NATIONAL RADIO NEWS

IN THIS ISSUE

Adding Extension Loudspeakers

Value of Graphs—How to Use Them

Alumni Association News

Dec.-Jan.
1948-1949

VOL. 13
No. 6

Christmas Greetings

To many of us, the Yuletide season is a time for reunions with relatives and friends. We gather around the big dining-room table for a long-to-be-remembered feast, then relax for a general roundtable discussion of how each and every one is getting along. Our successes seem bigger than ever at this time when they are discussed by those whom we regard most highly.

At Christmas, too, we slow the mad pace of life a bit to see if we can be of help to others who may be needy. A cheery greeting, a few words of encouragement, a small gift, often change despair to happiness for those less fortunate.

And soon the New Year will roll around, bringing with it new opportunities to gain happiness, to acquire comforts and even luxuries for ourselves and our family. Resolve to take these opportunities, to prepare for more profitable work, to get an early start towards making the next Yuletide season the happiest of them all.

May the spirit of Christmas be with you. And may the New Year bring you good health and genuine happiness. To you and yours my sincere wish is—Merry Christmas and Happy New Year.

J. E. Smith, *President.*

Adding Extension Loudspeakers

By

DON E. QUADE

NRI Instruction Department

Don E. Quade

THE addition of an extension loudspeaker to a radio receiver is not a difficult job and holds interesting possibilities of profitable work. The installations can be sold without difficulty to owners of radio receivers who want extra speakers in a cellar or place outside of the room in which the radio is located. The most successful results will be obtained on a radio receiver which is a console, having plenty of output power, but a speaker may also be added to an a.c.-d.c. type of set and, as a matter of fact, it is quite surprising what a vast improvement in the tonal quality can be obtained by hooking up a loudspeaker of the 10-inch or 12-inch type to a small a.c.-d.c. set. This is particularly true if the speaker is mounted on an adequate baffle or in a good cabinet.

The owner of the radio may want the extension loudspeaker disconnected temporarily, or the main loudspeaker of the radio disconnected. The job of switching can be done using appropriate circuits which will be described.

The type of speaker selected for this work usually is a permanent magnet dynamic because of the good quality reproduction that the speaker will afford. In addition, the p.m. speaker does not have a field coil and no field supply is required.

When the loudspeaker is used in a room where the noise level is high, people are dancing and talking, a high volume level is necessary. A small speaker which does not have sufficient power handling ability will not be able to do a good job of reproducing sound in such a room. In most cases, a reasonably large speaker is desirable.

The types of speakers in common use in radio receivers are the permanent magnet dynamic and the electrodynamic. Receivers using electrodynamic speakers provide for energizing the field coil of the electrodynamic speaker. If the field of an additional speaker is added to the radio receiver circuit, the normal voltage relationships no longer will exist and will be changed by the presence of the additional speaker field. For this reason, the electrodynamic type of speaker which does not have its own field power supply is not considered suitable as an auxiliary type and seldom is used for such service.

We will consider the addition of permanent magnet dynamic and separately excited electrodynamic speakers. The separately excited electrodynamic speaker is a type having its own field supply built into the base of the speaker itself. Speakers of this type commonly are used in public address work and may be obtained for servicing purposes and speaker addition work.

Adding a P.M. Speaker. The p.m. speaker has a low impedance voice coil and may be connected easily without resorting to blocking condensers. The circuit of Figure 1 is suitable. If switch S_1 has Arm A thrown to position C, the radio speaker will be operated. If Arm A is thrown to position B, the radio speaker is "dead." Switch S_2 controls the extra speaker. With S_2 closed, the extra speaker is supplied with audio power and will be heard. With S_2 open, the extra speaker is "dead." Using arrangements of this sort, there will be some impedance mismatching and a slight loss of power when both speakers are being operated. The results obtained, however, will be fairly

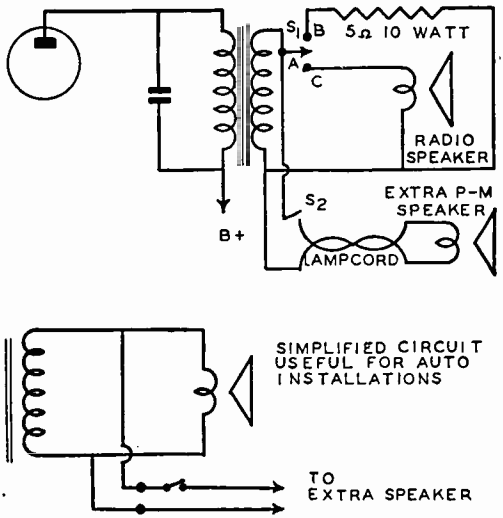


Fig. 1

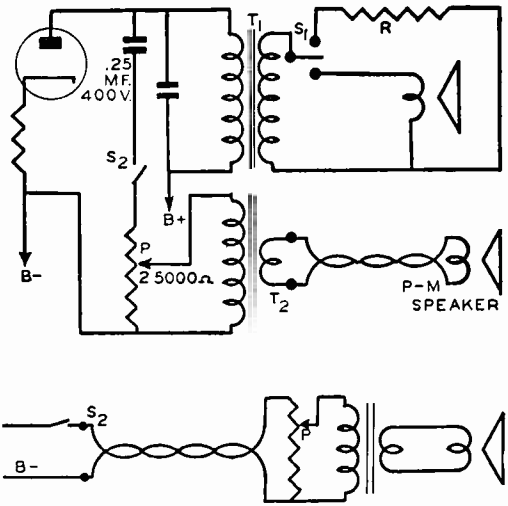


Fig. 2

satisfactory from a practical viewpoint and on the basis of experience are entirely workable.

Switch S_1 and the 5-ohm, 10-watt resistor will not be required in many cases because of the fact that the owner of the radio will often simply want to have an arrangement whereby the extra speaker can be cut on or off at will. In such cases, we may use the simplified circuit illustrated in the lower part of Figure 1. One practical application of this circuit is in auto radio installations where an additional speaker is to be put in the rear of the car. The speaker can be mounted in the shelf behind the rear seat so that listeners in the back section of the automobile may listen to the radio comfortably. At the same time, people in the front of the car, near the main loudspeaker, will also be able to hear without being subjected to blasting sounds from the speaker in the front of the car. This sort of mounting, however, may be difficult and the mounting job should be done by qualified automobile mechanics.

Using the voice coil connection in Figure 1, it makes no difference whether the output stage is single-ended or push-pull because of the fact that the secondary of the output transformer, in either case, will feed directly into the voice coil of the radio loudspeaker or the voice coil of the extra loudspeaker. There is no high d.c. voltage present —only signal voltages. These signal voltages can be conveniently handled using the indicated circuit.

If the owner wants to control the volume of a distant extension loudspeaker, more complicated circuits are necessary. In practice, the use of volume controls in voice coil circuits is found to be undesirable because a current in the voice coil circuit is apt to be very high compared with the signal current values in other parts of the radio and a high wattage rating of the control is necessary. Such controls are costly. They are also likely to become noisy in operation. A means of getting around the difficulty and using standard volume control circuits is illustrated in Figure 2. The volume level of a p.m. speaker is controlled by means of potentiometer P which may have a value of about 25,000 ohms. Switch S_1 permits turning the regular loudspeaker of the radio on and off. Resistor R may be a 5-ohm, 10-watt type in most cases. Transformer T_1 is used for matching the output tube to the original loudspeaker and T_2 is an output transformer on the extra loudspeaker. T_2 should have a turns ratio such that it will match the voice coil load to the plate circuit impedance of the output tube. In ordering the transformer, simply give the radio distributor the value of the voice coil resistance of the extension loudspeaker and state that you want an output transformer which will match the speaker to a single 45, single 6F6, push-pull 45's, push-pull 6F6's, or whatever output tube circuit may be used in the radio.

Where a push-pull stage is encountered, the circuit in Figure 3 is used. Output transformer T_2 matches the output tubes to the extension speaker. Switch S_1 serves as it did in the previous examples to turn on or off the main loudspeaker. Switch S_2 permits turning on or off the extension speaker. By means of potentiometer P, the signal level at the extension speaker can be controlled. If the primary of T_2 is equipped with a center

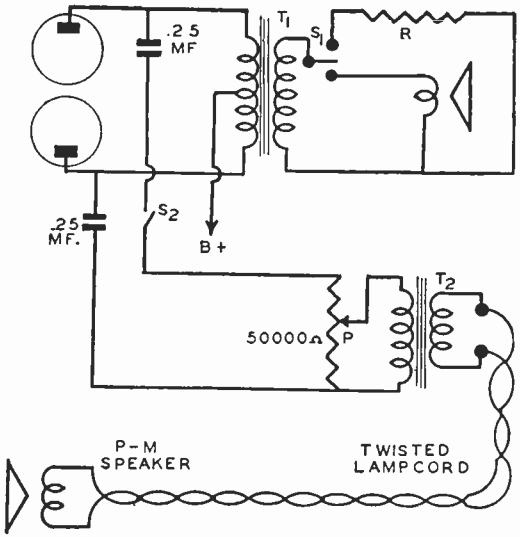


Fig. 3

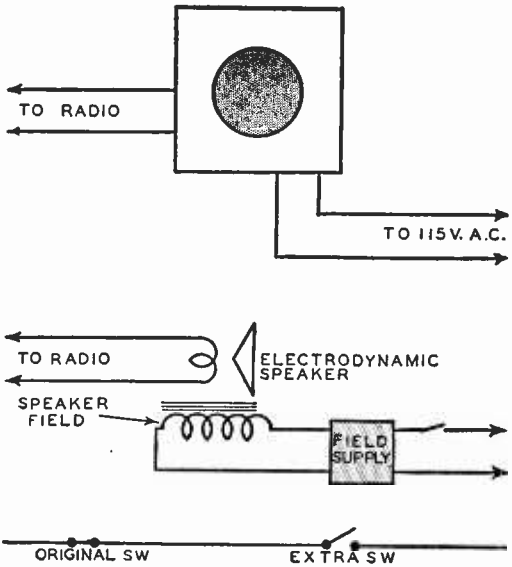


Fig. 4

tap, this lead is disregarded, being taped up and tucked out of the way.

In Figure 2 and Figure 3 the volume controls governing the volume levels of the extension speakers are located close to the radio receiver and the output stages. It may be more convenient, in many cases, to control the volume at the extension speaker. An alternate arrangement is shown at the bottom of Figure 2.

Adding an Electrodynamic Speaker. The addition of an electrodynamic speaker not equipped with its own field supply is not recommended. A speaker which has its own supply may be added to the radio using the same method previously described in the addition of a p.m. speaker, but there will be the necessity of connecting the power supply to an a.c. line as shown in Figure 4. The field supply may consist of a step-down transformer which supplies about 20 volts to a copper-oxide dry disc rectifier with an output voltage of approximately 6 volts. Or, if desired, the power supply used in the speaker may be a full-wave rectifier type having a power transformer and filter condenser-choke coil system. In either case, the a.c. line must be connected to the special power supply to permit operation of the speaker. Because of this inconvenience, in making a special power connection, the p.m. speaker is more often used than the electrodynamic type.

If a 110-volt d.c. line is available and the speaker field resistance is between 1500 and 3000 ohms, the field may be connected directly across the d.c. line. It may be found, on some occasions, that when this is done the line noise is very evident. Connecting a 2 microfarad, 600 volt paper condenser directly across the speaker field will help in getting rid of the noise. Where high intensity noise is present, the filter may not be effective and a p.m. speaker should be used instead of the electrodynamic type. The original switch in Figure 4 would be mounted on the power supply chassis. It would be inconvenient to reach around to the rear of the speaker to turn the power on and off. Therefore, an extra switch may be added as shown in the lower part of the Figure. The original switch is closed and allowed to remain closed at all times. However, if the owner of the equipment wants to turn off the apparatus he can do so and allow it to remain off—without the possibility of having an unauthorized person turn the speaker on.

Not the least important part of this work is mounting the loudspeaker properly.

Mounting the Speaker. A speaker mounted in a small walnut cabinet often can be purchased without difficulty. The speaker cabinet can be placed on top of a bar, bureau or any other piece of furniture. It may be mounted by means of brackets if desired. As an illustration, in one installation in a restaurant the cabinet was mounted on a shelf as shown in Figure 5. To prevent the speaker coming loose from vibration as people walked by, and safeguarding against its falling on someone, the speaker was attached to the shelf by means of small metal brackets which may be obtained from any hardware store. The wood screws may be about three-eighths of

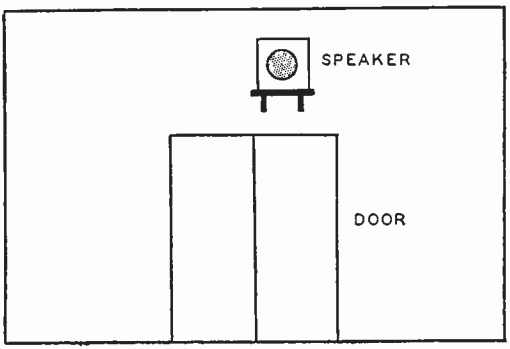
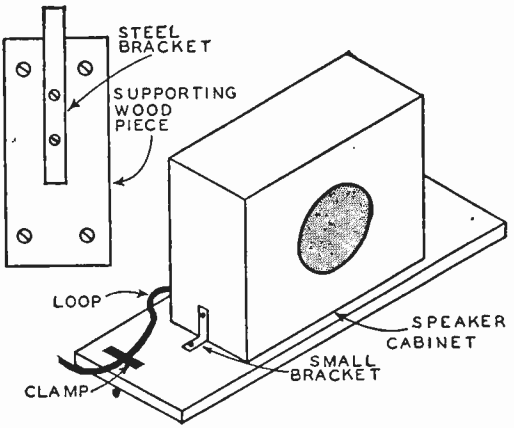


Fig. 5



an inch in length. If heavy brackets are used, the screws will need to be longer but the problem is purely mechanical and can easily be worked out after a little thought is given to it. If the wall to which the shelf brackets are screwed is wood, the mounting brackets for the shelf can easily be attached to the wall. If the wall is plaster, special screws obtainable from a hardware store can be used. It may also be desirable to mount two small pieces of wood to the wall and then to fasten the brackets to the wood support. This method of mounting is illustrated in Figure 6. The wires to the speaker should be left sufficiently long to permit easily removing the loudspeaker for repair or replacement purposes. A small loop in the wire, or slack, can be allowed as shown in the drawing. Usually, it will not be desirable to have a closed back for the cabinet because of the tendency such a back would have to cause excessive boominess and a muffle tone. For this reason most cabinets have open bottoms or open backs. In some places, where the speaker is used temporarily, it may be permissible to use an open type of flat baffle as used in Figure 7. The baffle can be secured to a wall by means of wood and steel brackets. The center point on the flat baffle is found by drawing two lines from each corner as illustrated in the sketch. Next, a vertical and a horizontal line may be drawn as shown to get reference points at the top, bottom and side. For mounting purposes, the use of a pair of 2" x 4" wooden standoff boards has been found satisfactory. Two by four's are sufficiently strong to avoid clumsiness in construction.

A good job of mounting the speaker requires that two men work together. Therefore, get someone to help you in the work. A stepladder, woodsaw, carpenter's hammer, nails, etc., should be on hand.

A solid mounting is desirable for still another reason—elimination of noise production. If the speaker is loose or adjacent parts are loose, the

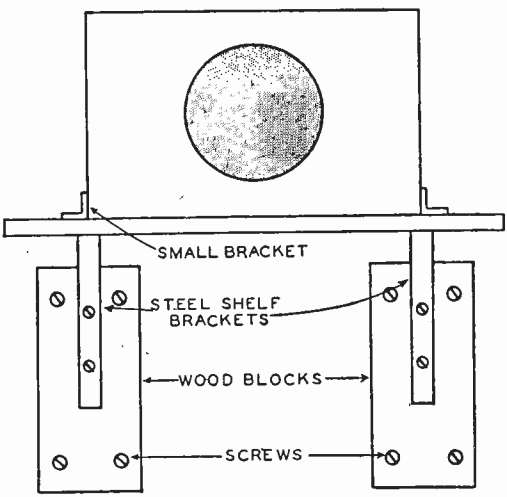


Fig. 6

sound vibrations may reach the loose parts and cause them to rattle, thus producing noise. This noise is likely to be very irritating and must be eliminated.

No mention has been made thus far of the hole in the center of the baffle. The reason is that usually the hole is already in the purchased baffle board and you don't need to make it. However, if you should for any reason find it necessary to make a hole and you don't have any special means of doing it, the following procedure may be used. Take a piece of string to one end of which is attached a black crayon. Hold one end of the string tight against the center point on the baffle board. Next, swing the taut end of the string with the crayon at the end of it so that a circle is

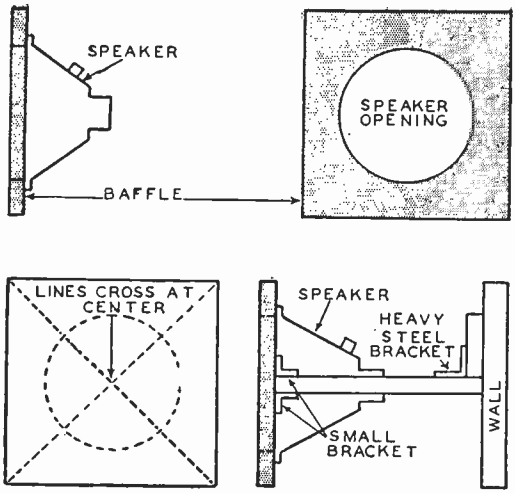


Fig. 7

marked out on the board. A keyhole saw may now be used to saw out the hole. First drill a small hole so that you can insert the point of the saw. Then, work the saw around the circle to cut out the large diameter hole. To start the saw, you may use a 1" diameter hole near the edge of the large circle. An old console type of radio cabinet may be used, on occasion, for housing the additional speaker. The original holes in the front of the cabinet can be covered up with an ornamental plate. Special speaker cabinets of the type which rest on the floor also are available.

A speaker may be mounted in the side of an artificial fireplace as shown in Figure 8. A hole is cut in the side of the fireplace. It's also possible to cut a hole in the panel over the fireplace opening so that the sound waves of the speaker come down from the fireplace panel and then go out, giving not only the illusion of sound coming from an unknown place, but also providing very good tonal quality. The action is illustrated clearly in Figure 8. Using the top mounting, no

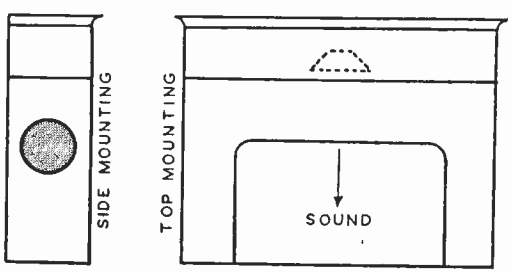


Fig. 8

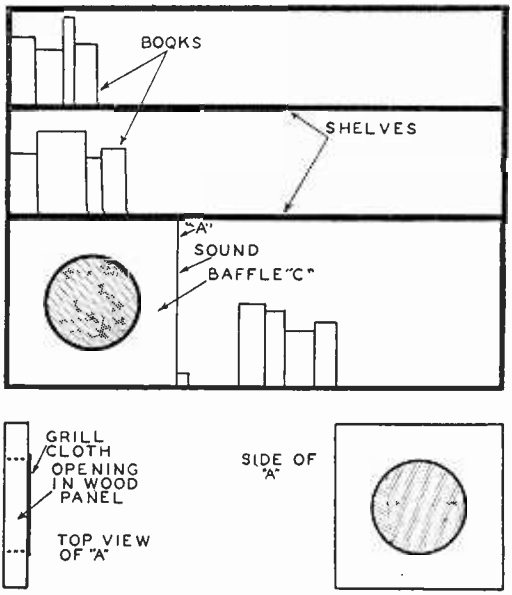


Fig. 9

grill will be needed, but if the side mounting method is employed the speaker opening should be covered with some sort of grill work to keep out dust and dirt.

Speakers may be mounted flush with the walls of a room if a hole is cut in the wall. A ceiling mounting also is possible. However, mounting methods of this type are quite difficult and are not recommended.

A practical method of mounting a speaker is illustrated in Figure 9. The speaker is located in a book-shelf arrangement. The right side of the baffle panel should be left open. If desired a grill cloth may be stretched across the opening to keep dust and dirt out of the speaker.

It is essential, however, that an opening be provided so that sound waves will not be trapped in the box-like cavity. Unless an opening is provided, an excessively boomy tone and considerable distortion may be the result.

The speaker is mounted so that its front faces towards you as you look directly at the bookshelf from outside. A small block of wood may be placed at the right to provide a small space between the books and the right side of the box-like enclosure holding the speaker. In this way, a column of air will be allowed to exist in the free space between "A" and the books, thus preventing boominess and distortion.

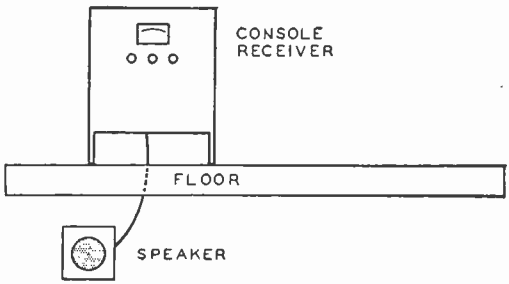


Fig. 10

Although not exactly related to mounting the speaker, the drilling of a hole in the floor of a room may be necessary as shown in Figure 10. A hand drill of heavy construction can be used but usually it is better to use a brace and bit of the type commonly employed by carpenters, building electricians and telephone installation men. Avoid drilling holes without good reason. Make a careful survey first of the location of the radio and the location of the extension loudspeaker. By thinking about the job beforehand and planning it efficiently, you can cut down the amount of work required in order to do the job properly.

n r i

I won't, is a tramp,
I can't, is a quitter,
I don't know, is lazy,
I wish I could, is a wisher,
I might, is waking up,
I will try, is on his feet,
I can, is on his way,
I will, is at work.
I did, is now the boss.

n r i

AN AMERICAN POTPOURRI!

By Grant F. Shay

Reprinted through courtesy of the magazine *Spinning Reels.*

An American seldom stops to realize that he is one of the most fortunate people. America still is the land of opportunity, the land of freedom and advancement. Sure he gripes, he groans, he complains, but if he didn't he wouldn't be an American. Where else in this world would you find a country like ours? I always remember a simple saying I once heard which I believe answers the question. It went something like this: "Say, fellow, if you weren't an American, what would you like to be?" Yes, just what would you like to be, besides an American?

We could mention the vast forests, the beautiful fields of grain, the broad arterial highways, the rivers and streams, the mountains serene, but the American thinks only in terms of his own backyard, whether it be 40 feet from house to garage as in New York or Chicago, or 4,000 acres as in Texas or Wyoming. An American talks heatedly about his country, its politicians, its rules; he gripes about the political group in present power and swears his public officials are crooked or dumb or both; claims everyone who drives a car should be jailed; says all night clubs are clip joints and will not admit that the hamburger he is being served contains beef. He questions every decision of the official at a sporting event, calls every horse he bet on a goat, and swears the jockey didn't ride him like he should. Couldn't fight his own way out of a paper bag, yet spends twenty bucks for ringside seats, then proceeds to tell two men who have devoted their lives to the art of fisticuffs just how they should fight.

He never visits the zoo or aquarium in his own home town but spends hours raving over a botanical garden he happened to visit on his last business trip. He insists that "this country is going to blazes!" Does not have enough sense to notice his wife's new hat and then wonders why he gets cold shoulder and hot tongue for supper. Has the best phone service in the world, yet will let out a blast at the operator if he doesn't get his number, 1,000 miles away, within 50 seconds. Enters his car and from then on believes that the road is his, and when he finds someone else with the same thought proceeds to "play tag" with fenders of his fellowman.

Yes, the average American can be found within this story and, like his neighbor, will continue to complain about conditions, yet when the band plays The Star Spangled Banner, he stands with tears in his eyes and a throb in his throat. Yes, no one but an American had better say anything off-color about our America!

HOW TO GET ALONG WITH OTHERS

By

DR. JAMES F. BENDER, DIRECTOR

THE NATIONAL INSTITUTE FOR HUMAN RELATIONS

Do you remember from your Sunday school days, "Suffer little children to come unto me, for such is the kingdom of Heaven"? Children can teach us so much about living the good life.

Children are enthusiastic. They do things with a bang. When they like something or someone, they're never half-hearted about it. One of my prayers is that I may always be as enthusiastic about my work as a little child is about his play.

Children are optimistic. They look to the new day. They soon forget their woes. They can't afford to worry. Their hopes mount high. They accent the positive. Their frame of mind is basically healthy.

Children are whimsical. They laugh joyously. Their sense of the ridiculous is keen. They don't take themselves too seriously. They are good fun and when you romp and play with them, you get a new perspective on life.

Children enjoy simple things. If they lack mechanical toys, they call on the imagination to supply their needs. They go to their own resources and are quite independent. Above all they value companionship. Given a chance, they get along very well with others.

Children play hard. There's nothing half-hearted about their games. They go all out. How many of us forget to play! How many of us would work and sleep better if we really gave ourselves up to rambunctious play!

Children know how to relax. They stumble and fall, often from incredible heights, and rarely get seriously hurt. Why? Because they are relaxed. Ever see a youngster sleep? He's either all curled up in a ball or stretched out to the four-corners of the earth. He sits in all kinds of funny ways. Why don't we, especially in off-hours?

Children put their trust in people. They never doubt that supper is just around the corner. Or that Daddy will bring them a present when he comes home from a trip. They expect the good things of life. And they usually get them. Isn't it true that we usually get from others what we expect from them?

Children ask questions. Their best friends are *Who, What, Why, When.* Their curiosity is their university. They relish learning about the great buzzing world about them. Don't we have to guard against becoming satisfied? Isn't there a mass of things that need our questions?

One of the best tests of your human relations is: "Am I popular with little children?" If you are, you are a grand person. And you will do everything in your power to make the world a better place for your youngsters.

Which Radio Test Instrument Should You Buy First?

By
H. L. EMERSON
NRI Supply Division

Because of the increasing number of letters received on the subject of Radio Test Instruments, we feel that this article will be of interest to many of our Students and Graduates. One of the most often asked questions is fully covered. It is, "Should a Signal Tracer or a Signal Generator be purchased first?"

FOR the beginner or the radioman with years of experience, good radio test equipment means faster, more efficient work, and hence greater profits. If you are following the normal pattern of developing into an experienced Radiotrician and Teletrician, your first test instrument will probably be the NRI Tester. This handy tester is built from kit 2 RK, supplied after the 12th lesson of the NRI Course. With it you will be able to locate many of the more common receiver defects.

Usually a spare-time radio business starts with the servicing of one's own radio, or the radios of friends and neighbors. Total volume of sets repaired may only be three or four sets per month for the first few months. (At this stage, most of your spare time should still be applied toward study and completion of your NRI Course.)

While "just beginning," the NRI Tester will serve you faithfully. It is a fine little instrument and is excellent for training purposes. As you become more familiar with it and as you acquire a more professional touch in your Radio work you will wish the NRI Tester had greater accuracy and that the scales were larger and easier to read. You will feel you have outgrown your NRI Tester and you will be looking forward to the day when you will own a large, professional appearing meter which will create a real impression of confidence among your customers. But you'll get by—for the time being.

The NRI Professional Tube Tester

You may be surprised upon learning that at least 75% of all radio trouble is caused by faulty tubes. Here you will meet difficulties, since the NRI Tester can only measure the continuity of vacuum tube filaments. You may be able to take tubes to a local store to have them tested, but this will soon prove tiresome to you and to the people who test the tubes. It also takes up valuable time which should be used for study or repair work. Therefore, your first commercially manufactured test instrument should undoubtedly be a tube tester.

Ownership of a modern, emission type tube tester, such as the Model 68 NRI Professional Radio

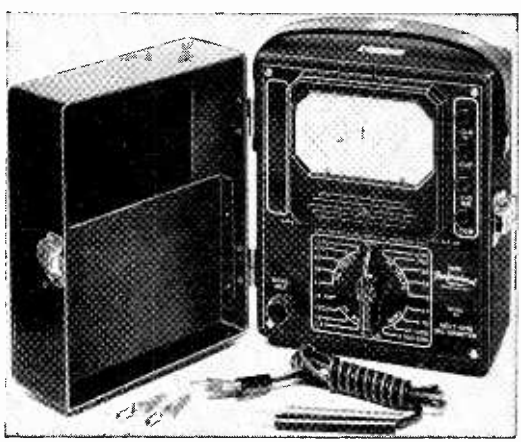
Tube Tester, should end the problem of finding defective tubes. What comes next?

If you are beginning to service several sets a week the NRI Tester may not now be adequate. It has served its purpose. It has brought you to the point where now you need a dependable Multimeter, such as the Model 45 NRI Professional Volt-Ohm-Mil-Ammeter. Instruments of this type should present a good appearance, and be easily carried on the job. If the D.C. voltmeter sensitivity is ten or twenty thousand ohms-per-volt, the instrument is ideal for general service work.

At this point you may ask "Why do I need more test equipment? Are there any parts used in a radio receiver that cannot be checked either with my Volt-Ohm-Mil-Ammeter or my Tube Tester?" Well, with a few unimportant exceptions, the answer is "No." You do have enough equipment to haphazardly check each part in a receiver, going along until you luckily discover the defect. A reliable Resistor-Condenser tester would be very helpful in testing individual parts, but you can get by with your multimeter and by substituting parts here and there. This is a "mechanical" method of servicing, and wastes a great deal of time.

You will need equipment to quickly localize trouble to a definite stage in a receiver, and often to a definite part, if you are to develop a truly "professional" servicing technique.

Many experts will tell you that a Signal Generator is needed next. It can be used to quickly localize the defective stage in a "dead" receiver. More important, it seems very necessary for alignment of superheterodyne circuits.



The NRI Professional Volt-Ohm-Mil-Ammeter—20,000 ohms per volt

Up until a year or two ago, we at NRI would have made the same recommendation to the beginner. It was then that we completed the development of the Model 33 NRI Professional Signal Tracer. So far as we know, this is the only tuned Signal Tracer being sold in the low priced field. When first developed, the versatility of the instrument amazed our technicians and engineers. And the instrument has since been improved in design.

Many of our students and graduates write for advice on whether to purchase a Signal Tracer or a Signal Generator first. To them it seems that both instruments do primarily the same thing. Actually they are companion instruments, and when used together form a team for alignment and localizing trouble that is hard to beat.

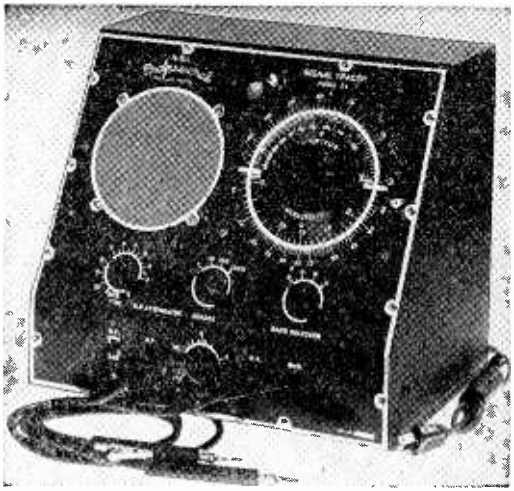
We have prepared a chart summarizing the uses of these two instruments. This chart appears on page 13. It clearly shows which test functions are incorporated in only one of the instruments, and where test functions overlap. In cases where either instrument may be used in a given job, we have marked with an asterisk (*) the instrument which would probably be preferred by most experts. This chart should be very helpful to anyone who is thinking of purchasing the Model 33 NRI Professional Signal Tracer or the Model 88 NRI Professional Signal Generator. The chart applies **only** to these NRI instruments and not to instruments offered by other manufacturers.

Since many of you are interested in alignment, let us very **briefly** summarize the alignment procedure used with the Model 33 Signal Tracer and the Model 88 Signal Generator. We will assume that the broadcast band of a standard A.M. superheterodyne is to be aligned.

Using the Model 33 Signal Tracer in Alignment

This alignment procedure amounts to merely tracing the signal from the antenna of the receiver to the 2nd detector. Since the Model 33 is tuned, we can readily check the frequency of any signal being traced, and make alignment adjustments as necessary. No output meter is needed, since the Model 33 Signal Tracer has a tuning eye built in, as well as loudspeaker output. Procedure is as follows:

(1) Disable local oscillator in receiver.
(2) Set dials of receiver and Signal Tracer to the frequency of a local broadcast station in the region of 1400 Kcs. or 1500 Kcs.
(3) Attach R.F. Probe of Signal Tracer to plate of converter tube in receiver.
(4) Peak R.F. trimmers across input circuit in receiver.
(5) Re-energize local oscillator in receiver.
(6) Set Signal Tracer to I.F. of set.



The NRI Professional Signal Tracer

The NRI Professional Signal Generator

(7) Adjust local oscillator trimmer for maximum Signal Tracer output.
(8) If the receiver has a low frequency oscillator padder condenser, tune in a local station on the Signal Tracer at approximately 600 Kcs. (R.F. Probe attached to antenna.)
(9) Again disable the receiver's local oscillator.
(10) Attach R.F. Probe to plate of Mixer tube, and tune the receiver for Maximum Signal Tracer output.
(11) Re-tune Signal Tracer to the I.F. of the receiver, as in Step 6.
(12) Unblock the receiver local oscillator and tune oscillator padder condenser for Maximum Signal Tracer output.
(13) Move R.F. Probe of Signal Tracer to the hot side of the diode 2nd detector load resistor.
(14) Peak I.F. trimmers for maximum Signal Tracer output.

This simple procedure completes alignment. There are a few disadvantages. Some men may not have strong local stations of the correct frequency near them. Signals from distant broadcast stations may vary slightly in amplitude, making alignment difficult. The other extreme is the man who is in a metropolitan area, where several stations are near the desired frequency. He may need a little patience in finding the correct frequency.

The ideal solution is to feed a steady signal of known frequency into the receiver. Such a signal could be furnished by a Signal Generator. Then follow the alignment procedure using the Signal Tracer. This system is foolproof.

Using the Model 88 Signal Generator in Alignment

This technique is nearly opposite from that used with the Signal Tracer. The main advantage is that you need not depend on the Signal received from a broadcast station. Briefly, procedure is as follows:

(1) Disable local oscillator in receiver.
(2) Attach suitable output meter to receiver, preferable measuring AVC voltage.
(3) Attach Signal Generator output probe to plate of mixer tube, or preferably signal grid of mixer tube if sufficient signal output is available and receiver is not badly out of alignment.
(4) Set Signal Generator to I.F. of set.
(5) Peak all I.F. trimmer condensers.
(6) Re-energize local oscillator in receiver.
(7) Set receiver and Signal Generator to 1500 Kcs.
(8) Attach Signal Generator probe to antenna of set.
(9) Adjust oscillator trimmer condenser for maximum output. Also adjust R.F. trimmer for maximum output at this frequency, or at 1400 Kcs., depending on manufacturer's recommendations.
(10) Set Signal Generator at 600 Kcs. and pick up Signal with receiver.
(11) While "rocking" the receiver tuning condenser back and forth, adjust the low frequency oscillator padder condenser for maximum receiver output. (Note: No rocking procedure is necessary when using the Model 33 Signal Tracer.)
(12) Repeat high frequency oscillator trimmer adjustments.

We conclude that average alignment jobs can be

Comparison of Model 33 Signal Tracer with Model 88 Signal Generator

	Testing Function	Model 33 Signal Tracer	Model 88 Signal Generator
1.	Locating general types of "hum"	X	
2.	Locating "hum modulation" in RF Stages	X*	X
3.	Locating distortion in RF Stages	X	
4.	Locating distortion in AF Stages	X	
5.	Locates noise in AF or RF Stages	X	
6.	Locates sources of squeals, oscillation, and motorboating	X	
7.	Aligning standard, broadcast band AM receivers	X	X*
8.	Aligning Shortwave AM receivers, up to 11.3 Mcs.	X	X*
9.	Aligning Shortwave bands above 10.3 Mcs.		X
10.	Aligning IF section of FM receivers	X	X*
11.	Aligning the RF section of FM receivers		X
12.	Isolates defective stage in "dead" receivers	X*	X
13.	Television Servicing—supply "marker signal" for use with a sweep frequency generator and oscilloscope		X
14.	Supply sine wave of audio frequency for analyzing audio amplifiers with an oscilloscope		X
15.	Quickly and positively checks for operation of local oscillator in a receiver (Up to 11.3 Mcs.)	X*	X
16.	Used in locating sources of intermittent trouble	X*	X
17.	Testing microphones and phonograph pickups	X	
18.	Approximate measurement of RF or AF Stage Gain	X*	X
19.	Helpful to beginners in understanding what goes on in a radio receiver	X*	X
	*When both instruments can be used, this one is preferred.		

satisfactorily done with either instrument. More difficult jobs will be done more easily with a Signal Generator, or preferably with both instruments.

Adding up the advantages of each instrument as listed in the chart on page 13, we feel that we should recommend the Model 33 NRI Professional Signal Tracer to the average beginner. This instrument is not only a versatile piece of test equipment, but it is a great aid in helping the beginner understand circuit action in radio receivers. The information in this article should help you decide which instrument will best fill your needs.

After you have the necessary test equipment for localizing trouble in sets, you may wish to con-

The NRI Professional R-C Tester

sider the purchase of auxiliary instruments for more specialized tests.

One of the most useful instruments is used to test condensers for capacity, leakage, and power factor. This type of instrument usually tests resistors also. The Model 112 NRI Professional R-C Tester is an excellent example of this type of instrument. In the leakage test, actual D-C working voltage (Up to 600 volts) can be applied across the condenser. This shows defective condensers which cannot be located readily with an ohmmeter. The power factor test is important in spotting electrolytic condensers that are about to fail. As dry electrolytics start to age, their power factor increases, and they can be replaced, preventing complete failure of the receiver. It it usually necessary to unsolder one lead of the condenser or resistor under test to be absolutely sure that readings are correct.

Special Equipment for F.M. and T.V.

Many men inquiring about NRI test instruments ask if the equipment will be useful for FM and Television. For the Model 45 Volt-Ohm-Mil-Ammeter, the answer is definitely yes. Basic tests with this type of instrument are the same for AM, FM, or TV. A special high voltage test probe is available for this instrument. It extends the D.C. voltmeter range up to 12,000 volts for TV work.

The Model 68 Tube Tester is also up-to-date with the new nine-prong socket for testing new TV and FM tubes.

The Model 33 Signal Tracer is useful in testing the audio sections of FM and Television sets. It can also be used in tracing signals through the I.F. section of an FM set. However, the Model 33 Signal Tracer is primarily designed for servicing AM sets.

The Model 88 Signal Generator covers frequencies up to 460 Mcs., on fundamentals. This includes the I.F. frequencies of FM and TV sets. By using the 2nd harmonics, the RF sections of FM sets can be satisfactorily aligned. A sweep frequency generator and oscilloscope are usually necessary in TV alignment. The Model 88 Signal Generator is useful as a source of "marker" signal in conjunction with this specialized equipment. It can also be used in aligning the "stagger-tuned type I.F. stages in a TV set.

The Model 112 NRI Professional R-C Tester is of equal use in testing components used in AM, FM, or TV receivers. It is a basic test instrument. Like a multimeter, it is not likely to become obsolete.

Unless you are ready to do Television servicing now, we suggest that you do not attempt to purchase a Signal Generator which will be suitable for AM, FM, or TV work. Purchase a good Signal Generator which will handle AM, and FM. Later purchase a special Signal Generator for TV work.

Many of you may not be aware that the NRI Consultation Service includes advice on purchasing test equipment. We will be glad to give our frank, unbiased opinion of any instrument you are considering. If you would like circulars and full details on the NRI Professional Instruments, merely address a post card to:

L. L. Memne, Director, Supply Division
National Radio Institute
16th & U Sts., NW, Washington 9, D. C.

Our Cover Photo

We hope you see, as we do, in our cover photo, the old fashioned spirit of Christmas which, we are happy to say, seems to be returning especially in our smaller communities. There is the community Christmas tree where neighbors gather to sing Christmas carols. Then breaking up in smaller groups, they wend their way down the streets, stopping here and there to call on old friends, to sing carols, to thank the Lord for all we have in America.

Yes, Christmas is a season that brings people together, rich or poor, in humble reverence.

We hope you like our selection for our Christmas cover. The photograph is by Herbert M. Lambert of Philadelphia, Penna.

Bob Vosbury, Successful NRI Graduate, Has His Own Service Shop

In

Johnson City, New York

The below photographs show something of the progress which Graduate Bob Vosbury has made in Radio. We are always pleased to receive letters from Students and Graduates, particularly when accompanied by photographs. If you have an interesting story, let us hear from you.

Dear Mr. Smith:

"I have been reading, in my NATIONAL RADIO NEWS, articles about fellow NRI men in each edition. I thought possibly you might care to hear of my progress since graduating from NRI.

I enrolled in NRI right after graduating from high school, while working as a shipping clerk in a local department store. I began doing small repair jobs in my spare time at home in a workshop I finished off in my cellar. Later on I invested in a Tube Checker and Set Checker and carried on repairing in my home in my spare time. Two years ago I went to work for Westinghouse as Radio serviceman here in Binghamton. My Service Manager was Mr. B. F. Bailey. He serviced appliances whereas I did all the radio work.

Last May Mr. Bailey retired from Westinghouse and went in business for himself repairing electric stoves, refrigerators, and all small appliances. He wanted to find a man who would repair radios, etc., and be on his own sharing half the rent, phone and lights. I decided to go in business full-time for myself. I am enclosing a few snapshots of my store. I certainly feel I have accomplished a great deal since I graduated from NRI.

I have a half-hour advertising program over one of our local stations three times a week and I am agency for three famous makes of radios. I can truthfully say that I owe all my success to NRI. Many fellows have asked my opinion of NRI and you can be certain that I have told them of the success it brings if they just put their time and effort into their lessons and live up to the training faithfully. As in everything, it is up to the individual to get everything he can out of it. Well, I hope this letter proves of some interest to you and you can be sure I will always uphold NRI."

Sincerely yours,

Robert D. Vosbury,
Johnson City, N. Y.

THE NRI SERVICE MANUAL IS HIGHLY PRAISED

An exclusive service for NRI Students and Graduates. More than 7,000 have been sold.

WE are pleased to announce that the NRI Service Manual is again available. Originally we placed an order for 3,000. Although we knew this manual would prove very popular we did not anticipate that the demand would be as great as greeted our announcement. We quickly placed another order for 3,000, then still another order for 3,000 and of this last lot more than 1,000 have already been sold.

This manual was prepared especially for NRI students and graduates. For years there was a demand for a diagram manual of popular Radio circuits, for quick, ready reference. The NRI Service Manual is the answer.

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The Manual is of real assistance to those who are sufficiently advanced in their studies to be able to do part-time Radio Servicing work.

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This is another NRI service planned for NRI students and graduates. This Manual is a big help to both the beginner and the long experienced Radio serviceman, because it contains, in one volume, more than 1400 popular circuit diagrams, covering 7287 models, old and new, up to 1946.

The Manual contains 1566 pages of diagrams and service information, plus 31 pages devoted to index and 34 pages to alignment procedures.

Over sixty leading makes of receivers are covered including Air King, Allied, Andrea, Atwater-Kent, Crosley, Detrola, Emerson, Fada, Farnsworth, G-E, Magnavox, Majestic, Montgomery Ward, Philco, RCA, Sears-Roebuck, Sparton, Spiegel, Stewart-Warner, Warwick, Wells-Gardner, Westinghouse and Zenith, to name a few.

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The NRI Service Manual is compact and filled with valuable service information. It gives complete separate presentation of aligning methods, with each method keyed. Each diagram tells by a key what method to use.

It covers AM, FM, Television, Audio Amplifiers, Record Changers, Inter-Communicator Circuit Diagrams, and data.

It gives complete circuit diagrams, all with parts values, many with pictorial part layouts. Gives special adjustment procedures.

It includes push-button and automatic tuning adjustments. Intermediate frequencies are given on each diagram. All tube numbers are identified. Manufacturers' parts numbers are given in many cases. Most diagrams include operating voltages.

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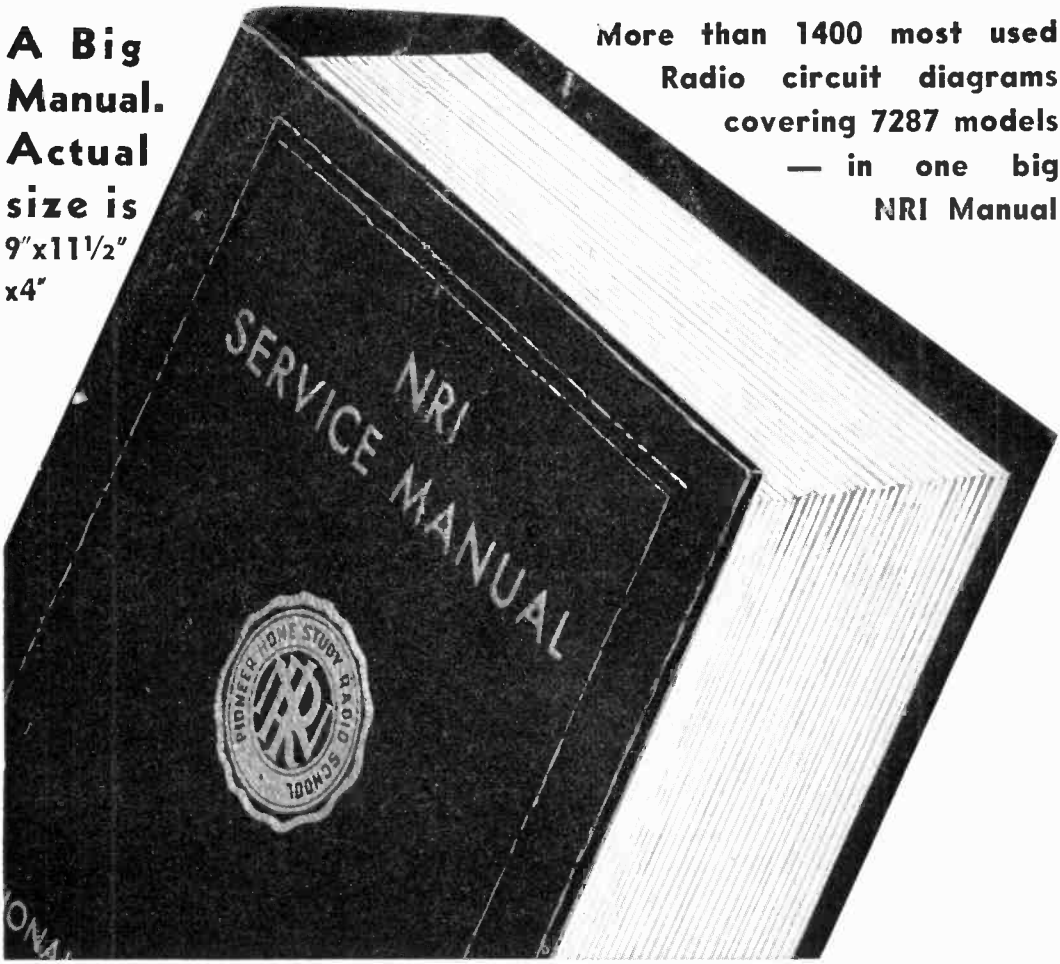

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The Veterans Administration will not authorize payment for "extras" such as this Manual.

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J. A. Dowie

The Value of Graphs and How to Use Them

By J. A. DOWIE

NRI Chief Instructor

THERE are many ways to present a collection of data. One can wade through complex and exhaustive reports. Or the material in the reports can be condensed into tables. Perhaps the simplest way to study a collection of data is through graphs.

Although a bewildering spectacle to the uninitiated, a graph is a source of valuable information to the trained Radiotrician. You will find graphs very valuable tools once you clearly understand how to construct and use them.

A graph can be considered a pictorial recording of a group of facts. For example, suppose we are interested in the growth of a weed from a seedling to maturity. Every two weeks, for eleven weeks, we could measure the height of the stalk,

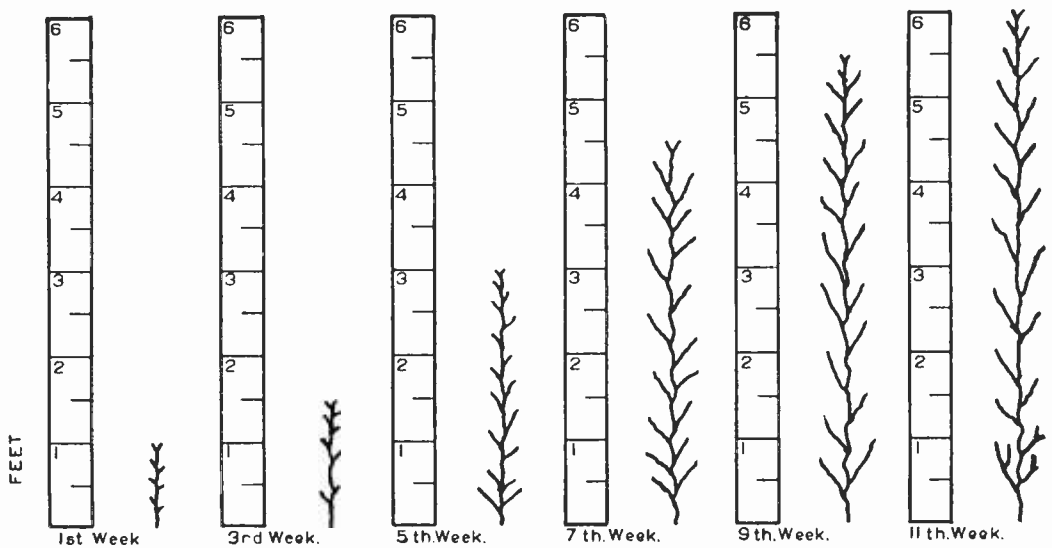


Fig. 1

recording our results in a table.

First week	1	foot
Third week	1½	feet
Fifth week	3	feet
Seventh week	4½	feet
Ninth week	5½	feet
Eleventh week	6	feet

This table gives us the facts. It does not give us a very clear picture. Figure 1 gives a better idea than the table above.

Notice that by comparing the height of the weed with the ruler, we can find just how tall the weed was at the end of each two-week period. It is just as easy to do away with five of the rulers and show the growth of the weed as in Figure 2. We can quickly compare the height of the weed at the end of the seventh week with the ruler at the left. We see that the weed was 4.5 feet high.

We can also eliminate the pictures of the weed. Just put a dot where the top of the stalk should come, as shown in Figure 3, and we still have the height clearly indicated. By going one step further and connecting the dots together with a line, we have, in Figure 4, a graph.

This line shows us at a glance the growth of the weed. Its growth was slow at first, speeded up between the third and ninth weeks, and finally slowed down again.

Furthermore, this line enables us to find where the top of the stalk was at any time between the two-week intervals. For example, let's find the height of the stalk at eight weeks. You see seven and nine weeks marked at the bottom of the graph, so eight weeks will fall on the line half-way between seven and nine. Notice that there is a line in the graph right here.

From this point, go straight up to the curve, and from there straight over to the left-hand side showing the height in feet. We find that the stalk was five feet high at the end of eight weeks.

Thus, with the complete graph, we are able to find values which were not even present in our original tabulation of facts. This demonstrates one of the most important uses for graphs.

Let's use our graph again. (See Figure 4). Suppose we wish to find when the stalk was four feet high. Just locate four feet at the left, then go straight over to the curve. From the curve, go straight down to the bottom of the graph. We will hit the bottom line at the point marked "a."

This is not on a marked value, so we must estimate the time. We know that the line half-way between five and seven represents the sixth week, and point "a" lies about one-third of the way between six and seven, so we call point "a" six and one-third weeks, the time at which the stalk was four feet high.

The scale at the left of the graph, which has numbers one above the other in a *vertical* column, is called the *vertical* scale. These are the

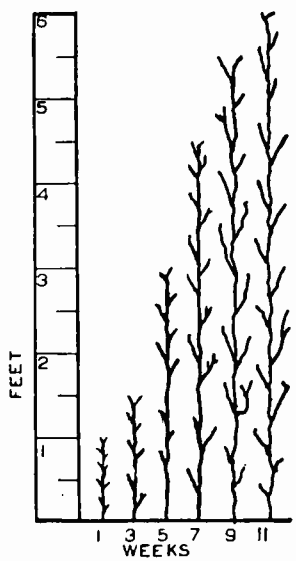


Fig. 2

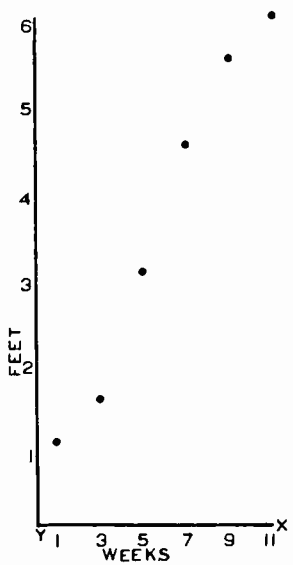


Fig. 3

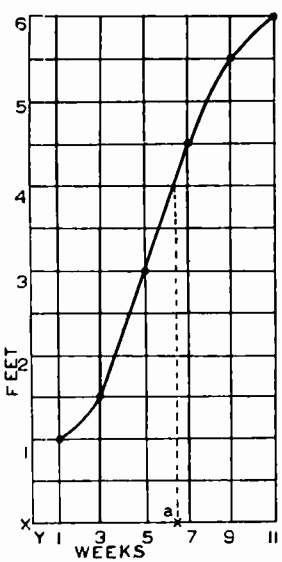


Fig. 4

numbers for the lines going across the page, which show the vertical distance from the bottom scale. The scale along the bottom of the graph is called the *horizontal* scale. These numbers are for the lines going up and down the page and show the horizontal distance from the scale at the left of the graph.

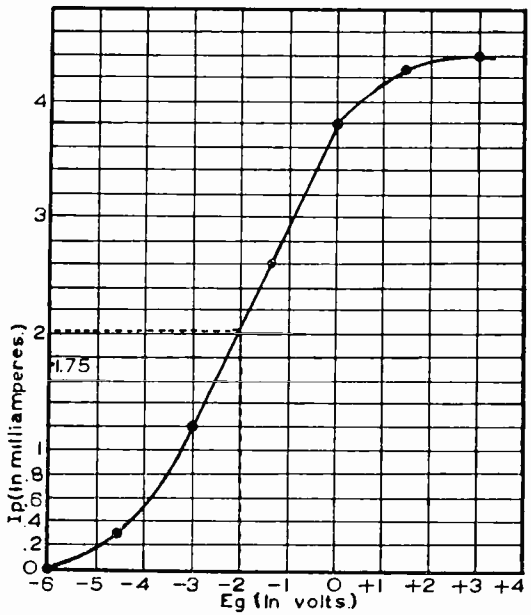


Fig. 5

It is also convenient to know that the vertical scale is sometimes referred to as the Y axis and the horizontal scale is sometimes referred to as the X axis as indicated in Figure 4. This is simply a matter of convenience.

You can see immediately how much valuable information is included in a graph. Before we go on to the consideration of graphs for radio problems, here are some additional facts which will help you to get the most out of any graph.

GRID VOLTAGE	PLATE CURRENT
—6	0
—4.5	.3
—3	1.2
—1.5	2.6
0	3.8
+1.5	4.3
+3	4.4

Fig. 6

Notice that the line drawn by joining the points together is not straight. Very few graphs will be straight lines. It is common practice, therefore, to refer to all graphs as *curves*.

Notice, also, that you can almost "see" the plant grow. As the weeks pass, the plant gets taller and taller. This is clearly evident just by glancing at the curve. Many, many times you will look at a curve for this type of information alone. You will have to know what "overall" change can take place under certain conditions.

Finally, notice the portion of the curve between the third and seventh weeks. Between the third and fifth weeks, the plant grew 1.5 feet. Between the fifth and seventh weeks, the plant grew 1.5 feet. This *portion* of the curve is a straight line. If you don't trust your eyes, place a ruler along this section. You will see this to be true.

Under these conditions, the change (growth in this case) is said to be *linear*. This is a piece of information for which you will have frequent need. You will want to know when the response of a circuit or a part is linear. You will be able to tell very quickly by referring to a graph.

In your radio studies, graphs are going to prove very valuable in learning how tubes, for example, perform their many duties. It is important that you know just exactly how a tube will work in order to make maximum use of it or to know what could cause it to operate improperly.

One type of graph which you will study is known as an E_g-I_p curve. E_g stands for "grid-voltage" and I_p stands for "plate current." This graph tells us how the plate current will change when the grid voltage changes. A graph of this type is shown in Figure 5.

This graph is made up in exactly the same manner as the one we just described in Figure 4. The necessary facts are taken from a table such as Figure 6. The facts presented in this table were secured by applying several different grid voltage values to a tube circuit and measuring the resultant plate current for each of the grid voltage values. The plate voltage was kept at a constant value.

Since some of the grid voltage values are negative while others are positive, we must lengthen the horizontal scale (the Y axis) at the bottom of the graph. Instead of zero (0) grid voltage being at the left end of the horizontal scale, it has been moved over. Positive numbers go from 0 toward the right, while negative numbers start at 0 and go to the left.

The vertical scale (the X axis) is like the scale used in Figure 4, except that the numbers are separated more, so that intermediate fractional values can be more easily read. Each vertical section of the scale is divided into five units. Therefore, each line is one-fifth or two-tenths of a milliampere. We usually use decimals because it makes our calculations simpler. In this

case, the intermediate values of 2/10, 4/10, 6/10, and 8/10 would be written .2, .4, .6, and .8.

Here's how you'd go about locating one of these intermediate points. Suppose you wanted to find the point representing 1.75 ma. plate current.

From the previous explanation you know that the third line above 1 on the Y axis indicates 1.6 and the fourth indicates 1.8. Therefore, 1.7 would fall half-way between these two lines. And the point we want, 1.75, would be half-way between this mid-point and 1.8. Notice that the approximate location of this point has been marked on Figure 5. Consider the graph lines, either horizontal or vertical, as building blocks. Then, when it is necessary to estimate some intermediate value, mentally divide the section into smaller convenient sections. Almost never will it be necessary to divide it into more than five sections. Usually two or four will be sufficient.

Now, having learned how to read the scales, we can plot the graph from the data given in Figure 6. At the first grid voltage (C bias) value of —6 volts, we have zero (0) plate current. Locate the C bias voltage value and place a dot at the intersection of this line and the zero plate current line.

For a C bias of —4.5 volts. we must locate the line half-way between —4 and —5 volts on the X axis. We travel up this line until we encounter the horizontal line for the corresponding plate current, .3 milliampere. Note that .3 ma. is halfway between the .2 ma. and the .4 ma. lines. Put a dot here.

In the same manner, locate the —3 volt line and read up until you cross the horizontal line having a value of 1.2 ma. The —1.5 volt value is found half-way between —1 and —2 volts, and the corresponding plate current of 2.6 ma. is on a horizontal line. The zero grid voltage 3.8 ma. plate current point is plotted in the same way.

Now we come to positive grid voltage values. You can see that the — and + signs used along the X axis are very important. The +1.5 volt value is entirely different from the —1.5 volt value so we must be careful to use the proper signs and to locate the proper lines.

After the dots have all been placed on the graph, they are connected together by a smooth (not straight) line, thus completing the graph. We now have a curve which shows us the over-all response of the tube and from which we can calculate quickly many intermediate values not included in our original table.

Suppose we wish to determine when a plate current of 2.0 ma. will flow. Locate this value on the vertical scale and read across the graph until you strike the curve. Then travelling downward, you will find that you cross the horizontal line at a bias value of —2 volts.

Now that we know how to construct a characteristic curve and how to find values from it, we can put this curve to work for us.

Suppose we are operating this tube with a fixed grid bias of —2 volts and with a fixed plate voltage. From our curve, we can find the plate current for this static condition. On Figure 7, this point is marked OP, called the Operating Point.

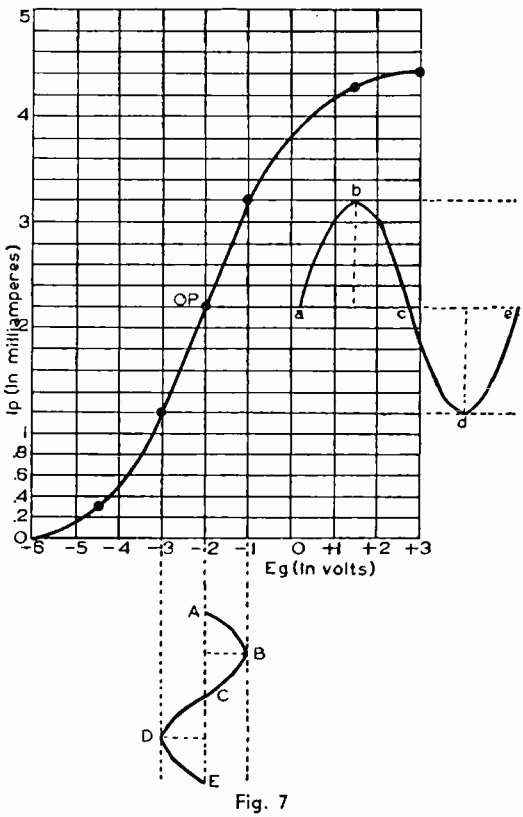


Fig. 7

You know from your previous study that if you vary the grid voltage on a tube, the plate voltage supply remaining constant, the plate current will vary in a manner similar to the grid voltage variation. Suppose we applied a sine-wave signal voltage to the grid of this tube. If this voltage applied to the grid has an amplitude of 2 volts, the voltage on the grid will vary as shown in Figure 7, being first —1 volts and the —3 volts. When the signal voltage is +1, this will subtract from the fixed grid bias and the resultant grid voltage will be —1 volt. When the signal voltage is —1, this will add to the grid bias and the resultant grid voltage will be —3 volts.

Now the plate current will vary as the grid bias varies. Let's consider one complete cycle. When the voltage on the grid is as shown at point A, the plate current will be the value shown at point a. A quarter of a cycle later, the grid potential will be as shown at point B. The plate current will, therefore, be as shown at point b.

At the end of a half cycle, the grid voltage will again be at the resting value. This is indicated by point C. The plate current will, of course, have dropped to the static position at point c.

After three-quarters of a cycle, the grid voltage will have changed to the value shown at point D. Since the grid voltage is now more negative, the plate current will have dropped to the value shown at point d. Finally, at the end of a complete cycle, the grid potential will again be back to the resting value. This is shown at point E. The plate current will be at its resting value also, as shown at point e.

The signal voltage applied to the grid was a pure sine-wave. The resultant plate current change is approximately a pure sine-wave. It is so close to a pure sine-wave that we can say that it has very little distortion.

The plate current change when the tube is operated at point OP in Figure 7 with an applied signal as shown, is practically an exact reproduction of the signal applied to the grid. Therefore, it is reasonable to assume that if an audio signal, such as voice or music were applied to the grid under these conditions, it would be reproduced in the plate circuit by the plate current with the same fidelity. Now let's consider Figure 8. This time we are applying a fixed grid bias of —4 volts to the tube with fixed plate voltage. The operating point, the static plate current, is much lower as you can see from the curve.

Again let's apply a signal with an amplitude of 2 volts to the grid. We can plot the resultant plate current just as we did for the previous example.

You can see at a glance that there is definitely something wrong here. The upper part of the curve is about twice the size of the lower part. Do you think this plate current curve is very similar to the grid voltage curve? Indeed, it is easy to see that it is not.

Consequently, if we applied voice or music signals to the grid, the reproduction in the plate circuit would be greatly distorted. The reproduction of the signal would be very poor.

The actual practical value of graphs is immediately apparent. If you found that the output of a receiver was distorted, you wouldn't draw a graph but remembering what you have learned from them you would certainly immediately check the bias on the audio amplifier stages. Thus you have learned where to look by your study of graphs. You will learn what can cause improper bias and how it may be corrected in your advanced lessons.

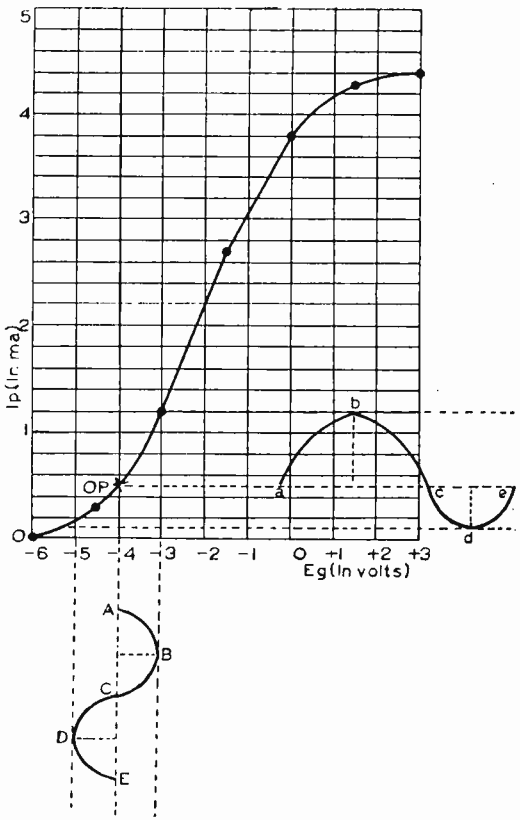


Fig. 8

As you will learn from your lessons, it is not necessary in many instances that the values be marked down on a graph, once the correct shape of the graph has been determined. In other words, you are going to encounter tube curves similar to Figure 5, in which just the curve is shown with no corresponding values. This is because you, a serviceman, are usually more interested in the shape of the curve than in the exact amount of current at some particular grid voltage. As you will learn, a tube operates best as an amplifier when the curve is made more nearly straight, or when operation is limited to the linear portion. It acts as a detector over a curved portion of the characteristic curve. This is fully explained in the regular N.R.I. Course.

You won't have to use graphs very often in your servicing work. But if you understand them, you will be far more efficient than the average repairman.

The difference between you, a trained Radiotrician, and the average repairman is that you understand the basic underlying theory. You know how the various parts operate in various types of circuits and you know why they operate in that manner. Thus, when some part fails, you can quickly reason through to a cause.

As previously pointed out, graphs are basically an "aid." They enable you to visualize just exactly what is happening. If what does happen differs from the picture you learned through study, you know just exactly where to start looking for the circuit breakdown. The fact that you are able to apply a knowledge of graphs to your analysis makes your efforts easier and more effective.

The experienced serviceman and the student need graphs constantly. From published graphs, the expert can find out just exactly what he can expect from a certain circuit. A student uses graphs to help him more thoroughly understand the theory he is learning. His future success in radio depends on the foundation he acquires during his student days.

Put a little "extra" effort into the job of learning to use graphs. It will pay you "extra" dividends.

Letters to the Editor

"I noticed all the NRI test equipment in the last issue of NR News. I have all five instruments and am very proud of them.

"Would like to see you design an oscilloscope, as I could sure use one. Have you any plans on this? Would like to hear what other Alumni members have to say on this."

LEON LATHAM
1016 N. Everett
Streater, Illinois

———n r i———

"Your article in the Aug.-Sept. 1948 issue on a Hand Capacity Relay proved to be quite a novelty. I have built mine. It is quite an attraction in this small town, which is mostly farmers. One farmer says, 'It ain't got me fooled, it's a Twin Ghost Motion.'

"I had trouble with the relay. It would not make a positive contact. Adjusting the spring on the relay and the trimmer condenser made it vibrate violently, but did not give positive contact.

"After a day of trying different parts, I changed the spring on the relay. Now I can change the position of the plate as much as ¾ in. and still get positive action. It works like a charm."

VINCENT J. HOLCZMAN
P.O. Box 63
Ovid, Michigan

———n r i———

"In response to the question 'Are you in television?' in the Aug.-Sept. NR News, let me say yes and no.

"No, in that my main occupation is in the administrative end of the Staff Communications Office, Dept. of the Army.

"Yes, in that I'm trying to keep up on the latest in TV. Have a Hallicrafter in my home, which is in a poor location.

"I get good reception due to my antenna — a Ward Hi and Low Band, with the Hi element 33 feet from the ground. Use reflectors on both bands, and have a folded dipole FM antenna on the same mast. In my observations, I have found the majority of unsatisfactory installations due to the use of cheap antennas.

"I am sure I have received the Westinghouse Stratovision tests, although, at the time, I thought it was a freak signal. Am continuing with my TV experiments in the little spare time I have."

JOSEPH C. KREUSER
504 Adams Place
Falls Church, Virginia

The Editor appreciates comments such as these. Let us have your frank criticism as well as constructive suggestions.

TELEVISION NEWS

by H. L. Emerson

Expansion of Television Viewing Tube Production. Operation of the new Sylvania Electric Products plant in Ottawa, Ohio will double Sylvania's present rate of tube output for increasing demand of TV set makers.

100,000 Sets a Month Forecast. Production of TV receivers in the United States will reach 100,000 a month during the last quarter of 1948, according to James H. Carmine, Philco Vice President. In New York City alone, sets are being installed in private homes at the rate of 1,000 per day. Philco plans to increase its production to 10,000 sets a week early in 1949.

Are Present Transmission Lines Adequate? In a recent survey conducted among TV servicemen, 413 said "No" and 79 said "Yes." When asked if any particular loss of signal on these lines was observed when tuning to higher frequency stations, 421 answered "Yes" and 63 "No." Many who answered "Yes" went on to say that when coaxial cable is used, only slight losses occurred, but when 300 ohm twin lead was used, losses were extreme.

British Broadcasting Company "Freezes" 405 Line Standard. The 405-line standard has been frozen indefinitely, since the improvement resulting from a change would seem insufficient to warrant the discarding of approximately 60,000 British owned sets.

FCC Halts Further Granting of TV Construction Permits. This will allow further study of existing Television standards with relation to spacing of stations on co-channel and adjacent channel mileage. This study should result in better, interference-free reception by the ever-growing Television audience. The stations now in operation, or under construction, will not be affected by this order.

Airline Riders See TV. Passengers between Washington and Chicago aboard a non-stop flight of Capital Airlines are now enjoying the latest in entertainment as they watch a Philco television set. Programs radiated by stations in Chicago, Baltimore, and Washington are tuned in on the plane, which flies at an altitude of 10,000 feet.

Railroad Passengers Also See TV. The B & O Railroad has installed a Television set on one of its crack trains between Washington and New York. A newly developed non-directional antenna is used, and good results are obtained as the train passes through areas covered by Baltimore and Philadelphia Stations.

Stratovision Plane Relays Series Game. The final game of the World Series, played in Boston, was picked up by the Westinghouse experimental Stratovision airplane and rebroadcast to TV stations located in the mid-western section of the U.S. The plane, flying over Pittsburgh, picked up Channel 6 signal from WMAR-TV in Baltimore and then re-broadcast the images to stations in Cleveland and elsewhere. Total Television audiences for the series was said to exceed 6,000,000 persons.

The 475 to 890 Mc. UHF Band. General, though not unanimous, opinion seems to urge continuation of experimentation in this band. Dr. Goldsmith, Jr., speaking for DuMont, said DuMont favors immediate opening of the 475 to 890 Mc. band for commercial use in areas where higher power or large coverage is not essential. RCA also urges continued experimentation in higher frequencies so that more channels can be made available for TV, but stressed the fact that the present 12 commercial channels are the "bedrock" from which further development can grow.

TELEVISION BOX SCORE

Stations Operating	41
Construction Permits Granted	83
Applications Pending	310

(AS OF OCT. 28, 1948)

Television Reception and Interference

IN cases of unsatisfactory television (TV) reception, many set owners are complaining to the Federal Communications Commission. The following is the form on which the FCC replies to such inquiries. TV service men and students will find this information to be both interesting and useful in solving TV interference problems.

Receipt is acknowledged of your recent letter concerning unsatisfactory reception of television stations. A radio engineer, experienced in field investigation of cases of unsatisfactory television reception, has studied your case and from the information contained in your letter, has checked the probable source of your difficulty in the paragraphs below:

Experience has shown that unsatisfactory television reception is due to two broad causes:

1. Attempted reception of television signals beyond the normal service range of a television broadcast station.
2. Deficiencies in receiver design.

( ) RECEPTION BEYOND THE NORMAL SERVICE RANGE OF A TELEVISION STATION

The average full-power television station has a normal reception radius of only about 40 miles. This is because television receivers require a relatively strong signal for their operation to overcome unwanted signals either from other radio or television stations or electrical disturbances caused by non-radio devices, such as heating pads, flashers, etc. The nature of television is such that it requires a signal at least 100 times as strong as an undesired interfering signal in order to obtain satisfactory reception, whereas a standard broadcast station requires a signal only 20 times as strong as an unwanted signal for satisfactory reception. At the present time many of the television stations are operating with low power pending the delivery of higher power equipment, and some of the stations in the smaller cities have been assigned lower power. In these cases the satisfactory reception range may be as low as 20 miles.

( ) DEFICIENCIES IN TELEVISION RECEIVER DESIGN

Certain receivers are built with sufficient sensitivity to receive desired stations but without sufficient selectivity to enable them to *reject* undesired stations. It is usually safe to disregard this factor with its consequent saving in manufacturing cost, as a large number of receivers are sold in areas where there is little chance of trouble occurring. However, in no small percentage of cases, the owners of receivers do reside in areas of low signal strength levels or near a radio station operating on another frequency. Then, if the receiver does not have sufficient selectivity to reject the unwanted signal, reception is unsatisfactory. The possible solutions for the receiver owner are to obtain a receiver with good electrical characteristics, or to install wave traps or other devices to tune out the unwanted signals.

Types of Unwanted Signals on Television Receivers

Some of the different types of interference which affect television receivers are listed below. Unwanted signals occur either as audible interference in the sound channel of the television receiver or in the television picture in the form of bars, herringbones, reversed pictures, or torn pictures. These conditions are most likely to occur where the television station signal is weak and the undesired signals are relatively strong.

It appears that your difficulty is most likely being caused by the type of interference opposite the checked paragraph.

( ) The reception of FM BROADCAST STATIONS on television receivers is due to what is commonly known as "Receiver Image Response." This condition is troublesome when the FM Station is operating on a frequency which is removed from the wanted frequency by twice the intermediate frequency of the particular television receiver. This trouble may occur when a television receiver is tuned to Channels 2, 3, or

4. This is a receiver design fault. Trap circuits or reorientation of the television receiving antenna may relieve this interference.

( ) The reception of INTERNATIONAL SHORTWAVE BROADCASTING STATIONS and POINT - TO - POINT TELEGRAPH STATIONS on all television channels is due to direct feed-through from the radio frequency amplifier section of the television receiver to the intermediate frequency amplifiers in the 8 to 12 megacycle region, and occasionally occurs in post-war receivers having intermediate frequency amplifiers between 21 and 26 megacycles. Trap circuits at the antenna terminals of the television receiver are usually effective.

( ) The reception of AMATEUR STATIONS on a television receiver may be due to harmonics of nearby amateur stations operating in the 27 or 28 megacycle band; or it may be due to receiver adjacent channel response to amateur stations operating in the 50 to 54 megacycle amateur band. Adjacent channel interference may occur to television channel #2 from amateur stations in the 50 to 54 megacycle band. The fact that you may hear an amateur station on your television receiver is not necessarily an indication that it is operating "off frequency," or in any other illegal manner, but may be an indication that the amateur station's signal may be many times stronger than the desired television signal, and your receiver is not designed to operate and afford adequate rejection of unwanted signals under these unfavorable conditions. The condition is the result of an engineering design compromise inherent in most present-day television receivers. By adding "pre-selection" or appropriate "filters" to your television receiver, interference may be eliminated or greatly reduced. The amateur's assistance should be solicited and adjustments made on a cooperative basis. This is especially true in the case of harmonics which can not be eliminated by "traps" on the receiver without removing the desired picture.

( ) The reception of POLICE, AVIATION, UTILITY, and other low-power stations either at fixed locations or mobile is usually due to adjacent channel interference, which is primarily a television receiver fault. It appears that your television receiver has not been designed by the manufacturer to reject these unwanted stations on frequencies near the television channels. Such interference is usually intermittent and therefore may not be found objectionable, otherwise "trap circuits" tuned to the interfering signal will usually be found helpful.

( ) The reception of signals that mar either the sound or picture, but can not be identified as a radio station of any type, due to lack of intelligence being transmitted by the unwanted signal, may be due to MEDICAL DIATHERMY MACHINES, INDUSTRIAL HEATING APPLIANCES, FLASHERS, HEATING PADS OR OTHER ELECTRICAL DEVICES, which are, in effect, radio transmitters used for other purposes than communications. The radiation of signals from these "transmitters" is an unintended by-product of their operation. Though frequencies have been assigned for Diathermy and Industrial heating operation, many machines are now in existence that are not operating on the assigned frequency. It will probably be some time before all existing machines are replaced with those designed to operate on the assigned frequencies and, in the interim, it will be necessary to solve the interference on a case-to-case basis. These signals may be identified by a scratching or tearing sound or by a low-pitched hum when being received by the sound channel of a receiver, and moving bars, or tears in the picture. Once the offending machine is definitely located, it is usually possible to add certain signal-suppressing equipment to the machine and reduce the signal to a low value.

( ) Another source of interference to television reception that produces a condition similar to the result produced in a receiver by diathermy or industrial heaters, as outlined in the paragraph above, is INTERFERENCE FROM OTHER TELEVISION RECEIVERS in the vicinity of your receiver. This usually occurs in apartment houses where two or more receivers are in close proximity. Each television receiver contains a beating oscillator which is, in effect, a miniature transmitter to perform certain electrical functions within the receiver. An unwanted by-product of this oscillator, in some receivers, is the radiation of a strong signal over a distance of a few hundred feet. This is due to deficiencies in the receiver design. This type of interference usually occurs when your neighbors receiver is tuned to one of the lower numbered channels and your receiver is tuned to one of the higher channels. The signals radiated by his receiver may be on the same frequency you are attempting to receive. For instance, if you are receiving Channel #5, and your neighbor in a nearby apartment is receiving Channel #2, you may encounter interference on your receiver.

Suggestions to Radio Servicemen and Radio Dealers

The material preceding this section is based on several years of experience accumulated by Federal Communications Commission Field Engineers investigating interference cases to television reception in cities where television stations have been operating for some time. Since television is a relatively new and different radio broadcasting service, there appears to be a limited knowledge on the part of both receiver owners and radio dealers as to what should or should not be expected in the reception of television stations. The preceding material attempts to outline broadly these factors for your assist-

ance and the assistance of receiver owners.

It is suggested that if you encounter any of the above difficulties, you proceed along the following lines:

1. Determine if the trouble is occurring on all makes of television receivers in use in your area. If the trouble occurs predominantly on one make of receiver, it is entirely possible that it is due to receiver deficiencies.
2. Should cover a check of all electrical devices in the complainant's home, such as heating pads, refrigerators, etc., and turning them on and off, etc.
3. Obtain assistance from the research or production engineering department of the manufacturer of the receiver you are selling or servicing in tracking down the trouble. Most of the television receiver manufacturers have experts who have already had experience in the solution of these problems.

It is possible to add trap circuits to the input terminals of a receiver and reject an unwanted signal, provided the unwanted signal is on a frequency other than the desired signal. Suppose a television receiver tuned to Channel #2 is receiving image interference from an FM station on 100 megacycles, and it is desired to reduce the 100 megacycles signal input to the television receiver: A piece of transmission line cut to a length equal to one-quarter the wave length of the undesired station and attached across the input terminals of the receiver along with the antenna lead-in will considerably reduce the unwanted signal. To determine the length in feet of a transmission for such use, the following formula applies:

$$\frac{246}{\text{Station Frequency in Megacycles}} = \text{line length in feet}$$

For example: $\frac{246}{100\text{Mc.}} = 2.46$

Cut the piece of transmission line a few inches longer than the formula shows and attach it to the receiver terminals; cut it off a small piece at a time until it tunes to the desired frequency, and the unwanted signal is reduced. Leave the end "open"; that is, do not connect the wires of the unattached end together.

The cut transmission line mentioned above is called a stub. Frequently you will find that the stub must be shortened far more than the formula indicates because another length of transmission line in the chassis connects the main antenna terminals to the antenna coil. This will affect the stub length.

When the stub has been attached do not move the receiver when cutting lengths off the stub. The receiver should be in the exact position in which it is normally operated. Material near the stub (wall, cabinet, etc.) influences its length for a given frequency.

Qualities of a Gentleman

A gentleman has been described as one who—

Never inflicts pain.

Makes everyone at ease and at home in his presence.

Doesn't bring up topics that might cause irritation to another.

Makes light of favors while he does them.

Never gossips or slanders.

Never takes unfair advantage of another.

Is never mean in disputes but always fair and generous.

Never gives out sharp sayings for argument.

Bears no malice.

Is kind to another intellect inferior to his own.

Always just.

Respects weakness in human nature, and makes the proper allowance for it.

Measured by this rule of manly conduct, are you a gentleman?

Courtesy, Radio-Electronics Magazine

"Must have made a mistake in the wiring somewhere!"

N.R.I. ALUMNI NEWS

Ernest W. Gosnell ..... President
Harry R. Stephens ..... Vice Pres.
Harvey W. Morris ..... Vice Pres.
H. J. Rathbun ..... Vice Pres.
James J. Newbeck ..... Vice Pres.
Louis L. Menne ..... Executive Secretary

Harry G. Andresen of Chicago Elected NRI Alumni Association President for the Year 1949

ON January 1, 1949, Harry G. Andresen of Chicago will take over the reins of President of the NRI Alumni Association. He has just been elected to serve for one year.

Mr. Andresen has long been a member of Chicago Chapter. He served that organization in various capacities. For several years he was Chairman. He has usually held one office or another. In recent years, he has been a Vice-President of our National Organization.

Last year, Mr. Andresen was a candidate for President but came out second best. This year he ran a very strong race.

Mr. E. W. Gosnell of Baltimore will retire from office on December 31. Ernie, as he is affectionately called by members of Baltimore Chapter, has now had just about all of the honors in our organization. He has been Chairman of Baltimore Chapter for five years. He then was elected a Vice-President of our National Organization and last year served us very well as our President. These positions carry no salary. They are strictly honorary and all of our members are very grateful to Mr. Gosnell for his fine administration.

Four Vice-Presidents have been elected. Harvey W. Morris of Philadelphia, H. J. Rathbun of Baltimore, and James J. Newbeck of New York have been returned to office. Charles H. Mills of Detroit Chapter has been elected a Vice-President to succeed Harry R. Stephens, who has been such a stalwart member for many years. It was the wish of Detroit Chapter members that Mr. Mills be elected to a national office because he has been a member of Detroit Chapter since its inception. It is an honor which Mr. Mills richly deserves and Mr. Stephens, Mr. Oliver and other influential Detroit Chapter members are very happy with the result of the election.

Mr. Louis J. Kunert who was the candidate for President against Mr. Andresen is a past President and in reality he was campaigning for Mr. Andresen. Mr. Kunert feels, as do so very many of our active members, that it is a healthy condition for our organization to bring new blood into the top offices and, while Mr. Kunert appreciated the nomination, he did not this year seek the office. This is another example of the very fine spirit which has always been so evident in our national elections.

Our salute then to President-Elect Harry G. Andresen of Chicago, Vice-Presidents-Elect Charles H. Mills of Detroit, Harvey W. Morris of Philadelphia, James J. Newbeck of New York and H. J. Rathbun of Baltimore. They shall have the loyal support of all of our members.

Chapter Chatter

Detroit Chapter members are happy with the news that Charley Mills has been elected a Vice-President of our National Organization. Mills is a charter member of Detroit, has always attended meetings very regularly and has done his share in giving that chapter the prominent place it holds in our organization. . . . Incidentally they will hold their own annual election soon. Chairman F. Earl Oliver and Secretary Harry R. Stephens will retire from office. This is because of a resolution which they themselves sponsored limiting an office holder to two consecutive years. More news about this in the next issue.

Arrangements have been made for Mr. Harje of Philco to give a talk on television at the first or second meeting in January. Detroit members should watch for this announcement. Will be a bang-up meeting . . . a swell long report from Secretary Stephens. That man is a bear for details and certainly deserves a lot of credit for his fine work. . . . Floyd Buehler presented a very interesting talk on television based on material published with Photofact Folders put out by Howard W. Sams. In fact there is still some hope that the author of this material, Mr. Arthur C. W. Saunders, will come to Detroit to talk to a large group of Radio servicemen on the subject of television. Detroit Chapter is very anxious to help sponsor this meeting. . . . Nice photo from Detroit member Kenneth L. Kacel showing his Radio bench and instruments. One of our newer members in Detroit who is doing exceedingly well.

By the way, Floyd Buehler visited Washington headquarters. Was delighted with his reception at the school where he found much of interest.

Attendance is gradually coming up as we get into cooler weather. Thirty-four last meeting. Should be fifty and will be fifty by January. . . . door prizes at each meeting. Very popular and lots of fun. . . . Now let's move on.

Chicago Chapter goes on merrily, not losing any ground, but not gaining any either, speaking frankly. Our handicap in Chicago is that we do not have a suitable place to meet. That has been our problem for several years. Something must be done about it soon . . . lots of credit to Chairman Albert Horvath and Secretary Louis Brodhage for their loyalty. Doing a swell job but somewhat disappointed because attendance does not increase. Meeting on the West side makes it difficult for those on the far South side and far North side to attend meetings. The proposal that we have two Chapters in Chicago, one on the North and one on the South side has not gone over very well. S. J. Crawford, for instance, voices the sentiment of most members. We should have a central meeting place somewhere near the Loop. Yeah, but where! Any help from members will be appreciated.

The members went all out for the election of Harry Andresen for President. It is all over. Andresen is in. Chicago Chapter is proud of this honor. Executive Secretary Menne will visit us at our next meeting. That will be before this issue goes to press.

Baltimore Chapter members distinguished themselves by doing something outstanding. About fifteen of them accompanied Alumni President Ernest W. Gosnell and Vice President H. J. Rathbun to Philadelphia where they were the guests of Philadelphia Chapter. Menne also joined the crowd. It was a good, old-fashioned reunion reminiscent of the days before the war when Baltimore, Philadelphia and New York Chapters occasionally exchanged visits. We should and will do more of that. By the way, Robert Many, who lives in Washington and who attends meeting quite regularly in Baltimore where he is a member, was one of those who went to Philadelphia. Baltimore is about 45 miles from Washington and Philadelphia is about 150 miles from Washington. There is loyalty for you. . . . But why not — all had a grand time.

Speaking of visits, President Gosnell with Mrs. Gosnell spent a day at headquarters with J. E. Smith, J. A. Dowie and L. L. Menne. Had a grand visit and took back a lot of interesting information to Baltimore Chapter members. . . .fine people, these Gosnells. . . . Among those who spoke to our members on various Radio subjects were Mr. Ingram, Mr. Whitt, Mr. Rathbun, Mr. Gosnell and others. Fred Horvath and Leo Taylor are two new members . . . good report by Chairman Marsh on our Philadelphia visit. Some members talking about visiting New York before long.

Philadelphia Chapter. The big meeting of course was the visit of Baltimore Chapter members. In order that we might have larger quarters and all facilities for serving refreshments we changed our place of meeting for this particular occasion. We are back at our regular place of meeting now, however. Chairman Harvey Morris doing a grand job as usual. Has been re-elected a Vice President of our National organization . . . a good man . . . an expert on television. Secretary Clifford Hill very active at meetings, but must have writers

cramps . . . no reports in recent weeks. Good old Charley Fehn always out in front doing his share. Good crowd at Philadelphia. Let's go on to New York.

New York Chapter got off to a very good winter start by having one of their celebrated pep meetings. To begin with Chairman Wappler, Secretary Kunert, Vice Chairman Alex Remer and Assistant Secretary-Treasurer Frank Zimmer, met at dinner with Executive Secretary Menne. At this meeting the officers of New York Chapter disclosed their plans for coming meetings . . . . They have some mighty good things in store for their members.

From this little meeting the officers hurried to the regular meeting place of New York Chapter where seventy-four members were present. Chairman Wappler opened the meeting with his usual spirit of enthusiasm and then escorted Mr Menne to the rostrum. Menne was given a heart-warming reception and spoke at some length on the activities of the National Radio Institute. Following this there were good snappy talks by Kunert, Remer and Zimmer. Then a recess for refreshments . . . . plenty to eat and drink which is always the order at one of these social meetings. Bert Wappler, who is a grand leader, conducted the meeting in his delightfully characteristic way. Some members stayed long after the meeting closed just "chinning." Everything is hotsy-totsy in New York.

Jimmy Newbeck hopes to spend more time with us soon. Members are pleased to learn of his re-election as a Vice President.

Always good talks at these meetings. Vice Chairman Alex Remer spoke on power packs. There is a man who is being primed for a national office. A good Radio man who knows how to mix his serious talks with a bit of humor now and then . . . Dick Patton giving one of his characteristic good talks on radio servicing. . . . John Krebs, one of our newer speakers spoke on amplifiers. By the way Krebs takes care of our amplifiers at our Chapter meetings . . . . William Fox with one of his good talks on television. . . . Chairman Wappler and Secretary Kunert always on the job ably supported by the Executive Committee. Well, as Ethel Barrymore would say, "That's all there is — there isn't any more."

A Beautiful Alumni Pin Is Now Available

Here is a pin you can be proud of. It may be worn only by members of the NRI Alumni Association. It may be worn on the lapel of your coat or on your vest. It is very attractive.

This Alumni pin carries the star insignia of the Association with the letters "N.R.I.A.A." in the points of the star. The outer edge has these words inscribed, "National Radio Institute Alumni Association."

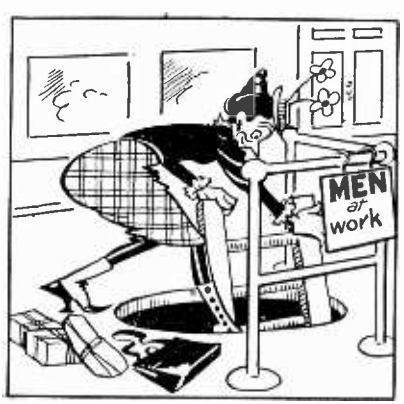
The back is fitted with a good strong patented safety clasp—as an added protection and to prevent loss—a clasp that really works.

The Alumni Association pin is designed to be worn on all occasions. It is made of beautiful bronze. It is quiet and dignified—just the type of pin you would expect a professional man to wear.

These pins are available as an Alumni service. They are carried by us strictly as an accommodation for those of our Alumni members who wish to purchase the pin for $1.

It is not at all necessary for Alumni members to wear this pin. However, a great many desire to do so and the pin was designed to meet this popular demand.

All you need to do is to write a note to L. L. Menne, Executive Secretary, NRI Alumni Association, 16th and U Streets, N. W., Washington, D. C., and say "Here is $1. Send me my Alumni pin." Then add your name, complete address and student number.



Here And There Among Alumni Members

Congratulations to Mr. and Mrs. W. C. Massett, Columbus, Ohio. They recently had the pleasure of celebrating their Golden Wedding Anniversary, as well as Mr. Massett's seventy-sixth birthday.

———n r i———

For some time now Charles L. Foster, of Cambridge, Ohio, has been planning on taking the examination for a First Class Radiotelephone license. He reports that after a flat tire and a car breakdown, he finally made it to Cleveland, Ohio, and passed the examination for the first class phone license. Foster is employed by the American Telephone and Telegraph Company.

———n r i———

Among the many visitors to NRI in recent months was Robert Coverston, of Baltimore, Maryland. He wanted some special information on television.

———n r i———

From Tonsberg, Norway, Graduate Einar Axelsen sends a long letter and a fine snapshot showing him at work at his Radio bench. Axelsen is also employed as a Radio Operator at the Tjome Radio Station. He is doing very well.

———n r i———

At a dinner meeting with Wappler, Remer, Zimmer, and Menne, in a swank New York Hotel, Lou Kunert ordered sweet potatoes. The waitress brought him spinach. Back it went. After waiting 15 minutes, the waitress set a covered dish before him and said, "There you are, sir." This time she brought him boiled onions. Kunert, fit to be tied, gave up in disgust.

———n r i———

Graduate John B. Simmons, Belleville, Kansas, writes that he has just opened up his full-time Radio shop. He feels that the prospects are very good. Best of luck to you, John.

———n r i———

A letter from L. Perillec tells us that he is now employed at the Canadian Celanese Ltd. He reports working on an electronic counter which will count good pirn (fishing reels) and reject empty or partly filled pirn.

———n r i———

Another amateur, Clayton Phillips, of Cortland, New York, has just been appointed by the American Radio Relay League as Emergency Communications Coordinator for Cortland County. Phillips is also in charge of the Radio Service Department at the Ames Chevrolet Company in Cortland.

———n r i———

William A. Mueller has been employed since July 1 by the Michigan State Police. He is a Radio Operator at Paw Paw, Michigan. He now has his First Class Radiotelephone license.

———n r i———

Graduate Robert Lambert and his wife, from Belle, West Virginia were also among the visitors. We had the pleasure of showing them around the Institute while they were in Washington on vacation.

———n r i———

Clyde Wilson Ray, of Lancaster, Kentucky, announces that he has recently joined the ranks of NRI Radio amateurs. His call is W4NRII.

———n r i———

Mr. and Mrs. Lucien J. Goulet announce the arrival of an eight pound three ounce baby daughter. We know that the Goulets are very proud of their new family addition. Mr. Goulet is employed by Station WSKI, near Montpelier, Vermont.

———n r i———

Graduate Joseph P. Smith, Jr., was able to visit NRI for a short while as a part of his trip to Washington, D. C. Smith operates a spare time Radio servicing business in Detroit, Michigan.

———n r i———

J. T. Hasselberger, of Baltimore, Maryland, was also a recent visitor.

———n r i———

Graduate Walden P. McKim is doing a good job at Radio Station WJLD, in Bessemer, Alabama. He has a first-class Radiotelephone license, a second-class Radiotelegraph license, and amateur call W4KVB. He has recently been occupied in the installation of a new F.M. transmitter for his company. Their F.M. call is WDXE.

———n r i———

We were glad to have Andrew Murphy, of New York City, visit NRI. He enjoyed a talk with Chief Instructor Dowie. Murphy is a member of the Local Alumni Chapter in New York City.

———n r i———

Metro M. Sorockha has just received his amateur license. His call letters are W2YPF. Sorockha also is a member of our New York chapter.

NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

Vol. 13 December, 1948-January, 1949 No. 6

Published every other month in the interest of the students and Alumni Association of the

NATIONAL RADIO INSTITUTE
Washington 9, D. C.

The Official Organ of the N R I Alumni Association. Editorial and Business Office, 16th & You Sts., N. W., Washington 9, D. C.

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Printed in U S.A

NATIONAL RADIO NEWS
16th & U Sts., N.W., Washington 9, D. C.
Published every other month by National Radio Institute

For:

Mr. Harold R. Rueth
RFD 3
Jefferson, Wis.

226 YE 42

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Washington, D. C.
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