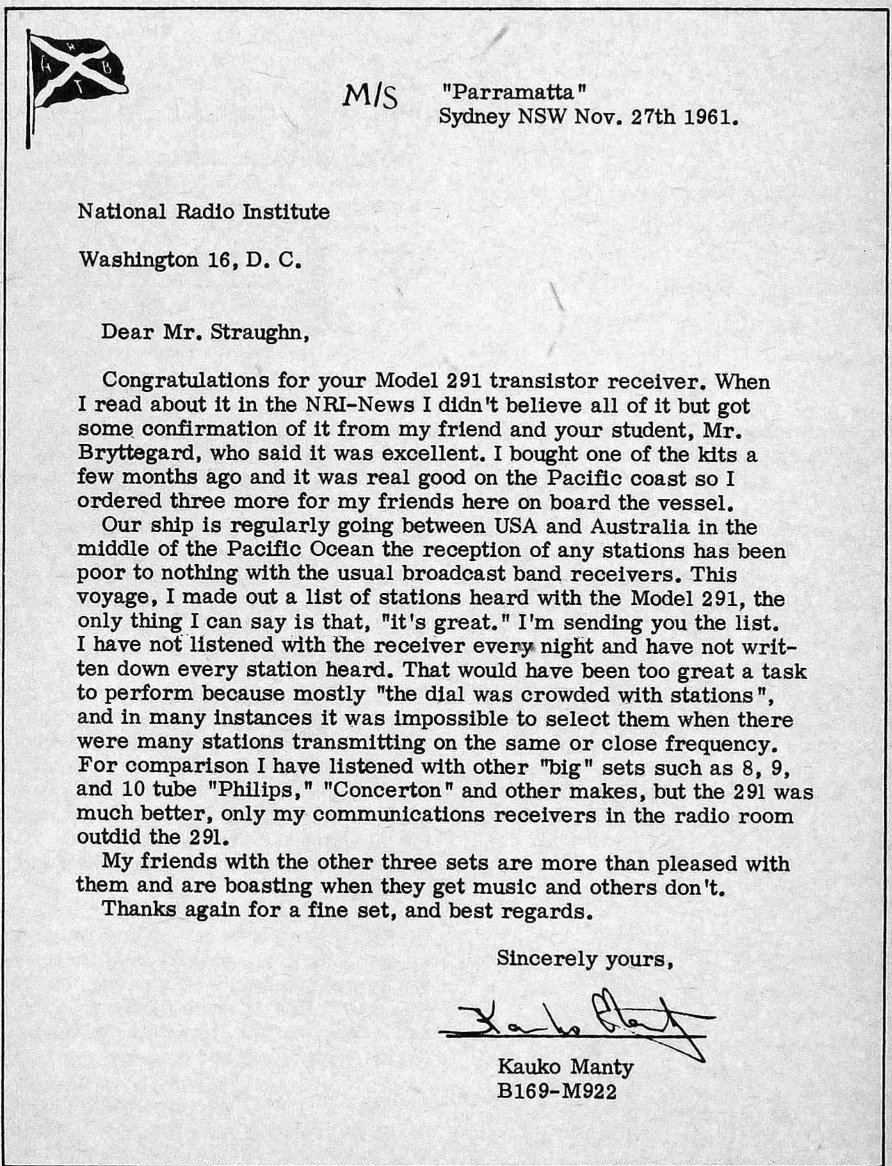
In Fig. 6C, we have helped things a little more by running a single wire from the top of the winding to one side of each filament and another single wire from the lower side of the winding to the opposite side of each filament.

We can do even better, however. Look at Fig.

(continued on page eleven)

A KIT PURCHASER WRITES:

The following is a letter that was sent to us from an NRI student. He purchased a Conar Model 291 Transistor Receiver a few months ago. Let's read what he has to say.



M/S "Parramatta"
Sydney NSW Nov. 27th 1961.

National Radio Institute

Washington 16, D. C.

Dear Mr. Straughn,

Congratulations for your Model 291 transistor receiver. When I read about it in the NRI-News I didn't believe all of it but got some confirmation of it from my friend and your student, Mr. Bryttegard, who said it was excellent. I bought one of the kits a few months ago and it was real good on the Pacific coast so I ordered three more for my friends here on board the vessel.

Our ship is regularly going between USA and Australia in the middle of the Pacific Ocean the reception of any stations has been poor to nothing with the usual broadcast band receivers. This voyage, I made out a list of stations heard with the Model 291, the only thing I can say is that, "it's great." I'm sending you the list. I have not listened with the receiver every night and have not written down every station heard. That would have been too great a task to perform because mostly "the dial was crowded with stations", and in many instances it was impossible to select them when there were many stations transmitting on the same or close frequency. For comparison I have listened with other "big" sets such as 8, 9, and 10 tube "Philips," "Concerton" and other makes, but the 291 was much better, only my communications receivers in the radio room outdid the 291.

My friends with the other three sets are more than pleased with them and are boasting when they get music and others don't.

Thanks again for a fine set, and best regards.

Sincerely yours,

Kauko Manty
B169-M922

Record of stations heard with NRI transistor radio. Used outside antenna approximately 30 feet long and approximately 36 feet from sea level. The antenna was inductively coupled to the loopstick in the set. Reception quality classified as excellent, very good, good, satisfactory and poor.

Date Nov.	Approx. Time G. M. T.	Ships Approximate Position	Stations Identified	Reception Quality
3	0800	Los Angeles	Local Stations	Excellent
"	"	"	KSL Salt Lake, Utah	Very good
11	1000	N16°25" W138°34"	KNBC Los Angeles	Very good
"	"	"	KFRC San Francisco	Very good
"	"	"	KEWB San Francisco	Satisfactory
"	"	"	KFBC Sacramento, Calif.	Very good
"	"	"	KFAY ?	Satisfactory
"	"	"	KEX ?	Satisfactory
"	"	"	KGU Honolulu, Hawaii	Excellent
16	0500	N02°55" W161°22"	KHVH Honolulu, Hawaii	Good
19	0600	S07°18" W173°41"	KNBC Los Angeles	Satisfactory
20	0800	S10°50" W177°34"	KFBK Sacramento, Calif.	Satisfactory
"	"	"	KGU Honolulu, Hawaii	Good
"	"	"	Suva Radio Fiji Islands	Very good
23	0700	S21°18" E170°31"	KOAL Honolulu, Hawaii	Good
"	"	"	ABC Brisbane, Australia	Excellent
"	0900	"	QUJ Sydney, Australia	Satisfactory

(continued from page nine)

6D. Here we have grounded the lower end of the filament winding. Then we ground one side of each tube filament. After that, a single wire is used to connect the top of the filament winding to the ungrounded side of each filament and we're in business. One side of the filament circuit for each tube is completed through the chassis.

It may seem that with currents flowing in all directions through the chassis, the electrons would become completely lost and wind up almost anywhere except where they were headed. Actually, this does not give as much trouble as one might expect.

The number of electrons flowing into a particular point in a circuit can't be any greater than the number of electrons leaving that point. In any of the tiny currents, the number of electrons arriving is great enough to take the place of those that are leaving. Therefore, there is no tendency for one current to attract electrons from some other current. So the currents do not mix as long as a reasonable separation between them is maintained.

It is possible to cause mixing by improper choice of ground connections. Look at Fig. 7A. Here we have three ground connections with currents flowing from terminal A to both terminals B and C. So long as the currents are separated like this, no mixing results.

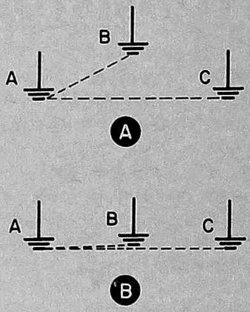


FIG. 7. Ground connections. (A) right; (B) wrong.

Suppose we move the connection at point B to another point on the chassis, as shown in Fig. 7B, so that the current flowing from A to C has to flow very close to terminal B. In this case, we are going to have mixing and possible trouble.

For this reason, you should not change ground connections around, indiscriminately. If you move a ground connection, be sure you know exactly what you are doing and check the operation to see that the move won't cause you any trouble.

Be careful moving ground connections, make sure ground connections are made when they are needed, and be very, very careful of accidental grounds. Happy grounding.

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

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Attractive styling

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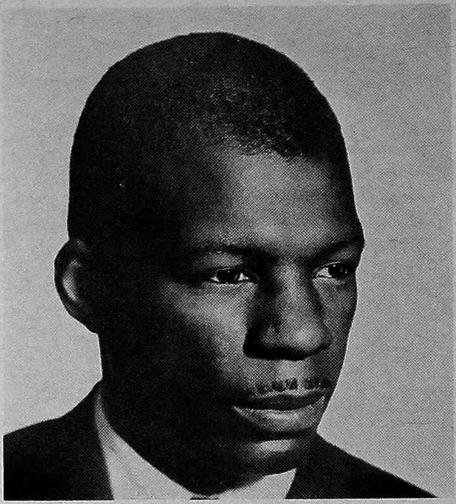
Circuit Analysis of AM-FM-SW Transistor Radio

By
Harry Taylor

Technical Editor



Harry Taylor

I am sure that many of you are interested in transistor circuits. As a technician, you are concerned with the functions of the various stages and components rather than the number of transistors or loudspeakers. It is important for you to familiarize yourself with many circuits to improve your over-all knowledge of transistor operation.

The Grundig Model 11/59E was chosen for this discussion. This is an FM-AM-SW superheterodyne receiver which employs junction transistors and crystal diodes. Many of the circuits in this receiver have at least two functions. By using as many components as possible for more than one purpose, the circuitry and difficulty in troubleshooting are held to a minimum.

Ruggedness, portability, and the low cost of operation all contribute to the current popularity of the transistor radio. The compactness of the receiver may seem mysterious to the man who deals only with vacuum tube circuits. However, analysis will show that the basic principles of transistor circuits are quite familiar.

Before discussing the actual circuit, let us look at a few block diagrams. This will give you a good idea of how the stages perform their various functions. Then, we will discuss each stage separately.

BLOCK DIAGRAM

Most, if not all, transistor radios have the AM broadcast band. Therefore, we will start with it. Refer to the diagram in Fig. 1. The antenna picks up the rf and feeds it to the

(continued on page eighteen)

(See order blank on page seventeen)

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- **Uses lab-type bridge circuit**
- **Wide resistance-capacity ranges**
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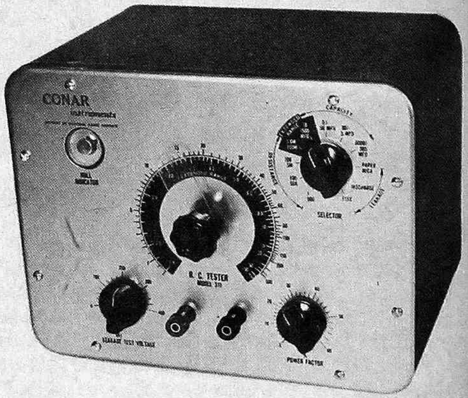

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- **Designed for tube & transistor radios**
- **Tuning eye output indicator**

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3. Locates sources of hum, noise and distortion. You actually *hear* the signal as it's traced from speaker to antenna—pinpoint source of trouble in minutes.

4. Trace down intermittent defects FAST. Just connect Model 230 to receiver and go on with other work. When trouble appears, observe it in Tracer output.

5. Measure gain per stage. Find cause quickly when a set lacks "pep".

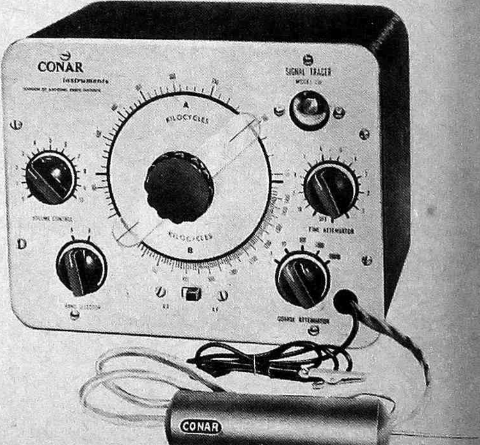
6. Accurately align radios without signal generator.

7. Isolate oscillation in RF or IF stages.

8. Select *only* that signal to which Tracer is tuned. Two stages of RF amplification provide required selectivity.

SPECIFICATIONS

7 Tubes: (2) 6GM6, (1) 6AV6, (1) 6AQ5, (1) 6E5, (1) 6AB4, (1) 6X4. **Frequency Coverage:** 170 kc to 1500 kc on two bands. **Planetary Drive** tuning capacitor; 3.1 ratio. **Permeability-Tuned RF** transformers. **4" Electro Dynamic Speaker.** Tuned RF and AF attenuators. **Cathode-Follower Probe** (comes assembled with both kit and wired instrument). Black wrinkle finish cabinet with satin finish steel panel. Size: 9⅞" x 7½" x 6½". Actual Weight 9 lbs. Shipping Weight 11 lbs. **All American Made Parts.** 90-day EIA warranty.



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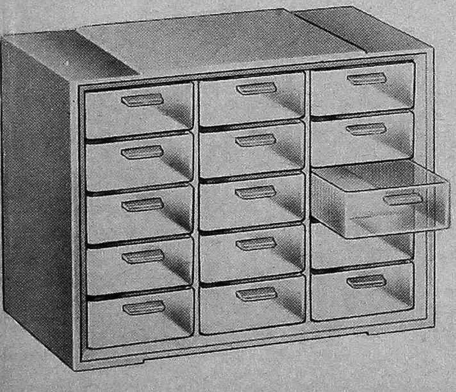

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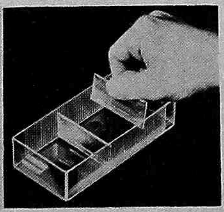

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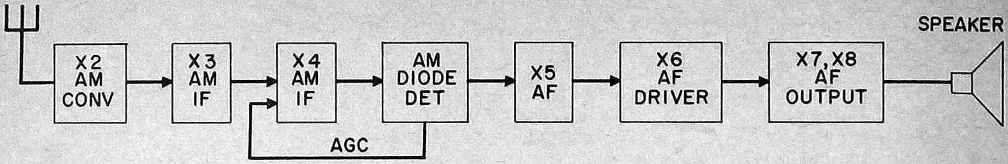

FIG. 1. AM block diagram.

(continued from page thirteen)

converter stage. The converter, X2, performs three functions. It generates the local oscillator frequency, and heterodynes or mixes the local oscillator frequency with the incoming rf signal. Finally, it amplifies the intermediate frequency. The oscillator operates at 460 kc above the rf to produce an i-f of 460 kc.

The first i-f amplifier, X3, has a bandwidth of approximately 10 kc. Thus, it will pass the desired signal and reject or attenuate unwanted stations. As you know, the i-f bandpass is largely responsible for the selectivity of the superheterodyne receiver. From the output of X3, the signal is fed to the second i-f amplifier, X4. Together, they provide the required selectivity bandwidth and gain.

The audio signal is removed from the carrier by the diode detector circuit. A simple diode rectifies the signal and the rf is filtered out by an RC network. As shown in Fig. 1, the detector provides an AGC voltage which is fed to the second i-f stage. This AGC voltage varies the gain of the i-f as the i-f carrier level changes. Thus, the i-f output level remains relatively constant.

From the detector, the audio is fed to the audio section. A conventional audio amplifier using one af stage, a driver stage and a push-pull power amplifier build up the weak detector output to the level needed to drive the loudspeaker.

Both the broadcast band and the 6 to 12-mc shortwave band rf signals are amplitude modulated, therefore, they are both treated as AM. With the exception of the rf tuning and local oscillator circuits, they follow the same signal paths from the antenna to the loudspeaker. Later, you will see this in greater detail.

A look at the FM block diagram in Fig. 2 will show that it looks much like the AM diagram in Fig. 1. Where the AM converter handles frequencies up to 12-mc, the FM frequency range is 88 to 108-mc. Thus, a separate converter stage is used for FM. X1 generates the local oscillator frequency, mixes it with the rf and amplifies the resulting i-f. Incidentally, the FM i-f is 6.7 mc.

Since the FM rf input is usually quite weak, three i-f amplifiers are used. X2 which functioned as the AM converter, now operates as the first FM i-f amplifier. The FM signal has a 150-kc swing, therefore, the i-f must be able to pass 6.7 mc ±75 kc. Transformer coupling is employed between all three stages.

HOW TO ESTIMATE PARCEL POST CHARGES

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3	.26	.38	.41	.47	.55	.64	.74	.83
4	.28	.43	.47	.55	.65	.77	.90	1.02
5	.30	.48	.53	.63	.75	.90	1.06	1.21
6	.32	.53	.59	.70	.85	1.03	1.22	1.40
7	.34	.58	.65	.77	.95	1.16	1.38	1.59
8	.36	.63	.71	.84	1.05	1.29	1.54	1.78
9	.38	.68	.77	.91	1.15	1.42	1.70	1.97
10	.40	.73	.83	.98	1.25	1.55	1.86	2.16
11	.42	.77	.89	1.05	1.35	1.67	2.02	2.34
12	.44	.81	.95	1.12	1.45	1.79	2.18	2.52
13	.46	.85	1.01	1.19	1.55	1.91	2.34	2.70
14	.48	.89	1.07	1.26	1.65	2.03	2.50	2.88
15	.50	.93	1.13	1.33	1.75	2.15	2.66	3.06
16	.52	.97	1.18	1.40	1.85	2.27	2.81	3.24

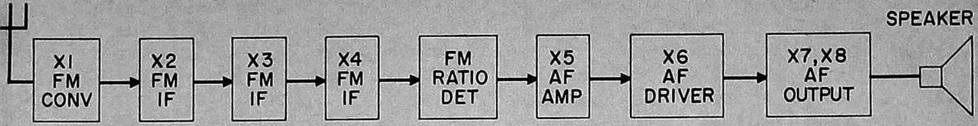


FIG. 2. FM block diagram.

After amplification by X2, X3 and X4, the FM i-f is fed to the ratio detector which uses crystal diodes to separate the audio from the carrier. As you know, the ratio detector responds only to variations in frequency. Therefore, no limiter stage is required.

Both the FM and AM audio signals are channeled through the same audio section, which was described earlier. Since most of the stages are in operation regardless of which of the three bands is in use, it is obvious that only one band can be heard at a time.

Interlocking push-button switches make the necessary circuit changes. To listen to an FM station, you simply push the FM button and tune in the desired station. The switch applies power to the converter, changes X2 to an i-f amplifier and places the ratio detector in the circuit to demodulate the signal. When the BC or SW switch is depressed, the power is removed from the FM converter, and X2 is changed from an i-f amplifier to an AM converter stage. Also, the ratio detector is replaced by the diode detector. Thus, ease of operation is not sacrificed for versatility and compactness.

Now let us look at the schematic diagrams in Figs. 3, 4, 5 and 6. Generally, the circuits are conventional. PNP junction transistors are used in the three basic configurations: common base, common emitter and common collector. The i-f coils and the oscillator transformers are encased shielded units. Thus, we may identify specific windings by their terminal numbers. The "A" near the coils and capacitors simply means that their inductance or capacitance can be adjusted.

FM RECEPTION

The switches on the schematic diagrams are shown in the FM position. Therefore, we will discuss the FM signal path and the FM circuits first. In this manner you will be able to see how the circuits work before we try to visualize any circuit changes.

Converter. Let us look at the schematic of the FM converter and first i-f amplifier in Fig. 3. Assume that an FM signal is being picked up at the FM telescoping antenna at the upper left corner of the schematic. L2 and C10 couple the incoming signal from the antenna to the rf tuning circuits. The dotted lines indicate that the variable capacitors in the three FM tank circuits are ganged together. Whenever the tuning knob is moved, the settings of all of these capacitors are changed simultaneously. The first tuned circuit or preselector consists of L3, the main tuning capacitor, M6, and the antenna trimmer capacitor, A24. All three components are variable. A24 and L3 are adjusted for proper tracking, and M6 tunes in the desired frequency.

The second tuned circuit sharpens the selec-

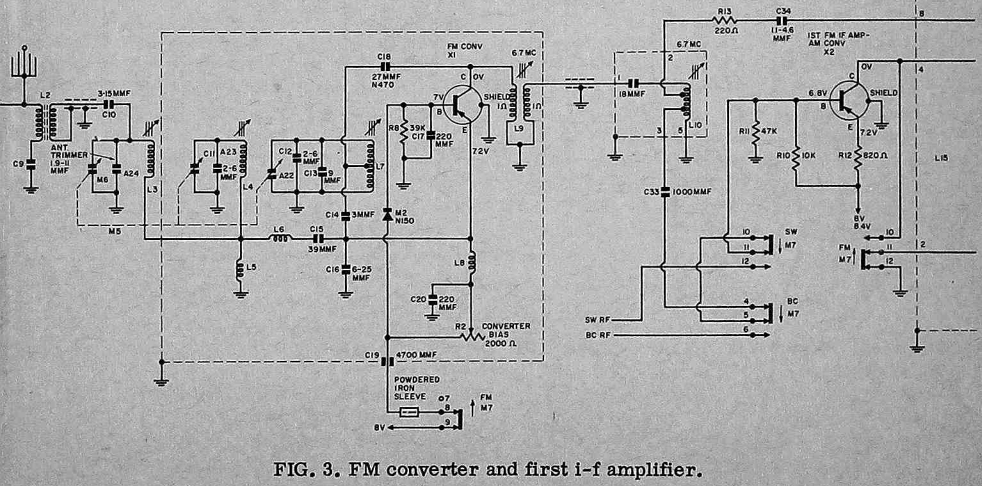


FIG. 3. FM converter and first i-f amplifier.

tivity of the rf input. L4, C11 and A23 oscillate at the same frequency as the preselector circuit. Both tank circuits are returned to ground through the rf choke, L5. This arrangement provides the necessary selectivity without using an rf amplifier stage. The rf is coupled through L6 and C15, and to the input of X1, the FM converter.

X1 operates as a grounded (common) base mixer, oscillator and i-f amplifier. Notice that a positive voltage is applied to both the base and the emitter. R8, C17 and the crystal diode M2 maintain a constant potential on the base. Normally, base current flows through the diode and through terminals 8 and 9 of the FM switch to the battery. Whenever the base voltage exceeds the proper level, the diode ceases to conduct and the current is limited by the relatively high resistance of R8.

The converter bias control, R2, is adjusted so that the converter operates on the non-linear portion of its curve. This non-linear operation is necessary for efficient heterodyning. L8 and C20 make sure that the signal is applied to the emitter of X1 rather than to the battery.

The local oscillator tank circuit consists of A22, C12, C13 and L7. Positive or inphase feedback is taken from the collector of X1 through C18 and applied to the center tap of L7. The output of the tuned circuit is developed across the ac voltage divider C14 and C16. The local oscillator frequency is mixed with the rf signal at the junction of C15 and C16. The main tuning control adjusts both the incoming rf and the frequencies of the local oscillator. The local oscillator operates at 6.7 mc above the rf to produce an i-f of 6.7 mc.

I-F Amplifier. The three i-f amplifiers X2, X3, and X4 (Figs. 3 and 4) are common emitter circuits. Notice that positive voltage is applied to the base and emitter as it is in a common base circuit. The signal, however, is applied to the base. The output signal is developed between the collector and the emitter. The output impedance of this circuit arrangement is higher than the input impedance, therefore, step-down transformers are required to match the impedances between stages.

The base voltage is applied directly to X2, while for X3 and X4, the voltage is applied through the input coils. The voltage divider, R10 and R11, maintains a constant potential at the base of X2. The voltage at the emitter of X4 is filtered by R15, R16, C1, and C35 and applied to terminal 5 of L15. The base voltage of X4 is applied to diode M3 and developed across R22. You may trace the circuit from the top of R21 through R19 to terminal 4 of L16. This is the ground side of the secondary of L16B. Since the coil has less than 1 ohm dc resistance, the voltage at this point is the voltage applied to the base of X4 and the voltage at the top of R21 and R22 is applied to terminal 4 of L16.

The FM i-f signal is fed to the base of X2. The amplified signal appears at the collector.

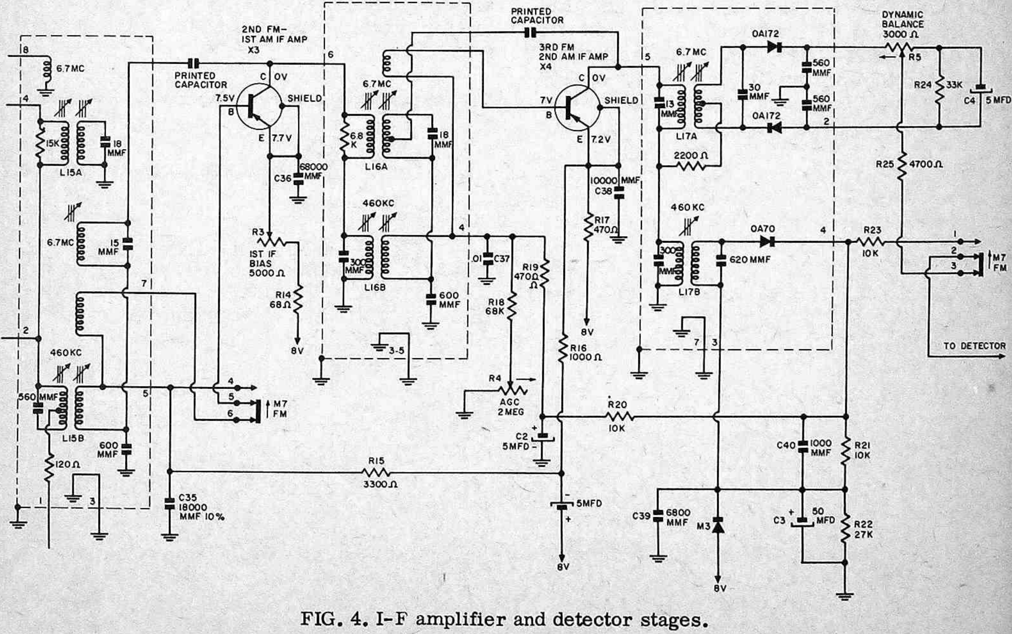


FIG. 4. I-F amplifier and detector stages.

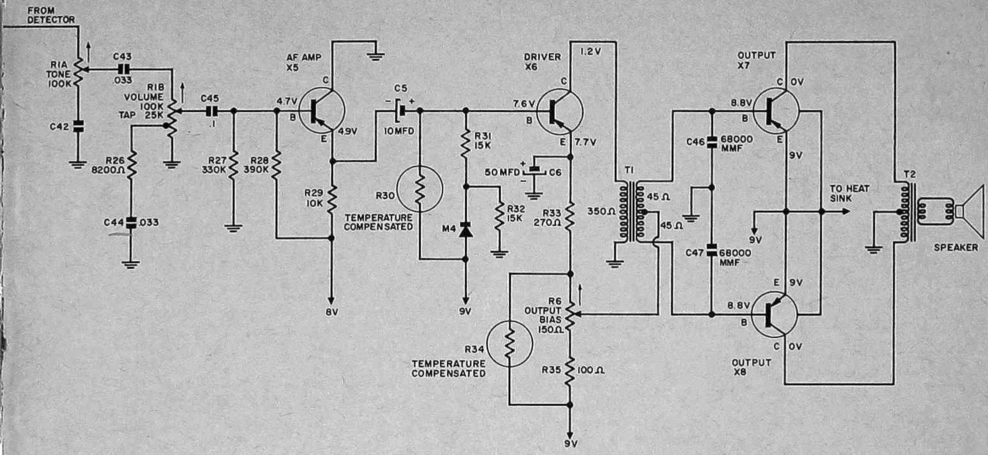


FIG. 5. Audio section.

Terminal 2 of L15 is grounded through terminals 11 and 12 of the FM switch, therefore, the signal is developed across the primary of L15A. The 15-K resistor across the winding lowers the Q and increases the bandpass of the i-f amplifier, X2. Some of the signal is fed back from the upper coil (terminal 8) of L15 to the input. This feedback neutralizes the amplifier to prevent oscillation.

The operation of X3 is almost identical to that of X2. The 6.8-K resistor across the primary of L16A increases the bandwidth of the amplifier and negative feedback prevents oscillation. The bias level control should be adjusted for the highest gain without excessive distortion. The output at the collector is coupled through the primary of L16A to the untuned winding. From terminal 1, the i-f goes to the third i-f amplifier, X4. Then, X4 amplifies the signal and applies it to the primary of the output transformer, L17A.

Ratio Detector. The i-f is coupled from the primary to the secondary of L17A. In addition to this inductive coupling, the signal is also fed through the 2200 ohm resistor connected between the bottom of the primary of L17A and the center tap of the secondary. As the frequency of the signal varies above and below 6.7 mc, the phase relationship of the signal across the secondary and the signal at the center tap changes. This changing phase relationship causes the diodes to conduct unevenly. This results in audio frequency variations at the tap or arm of R5. The audio is coupled through terminals 2 and 3 of the FM switch and then to the audio section.

Audio. The schematic of the audio section is shown in Fig. 5. The input audio is developed across the tone control network R1A and C42. Moving the arm of the potentiometer toward ground causes more of the highs to be shunted to ground. This loss of highs gives the effect of boosting the bass. Conversely, moving the arm of the potentiometer away from ground gives the effect of boosting the highs. C43 couples the audio to the volume control. The voltage developed between the tap of R1B and ground is coupled through C45 to the first audio amplifier, X5.

X5 is a common collector stage. Its operation is closely related to a vacuum tube cathode follower circuit. It has low gain, high input resistance and low output resistance. It is used here to match the input impedance to the driver stage. The output at the emitter of X5 is coupled through C5 to the base of X6.

R31 and R32 maintain the voltage at the base of X6. The resistance of R30 increases as the current through it increases. Thus, X6 is protected from thermal runaway. R34 which is in parallel with R6 and R35 has the same function in the emitter circuit. In addition to this, R34 controls the bias voltage applied to the output stage. T1 couples the audio signal to the output stage. It is a step-down transformer to match the input of the final amplifiers to the output of X6. Varying the potentiometer R6 varies the voltage at the center tap of T1. This is the bias voltage applied to X7 and X8. After amplification by the output stage, the audio is fed to the loudspeaker and reproduced.

BROADCAST RECEPTION

By comparing Fig. 2 with Fig. 1 you can see that the AM operation is almost exactly like the FM. There are some noteworthy differences, however. For our discussion of the broadcast band (BC), assume that all sections of the BC and FM switches are in the po-

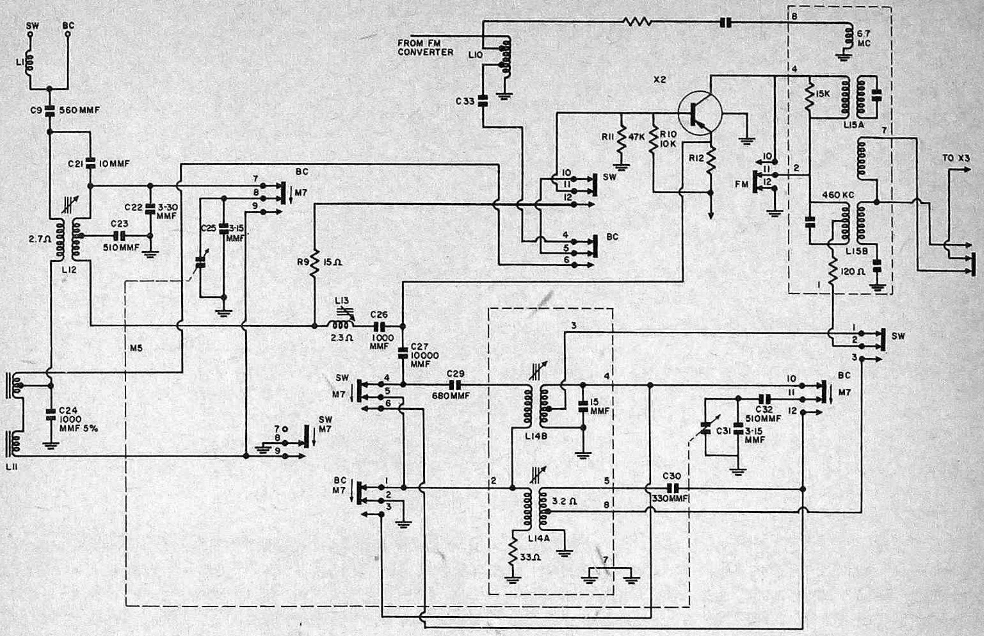


FIG. 6. AM converter stage.

sitions opposite from those shown in the schematics in Figs. 3, 4 and 6.

From the antenna in Fig. 6, the broadcast band rf is fed through the primary winding of L12 to L11. L11 is the built in "loopstick" antenna. This is the inductor in the rf tuning circuit. With the BC switch depressed, the main tuning capacitor, M5, and the trimmer, C25, are in series with L11. The resonant frequency of this circuit is determined by the position of the tuning capacitor. Thus the tuning capacitor selects the input frequency. Terminal 7 of the BC switch is open. Therefore, the secondary of L12 does not affect the circuit. The signal at the top of L12 is fed directly to terminal 6 of the BC switch and through the SW switch to the base of X2, the AM converter.

Converter. X2 is now the AM converter stage. The rf is fed from the rf tuning circuit to the base of the transistor. This signal is mixed with the local oscillator within the transistor and the i-f appears at the collector. L14A is the broadcast band oscillator transformer. The feedback is taken from the tap near the bottom of the 460-kc i-f output transformer, L15B. It is then fed through the 120-ohm resistor and through terminals 1 and 2 of the SW switch to the center tap of the primary of L14A. The top of the primary of the oscillator transformer is connected through terminals 11 and 12 of the BC switch to capacitors C31, C32 and the oscillator tuning capacitor. This circuit is parallel resonant. The frequency is 460 kc above the frequency of the rf input. The position of the main tuning capacitor determines the local oscillator frequency. The frequency is coupled from the primary to the secondary and through terminals 4 and 5 of the SW switch to the emitter of X2. Thus, we have the rf applied to the base and the local oscillator frequency fed to the emitter of X2. Then, X2 heterodynes the signals and amplifies the 460-kc i-f, which appears at the collector. Terminals 10 and 11 of the FM switch are closed. Therefore, the i-f goes directly from the collector of X2 to the primary of the 460-kc i-f transformer, L15B. The signal is coupled inductively to the secondary of L15B and through terminals 4 and 5 of the FM switch to the base of the second i-f amplifier.

I-F Amplifiers. The actual operation of X3 and X4 is the same on AM as it is on FM. The lower frequency does result in higher gain and higher stability, however. Refer to Fig. 4. The 460-kc signal is amplified by X3 and coupled to X4. The coupling is from the secondary of L16B through the upper untuned coil to the base of X4. The output of X4 is fed through the primary of the 6.7 mc i-f output transformer, L17A, to the 460-kc primary, L17B. The i-f is then coupled to the secondary and applied to the diode detector circuit.

Detector. The diode at the secondary of L17B rectifies the i-f. Current flowing up through

R21 and R22 develops a positive voltage at the junction of R21 and R23. C40 filters out the i-f, leaving only the audio signal. The amplitude of the i-f carrier determines the voltage at the top of R21. When the carrier is weak, the signal is less positive than it is when the carrier signal is strong. The detected audio voltage is filtered by R19, R20, C2 and C37 and applied to X4 through terminal 4 of the i-f transformer L16 as an AGC voltage. R4 and R18 set the relative degree of regulation. As potentiometer R4 is turned toward ground, the AGC has less effect on the gain of X4. With R4 turned away from ground, the AGC will control the gain of X4 so that slight variations in rf signal strength will be compensated for by the i-f amplifier. The detector audio output passes from terminals 1 to 2 of the FM switch and to the audio amplifier section in Fig. 5.

SHORT-WAVE RECEPTION

Earlier we mentioned that both the SW and broadcast band were treated as AM. Naturally, because of their different frequency ranges, distinction must be made in the converter stage. This is the only stage which must be changed.

The short-wave antenna is attached to coil L1 in Fig. 6. This connection permits the use of a shorter antenna as L1 electrically increases its length. The short-wave signal is fed to the primary of L12. This time, the BC switch is in the position shown and the SW switch is depressed. Therefore, C25 and the tuning capacitor are in parallel with the secondary of L12. This parallel-tuned circuit resonates at the frequency determined by the setting of the main tuning capacitor. The bottom of L11 is grounded through terminals 8 and 9 of the SW switch. Thus, L11 has no effect on the rf. The rf is fed from the bottom of the secondary of L12 through R9 to the SW switch. Terminals 11 and 12 are closed, so the signal is fed to the base of X2.

Meanwhile, the SW band oscillator is in operation. The feedback is from the tap on the primary of the first i-f transformer, L15B. The feedback is coupled through the 120-ohm resistor and through terminals 2 and 3 of the SW switch to the tap on the primary of the SW oscillator transformer, L14B. Now that the BC switch is released, contacts 10 and 11 place the capacitor network C31, C32 and the oscillator tuning capacitor in parallel with the primary of L14B. Thus, the primary winding resonates at the proper frequency, which is 460 kc above the incoming rf. The bottom of the secondary is grounded through terminals 1 and 2 of the BC switch. Terminals 4 and 5 of the SW switch are open. Therefore, the local oscillator frequency is fed through C29 and C27 to the emitter of X2. X2 heterodynes the rf and the local oscillator frequency and feeds the i-f to the i-f amplifiers. From the output of the converter, the SW signal path is the same as the AM broadcast band.

CONCLUSION

We have discussed the circuit of this receiver in each of its three modes of operation. You now have a clearer idea of how the stages work. Undoubtedly, you will find some of the information useful when you service this type of set. A knowledge of how the circuits work and how the switches alter the operation of each stage is often all the information you need to isolate the defect to one stage with a minimum of test equipment.

MAN-MADE SAPPHIRES TO SHIELD SATELLITE SOLAR POWER CELLS

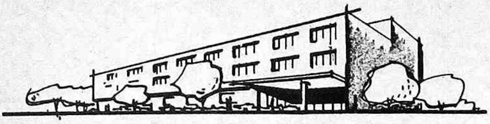
Thousands of pieces of man-made sapphire will cover the surface of the communications satellites now being developed by Bell Telephone Laboratories. The sapphires are expected to protect solar cells from space radiation, enabling "working" telephone satellites to endure the rigors of space for 10 years or more.

Covering the solar cells, invented at Bell Laboratories, will be an equal number of slices of man-made, clear sapphire. The sapphire does not cost significantly more than other high-quality materials that might be used, and only about one-third the cost of the solar cells themselves. Sapphire will convey heat away, preventing the cells from being overheated in long periods of continuous sunlight. Another advantage is that the use of sapphire overcomes the effects of very rapid and extreme changes of temperature in space.

HOW YOU CAN HELP NRI GIVE FASTER SERVICE

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

NRI ALUMNI NEWS



Frank Skolnik	President
Walter Berbee	Vice President
James Kelley	Vice President
J. Arthur Ragsdale	Vice President
David Spitzer	Vice President
Theodore E. Rose	Executive Sect.

Chapter Chatter

DETROIT CHAPTER members were intrigued with a demonstration by Leo Blevins on building an intercom from old table radio receivers. He also demonstrated the new NRI transistor intercom. A couple of meetings were scheduled to be taken up working with the NRI intercom.

FLINT (SAGINAW VALLEY) CHAPTER is continuing to feature lectures and demonstrations by Professor De Jenko of the University of Flint in its programs, and the members always come away from each meeting feeling that they have acquired new and useful information. They are free to ask Professor De Jenko for help on their Radio-TV theory or servicing problems and he is always glad to give it.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER devoted an entire meeting to a demonstration on taking peak to peak voltage measurements on a TV receiver with an oscilloscope. The demonstration was ably conducted by the Chapter's program chairman, George Fulks.

LOS ANGELES CHAPTER'S officers for 1961 were all re-elected to serve for the current year. They are: Eugene DeCaussin, Chairman; William G. Edwards, Vice Chairman; Frederick A. Tevis, Treasurer; and Earl E. Dycus, Secretary.

Another one of the Chapter's parties for its members and their wives was planned, to which everyone was to bring refreshments of their own choice. This party has probably already been held by now. The members and their wives always enjoy these get-togethers.

Three new members have joined the Chapter: Gerry Dougherty, Longbeach; Theodore Link, L. A.; and J. T. Lathema, Burbank. It's a pleasure to welcome these gentlemen as members of the Chapter.

Earl Dycus' wife, in her search for antiques, came across two 7-inch TV receivers that are becoming collectors' items. One of them is a Motorola portable and the other a Belmont, both in need of minor repairs. They have now been made available as ideal projects for meetings in the current year and should create a great deal of interest among the members.

MILWAUKEE CHAPTER wishes to call particular attention to a change in its meeting place. Meetings were formerly held at the Radio-TV Store and Shop of S. J. Petrich, 5901 W. Vliet Street. The meetings are now held at the home of Treasurer Louis Sponer, 617 N. 60th St. For any additional information desired telephone Mr. Sponer at SP 4-3289.

MINNEAPOLIS-ST. PAUL (TWIN CITY) CHAPTER for the time being is continuing its discussion type meetings with John Berka as leader, since members feel that they get the greatest benefits from these meetings.

The Chapter has adopted a proposal making it easier on new members who join the Chapter after the regular deadline for paying dues. Such members may attend meetings for only fifty cents per month until the next regular dues payment date.

A banquet has been planned to be held either in February or March for Chapter members and their wives or sweethearts. These banquets have always been very popular with the members and their wives.

NEW YORK CITY CHAPTER re-elected its entire slate of officers to serve for 1962, with the single exception of Sam Jacobs who was unable to continue in office as Secretary. The officers are: David Spitzer, Chairman, Tom Hull, Executive Chairman; Frank Zimmer, 1st Vice Chairman; James Eaddy, 2nd Vice Chairman; Alva Bonham, Secretary; and Frank Catalano, Treasurer. Our best wishes to these officers!

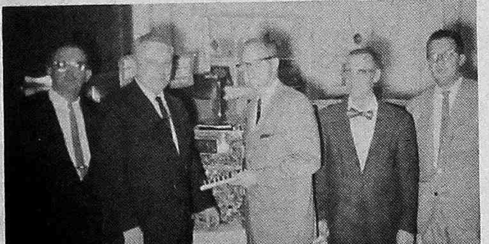
At the conclusion of elections Sam Antman asked for the floor to pay a compliment and to express appreciation to Jim Eaddy, who is always so helpful and willing to repair and correct transistor set troubles that the members bring in, and does so without charge or compensation of any sort. Sam was well supported in this tribute by the other members.

Tom Hull then resumed his meaty lectures and demonstrations on the Chapter's RCA Dynamic Demonstrator. James Eaddy delivered another of his talks on troubleshooting and the experience he had with a portable Motorola TV receiver that had a silicon rectifier circuit-breaker in its circuit.

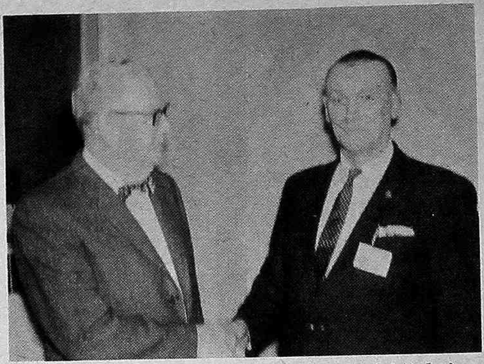
Emil Savino was admitted as the newest member of the Chapter. A warm welcome to you, Emil!

PHILADELPHIA-CAMDEN CHAPTER has been consistently successful in putting on outstanding programs with lectures and demonstrations conducted by representatives of Radio-TV manufacturers and distributors, who attend the meetings as guests. This has been due mostly to the efforts of Recording Secretary Jules Cohen. One such program was conducted by Al Steinberg of Albert Steinberg and Company and Marty Weinberg, Representative of the Bogen-Presto Co., University Loud Speakers, and Jackson Instruments. This program was all about Multiplex. The members were told what it is, how it will affect Radio-TV servicemen and what they will have to do. Another such program was one in which RCA representatives participated. This program was equally absorbing.

The Chapter held its usual year-end party at which officers for the ensuing year are elected. The successful candidates this year were John Pirrung, Chairman; Fred Seganti, Vice-Chairman; Jules Cohen, Recording Secretary; Joe Burke, Financial Secretary; Charles Fehn, Librarian; George Dolnik, Assistant Librarian; Charles Wells, Sergeant at Arms; and Joe Giba, Assistant Sergeant at Arms. NRIAA Executive Secretary Ted Rose, who attended this meeting, administered the oath of office to the new officers.



RCA representatives who staged an excellent program on RCA color TV for Philadelphia-Camden Chapter. L to r: Bill Powell, Field Service; Jack McCarthy, Sales Manager for color TV; Ty Yonkers, General Manager electronic parts; Al Wanamaker, Field Service; and Joe Novella, Sales, Parts Division.



National President of the NRIAA (right) being congratulated by NRIAA Executive Secretary Ted Rose after administering the oath of office to him.

Incidentally, there were eighty-eight members present at this meeting.

Then came the highlight of the evening, a talk and demonstration by Bill Heath of Westinghouse on the new 1962 Westinghouse portable TV receivers. Mr. Heath is an honorary member of the Chapter and is a frequent speaker at the meetings. At this particular meeting he gave his usual fine performance and it was easy to see why he is always in demand as a speaker by the members. Everyone's attention was then turned to the buffet supper consisting of hot dogs and sauerkraut, salad, all kinds of cold cuts and trimmings, with plenty of beer and soft drinks. It is always amazing to witness how much food these fellows can put away.

Despite its large size, the chapter continues to get more and more new members. The latest is Christie Urback (a real old-timer who studied with NRI way back in 1918), Francis Banko, Tony LaMucchio, Henry Denby, Charles Campbell, W. L. Johnson, and Walter Wiacek. A hearty welcome to these gentlemen!

PITTSBURGH CHAPTER held its customary Christmas Party and it was very well attended.

It is at this meeting that the officers for the following year are elected. The successful candidates this time were Howard Tate, Chairman; Wm. Lundy, Vice-Chairman; James Wheeler, Secretary; Jack Fox, Treasurer; Wm. Sames, Joseph Burnelis, and Ed Lowthers, Board Members. Our congratulations, gentlemen!

The party was unusual in one respect this year. The members proudly witnessed the swearing in of a fellow-member, Frank Skolnik, as National President of the NRI

Pittsburgh Chapter officers for 1962. Seated, l to r: Joseph Burnelis, Ed Lowther, Jack Fox. Standing: William Sames, Howard Tate, William Lundy, Jim Wheeler.

Alumni Association for 1962. Executive Secretary Ted Rose, who was present as a guest, administered the oath of office.

The members then proceeded to the heavily-laden buffet table and nobody left hungry.

SAN ANTONIO ALAMO CHAPTER has been featuring a series of Army Signal Corps Technical training films on radio-television-electronics at its meetings. Films on "tuned circuits" and "basic principles of frequency modulation" were shown at one meeting. These are excellent films containing much useful and practical information.

To enable members to get better acquainted with one another, it has been suggested that a personal column be included in the Chapter's monthly bulletin. A classified ad section has also been proposed in which any member of the Chapter may list equipment he may wish to buy or sell.

The Chapter has recently admitted Nicolas Mesquiti, Sidney Autry, and Gordon Iverson to membership. Glad to number you among the membership, gentlemen!

The members were sorry to lose Tom Love, a charter member of the Chapter and its first treasurer, who was transferred to Ft. Worth. Jesse DeLao was appointed to succeed him. The Chapter now holds only one meeting a month, on the second Thursday of each month, instead of on the second and fourth of each month as heretofore. All members, and all NRI students and graduates who may wish to attend a meeting as guests, please take note.

SAN FRANCISCO CHAPTER members enjoyed a film on transistors, showing their use in computers and methods of servicing transistors. Exhibition of this film was made possible by fellow-members Andy Royal, who brought the film, and Sid Mahler, who supplied the projector.

The officers elected for 1962 are Edward Persau, Chairman; Peter Salvotti, Vice Chairman; J. Arthur Ragsdale, Secretary; Charles Kilgore, Treasurer; George Law and Sidney Mahler, Finance Committee. Congratulations to these officers!

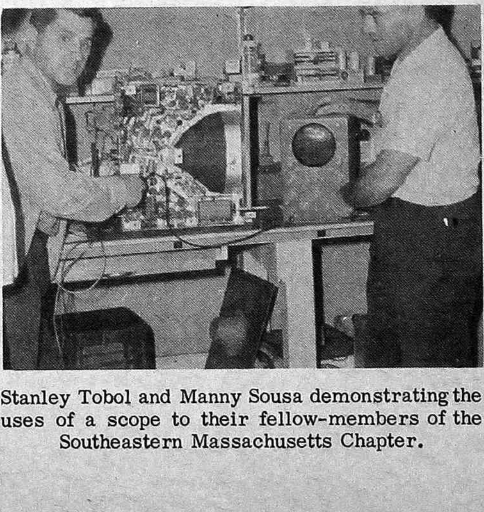
Demonstration of the circuit and operation of a three-transistor radio by Chapter member James McIntyre was scheduled for the next meeting.

SOUTHEASTERN MASSACHUSETTS CHAPTER welcomed guest speaker Robert Hendrickson, manufacturer's representative for Blonder-Tongue Laboratories, who made a very interesting and informative talk on master antenna systems. Mr. Hendrickson pointed out that specialization in the installation of master antenna systems for multiple dwellings and in fringe areas could be a very profitable operation.

The latest member to be admitted to membership in the Chapter is Ernest Grimes, Swansea. Welcome to the Chapter, Ernest!

SPRINGFIELD (MASS) CHAPTER held its annual banquet at Oaks Inn, Springfield. At this particular annual banquet the attending members brought their wives. The food was delicious, the surroundings perfect. You could tell that the wives were pleased and really enjoyed themselves.

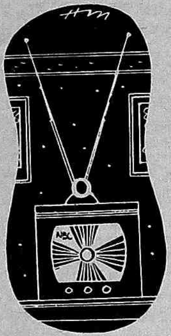
After the banquet the members and guests repaired to the Winchester Room where a short business meeting was held. Executive Secretary Ted Rose, who was present as a guest, made a brief address to the group. Howard Smith then took up the next hour to show his 16mm colorfilms of the Thousand Islands, Ausable Chasm, the St. Lawrence Seaway and Gloucester. This was highly entertaining. Along with his other many accomplishments, Howard is an expert photographer and these films are beautiful.



Stanley Tobol and Manny Sousa demonstrating the uses of a scope to their fellow-members of the Southeastern Massachusetts Chapter.

Members wives participated in still another event. That was the Christmas Party held each year by the Chapter. This was the only meeting held in December because of the Holiday season.

At one recent Shop Meeting five TV receivers were brought in by members; four of them were repaired and one diagnosed. Three transistor sets and one Radio receiver were also repaired at this meeting. At the following Shop Meeting four TV Receivers and one Radio were brought in by members and all of them were repaired. These Shop Meetings are a valuable and important function of the Chapter.



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: Edwin Wick, 4928 W. Drummond Pl., Chicago, Ill.

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

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month, Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: William R. Jones, 610 Thomson St., Flint, Mich.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month, at homes or shops of its members. Chairman: Harold J. Rosenberger, R. D. 1, Waynesboro, Pa., 1650R11.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, 5938 Sunset Blvd., L. A. Chairman: Eugene DeCaussin, 5870 Franklin Ave., Apt. 203, Hollywood, Calif.

MILWAUKEE CHAPTER meets 8:00 P. M., 3rd Tuesday of each month, at home of Treasurer Louis Sponer, 617 N. 60th St., Wauwatosa, telephone SP4-3289. Chairman: Philip Rinke, RFD 3, Box 356, Pewaukee, Wis.

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

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

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

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P. M., 2nd and 4th Monday of each month, 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: Howard Tate, 615 Caryl Dr., Pittsburgh, Pennsylvania.

SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 2nd Thursday of each month, National Cash Register Co., 436 S. Main Ave., San Antonio. Chairman: Thomas DuBose, 127 Harcourt, San Antonio.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: E. J. Persau, 1224 Wayland St., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month, home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Edward Bednarz, 184 Grinnel St., Fall River, Mass.

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

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