

NATIONAL RADIO NEWS



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Alumni Association News

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WELL DONE, FELLOW AMERICAN

THE war is over! The fanatical war lords who pounced upon an unsuspecting world have been thoroughly beaten. But what a price we had to pay in lives and material. What terrible suffering was inflicted upon millions of unfortunate peoples.

Make no mistake about it—we had a narrow escape. We were totally unprepared for what our enemies unleashed upon us in an attempt to beat us to the punch. Let us not forget that—ever.

They thought they had us. They thought we were soft—too comfortable in our smug contentment to get ready in time to defend ourselves. They thought they could push us around. What a mistake *they* made!

We have again proven that there is nothing to compare with American ingenuity. That our men are the best fighting men in the world. That our citizens in factories and on farms can and will give every ounce of strength in defense of our way of life. That our women can and will fight too—in the service, in industry and in the kitchen.

It makes a man's blood tingle just to think that he is an American—a vital cog in this great country.

Now for the peace! Now for newer and bigger opportunities for success. It will not all be rosy. Peace has its problems too, as we all know from experience. But we also know that our citizens love this country—that they are proud of it—that they will stick together, loyally, giving and taking, as the case may be, so that there may be peace and contentment for all peoples of the world.

I salute you, brother American. Yours is the joy of a job well done. You have helped preserve a Free America and have created a new world, with great hope for an enduring peace. I repeat—well done, fellow American.

J. E. SMITH, President





THE ABC's of RADIO SERVICING

By J. B. STRAUGHN

Assistant to the Director of Education, NRI

RADIO servicing is an ideal field—an interesting, profitable occupation which will give you real professional standing in your community. Almost everyone owns a radio, but relatively few people know how to fix one. The man who has this knowledge is sure of a comfortable living and the respect of his fellows.

To the eye of the average person, a radio appears to be a jumble of strange-looking objects. However, the radio man doesn't worry about how the radio *looks*. Whether the set is a large phono-radio combination, a television set, or a tiny midget—whether it is an a.m. (amplitude modulation) or an f.m. (frequency modulation) type—the serviceman knows that it contains only a few general types of parts. He knows that these parts are connected in certain ways to produce certain desirable operations.

In other words, the serviceman recognizes a radio receiver as an electrical device which operates according to well-known electrical rules. To him, there is nothing mysterious about a radio which operates improperly or goes dead altogether. He knows that some part or connection has become defective, and that he is to find and repair the fault.

Repairing a defect is simply a mechanical procedure of mending a poor connection or substituting a good part for a bad one. An expert serviceman generally spends only about 10% of his time in making the actual repair. He uses the other 90% in diagnosing the *cause* of the defective operation. Almost any handyman can repair a radio, once he is shown the trouble. But it takes real knowledge of radio to locate the defect with reasonable speed. It is

this *specialized knowledge* which sets the expert serviceman apart from ordinary “fixers”—and it is for this knowledge that he is paid.

The quicker a serviceman can find the trouble, the more receivers he can service and the more profit he can make. Hence, you should have *two* goals as you start on your radio career; first, to learn *how to service*; and second, to learn how to service *more quickly*.

This *second* goal is the one which makes the difference in the earnings of servicemen. Many are “stuck” in a rut, having learned just enough to get by, and then having stopped their radio education before reaching the point where it would really pay dividends. Remember, it's *knowledge* for which you are paid!

How Radio Parts Break Down

The basic parts of a radio receiver are tubes, coils, condensers, and resistors. Any one of these parts can become defective. Two of your first steps on the road to becoming a serviceman will be to learn to recognize these various parts and to understand what may go wrong with each of them. Let's take a few examples, and preview some of the parts you will study in detail in your Lessons on Fundamental Radio Principles.

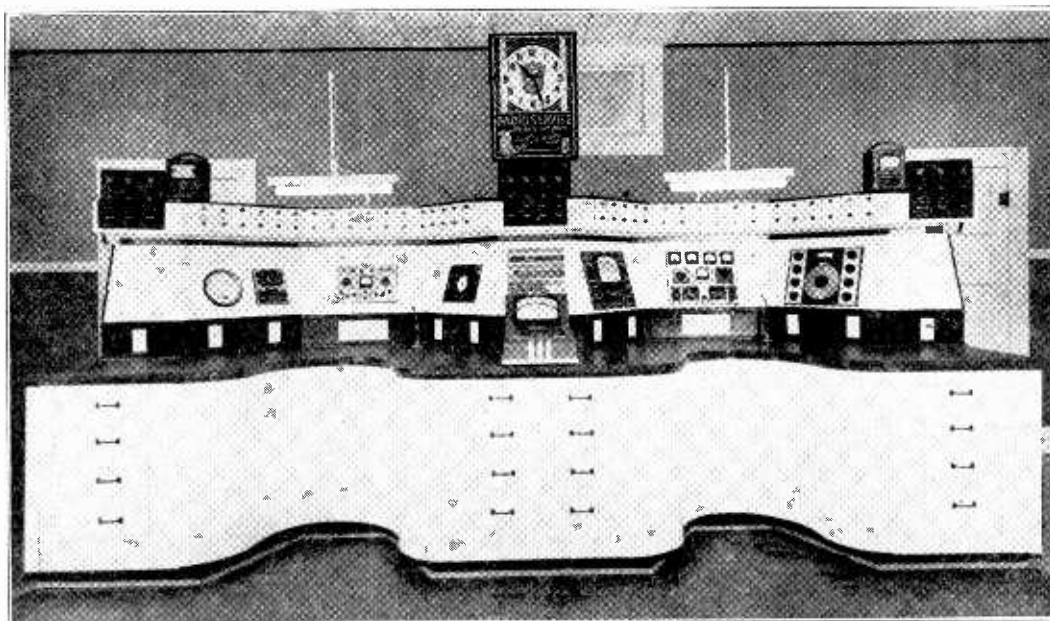
Radio Coils. Several typical coils are shown in Fig. 1. As the name implies, each consists of a coil of copper wire wound around a form. It may be wound in a single layer, or it may be wound in layers, like thread on a spool. The coil may be wound on a bakelite or fiber cylinder, or it may be wound on a cardboard bobbin.

In some cases, thin sheets of iron may be inserted inside the bobbin, so that the coil is around the iron. Frequently two or more coils are wound on a single core of iron, bakelite, or fiber. Such a combination of coils is called "a transformer," because it can be used to transform or transfer power from one circuit to another.

The wire is made of copper because copper is a good "conductor" of electricity. (Little electrical power is lost in the wire.) Silver would be slightly better, but its high cost rules it out except for special applications.

was first fastened to a terminal lug connector, and stretching or expansion of the coil form has snapped the wire. A more likely reason for a break in the wire is electrolysis—a kind of corrosion which attacks and eventually eats through wire which is carrying a current. Also, if too much current flows through a wire, it will overheat and melt.

Whatever the cause of the break, the circuit is opened and the radio no longer can perform normally, or it may be dead altogether. We may be able to see this break if it has occurred at a terminal. However, it is quite likely that the break is underneath several layers of wire,



Can you imagine yourself working at a modern fully-equipped service bench like this? Here you see an excellent example of a well-designed two-man service bench, built for an NRI graduate. This man started in business using a small desk-like bench and a limited stock (a picture of this is shown on page 7). In just two or three years his business grew to such an extent that this larger bench was necessary—and the business paid for it!

Open Circuits. Regardless of its appearance, a radio coil is a continuous piece of wire through which an electrical current can flow. Should this wire break, the current no longer can flow through the coil. Then we say that the coil has *opened*, because the circuit is broken and no longer has "continuity."

A break of this kind may occur sometimes because the coil wire (which usually has a very small diameter) was pulled too tightly when it

in some position where we cannot possibly see it. If so, to find the trouble, we either have to substitute parts until the radio comes back to normal or have to make electrical tests to determine just which part is defective. (Service-men make these tests by using indicating devices which show just what is happening electrically within the circuit. In your regular study lessons, and the experimental kits, you learn all about the different methods of testing radio parts and circuits.)

Short Circuits. An open circuit is not the only trouble which can occur in a coil. The turns of wire in a coil may be wound close together, or there may be many layers of turns. It is important that the wire-turns be electrically separated so that there is no copper-to-copper contact between wires or layers. To prevent contact, the wire is covered by "insulation." This insulation may be a varnish, or it may be a silk or cotton "sleeve," either of which has the property of blocking the flow of current, thus forcing the current to stay within the wire.

Should this insulating material become defective, it will be possible for electric current to flow through the break to some adjacent wire, or to an adjacent layer, without having to follow the turns of wire. Any such path through a break in the insulation is called a *short circuit*, so named because the current is following an undesirable (and usually shorter) path. Thus, it is not flowing at its full intensity through a portion of some electrical device. Again we have a defect which probably will not be visible.

Part Value Changes. In your Lessons on Radio Fundamentals, you learn that certain electrical properties of the coil depend on the spacing between the turns of wire. Should this spacing change ever so slightly, the coil will not have exactly the same properties. Also, you will find that if moisture is absorbed by the form on which the coil is wound, another electrical value of the coil will be affected. Consequently, it is possible for the electrical characteristics of the coil to change, and for the operation of the receiver to be affected thereby, without any visible alteration in the appearance of the coil.

Radio Condensers. As you can see, coils are subject to a variety of possible defects. This is true also of other radio parts. Let us see how some of the condenser types, shown in Fig. 2, can become defective.

One kind of condenser is made of two metal plates separated by an electrical insulator. The plates are strips of tin foil, separated by an insulator made of waxed paper. The condenser is rolled up in the form of a cylinder, and a wire is pressed against each foil plate. The condenser is then dipped in wax. On hardening, this wax holds the wires against their plates. These wires are used to connect the condenser to other parts of the circuit in which it is installed.

Should one of these wires pull away from its plate, the connection between other parts and that particular plate of the condenser will be broken, which *opens* the circuit. Since the contacts between the wires and the plates are sealed within the condenser housing, you can't

see whether a wire has pulled away or not.

If the insulation between the plates breaks down, an electrical circuit will be completed between them. This *short circuit* will ruin the condenser.

Another class of condenser has plates with variable spacing. One plate is made of a springy material and can be moved either closer to or

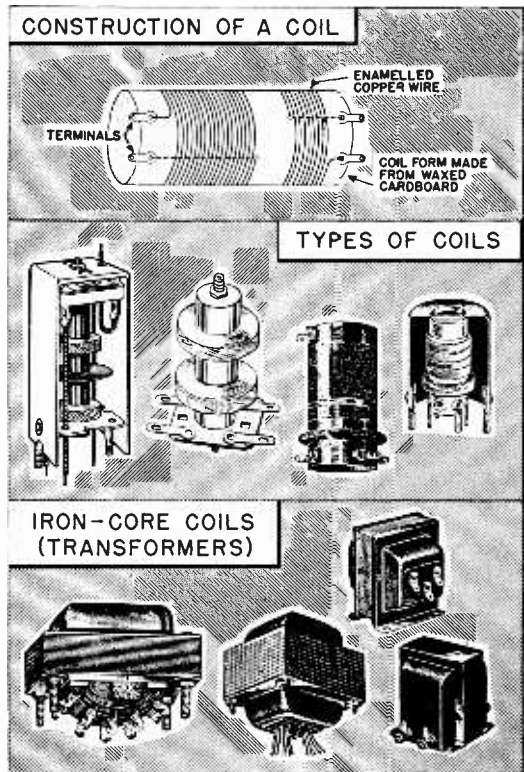


FIG. 1. Air-core and iron-core coils and transformers.

farther from the other plate by a controlling screw. These condensers are used to adjust circuits so that they are exactly in step with each other. Once they are adjusted properly, the radio performance will be at its best. However, the spring tension of such a condenser may change with age so that the spacing between the plates alters. When this occurs, the *electrical value* will change also. The actual amount of space variation may be so small that it cannot be detected by the eye, but it will

affect the operation of the circuit.

Still another kind of condenser contains a chemical solution which causes a film to form on an aluminum plate. The film acts as an insulator between this plate and the solution. As the condenser ages, evaporation of water from the solution will reduce the amount of liquid in contact with the insulating film, which will change the electrical rating of the condenser. Also, the liquid may become a poorer conductor of electricity, which will reduce the usefulness of the condenser. These changes will not be visible, although sometimes the escaping moisture will deposit some of the chemical in a whitish crust around the vent holes of the condenser housing.

Resistors. Lengths of special wire or carbon material which have the property of opposing the flow of current, but not of stopping it altogether, are known as resistors. Their electrical effects are in between those of conductors, which carry current with ease, and insulators, which prevent current flow.

Several types of resistors are shown in Fig. 3. Various defects may appear in them. For example, the wires used to connect them to the rest of a circuit may pull away from the resistance material inside the resistor, or the resistance material may break; either of these defects will *open* the circuit. *Short circuits* may occur within the resistor housing. And, as you will learn, heat may alter the characteristics of the resistance material so that it *changes in electrical value*.

Radio Tubes. A tube is perhaps the most famil

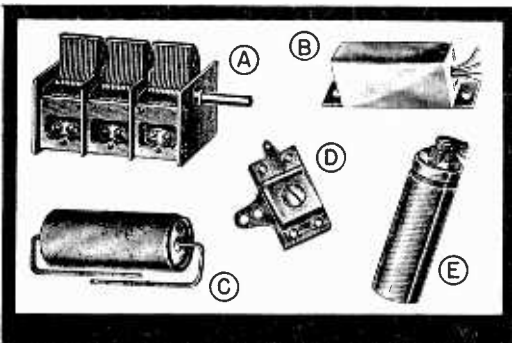


FIG. 2. Some of the many types of condensers. Their names are: A, a three-section tuning condenser; B, a filter condenser; C, a by-pass condenser; D, a trimmer condenser; E, another filter condenser. These are completely described in the Lessons on Radio Fundamentals.

iar of all the parts in the radio. As shown in Fig. 4, it consists essentially of a glass or metal bulb, inside of which are a number of pieces of metal and wire. Heat is necessary for the operation of radio tubes, so one of the pieces of wire is arranged in the form of a filament, somewhat similar to the filament in a lamp bulb or light globe. An electric current flowing through this filament produces heat, and this heat makes it possible for the tube to operate. If too much current flows through the filament, the heat may become so great that the filament wire will melt. This

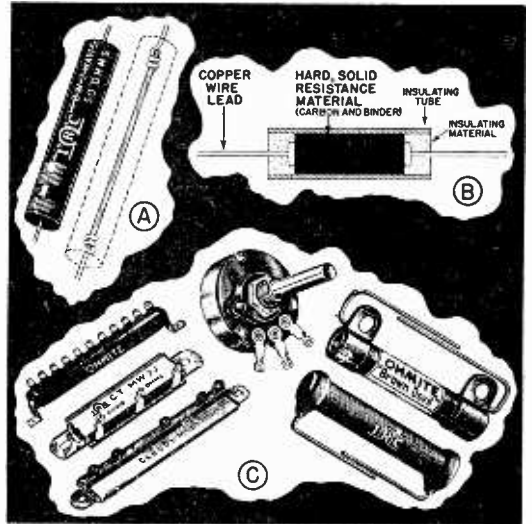


FIG. 3. Several types of typical resistors. A and B show how some are made.

breaks or *opens* the filament circuit, and the tube no longer will work.

The various pieces of wire and metal within the tube must not touch each other except as intended—otherwise, a *short circuit* will exist within the tube. Should the position of some of these parts change, the *tube characteristics* will be altered.

Connections. Radio parts must be connected to one another by pieces of wire. Each connection is soldered to produce a good electrical contact. Although a connection is not a radio "part," a broken connection can *open* a circuit just as well as a defective part. Excess solder may drop from a connection and cause a *short circuit* to the set chassis or to another terminal or part. If dirty wires are connected, or if improper soldering lets chemical actions occur at

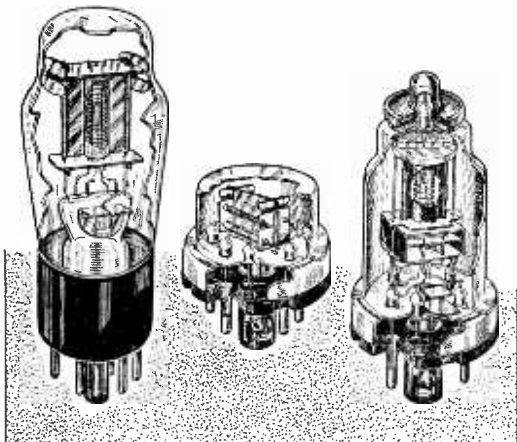


FIG. 4. Cut-away views showing the elements within three typical radio tubes.

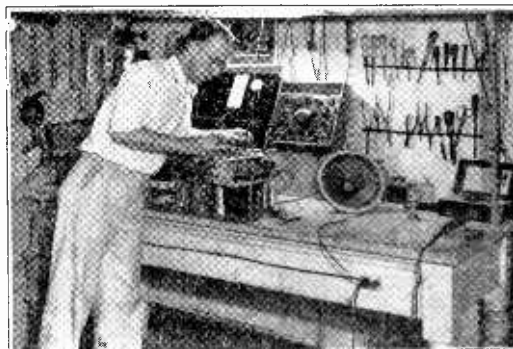
a connection, then the resulting poor contact will oppose the flow of current like an unwanted resistor.

The manufacturer of the radio is careful to see that proper soldering techniques are followed to avoid these troubles. However, servicemen frequently either do not know how to solder properly, or grow careless. Thus they make defective connections which can cause much trouble later.

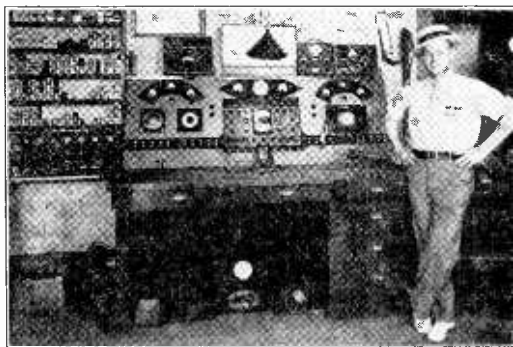
Be sure to learn all you can about this important service step. You will have to unsolder connections either to test parts or get them out for replacement; you will have to resolder the connections to the new part, so you constantly will be using a soldering iron in your radio work.

Summary. You can see a pattern repeating itself over and over in this picture—*regardless of the part, you know that you always look for a mechanical defect which has opened a circuit, caused a short circuit, or resulted in a change in the electrical characteristics of some part.*

It is rare to find a part which *looks* bad, although occasionally one will be found which has been overloaded so severely that it is actually burned or is otherwise visibly defective. Generally, the mechanical trouble will be inside some sealed container or will be of such a nature that it cannot be seen. *The only way we then have of finding the trouble is to observe the electrical effects produced by that particu-*



A good example of how most men get started. A sturdy table for a bench, a few tools neatly held on a board, a combination multimeter and signal generator, and a tube tester are all this man needs now. These basic test instruments are all many servicemen ever get for spare-time or small one-man businesses. However, it is a good idea to set aside some of your earnings to purchase additional equipment when such equipment can speed up your work.



Here is the man who now owns the fine bench shown on page 4. Even here, his few pieces of test equipment are arranged for convenience and good appearance. The latter is particularly important when customers can see the workbench.

lar trouble. From a thorough knowledge of radio theory and of service procedures, it is possible to localize troubles by reasoning. However, in most cases, the servicing procedures soon reach a point where test equipment is needed.

Test Equipment

We have to make tests for open circuits, short

circuits, and changes in parts characteristics. It happens that the majority of radio troubles are open circuits or short circuits, and the simplest way of finding these troubles is to use a device known as a continuity tester. This consists chiefly of an indicating meter and a

battery. When the test probes of this continuity tester are touched together, the meter reads. When the probes are placed on the terminals of a radio part, current from the battery flows through that part if the part makes a continuous circuit (is not open), and the meter indicates a reading. On the other hand, the continuity tester gives no reading if the part is open.



A typical multimeter.

If the part has continuity, the amount of the reading will indicate the characteristic known as the resistance of the part. Comparing this measured resistance with the usual resistance of the part will tell you whether the part is normal or is short-circuited.

Since this continuity tester indicates resistance, it can be used to check the electrical characteristics of resistors. It is, therefore, usually called an *ohmmeter*, because resistance is measured in ohms.

The same meter used in the ohmmeter can be used also to measure the voltage or the current in the radio circuit being checked. A tester which is built for such multiple-purpose use is known as a *multimeter*, and is one of the basic test instruments used by all servicemen.

Another basic instrument is the *tube tester*. With this test instrument, you can check tubes for short circuits and for changes in their characteristics; with it, you can determine the worth of a tube. Tubes are found defective so frequently that most servicemen test the tubes before doing anything else to a radio receiver.



Portable Tube Tester.

If the receiver still operates improperly after
Page Eight

any defective tubes have been replaced, the serviceman then searches for other troubles. Thus, a tube tester becomes the second basic piece of test equipment you should have almost as soon as you go into the service business. (At the beginning, you can take tubes to a radio store to be tested. Naturally, you can't waste this amount of time when you are established in business, and then you will want to have a tube tester of your own.)

The third basic piece of test equipment is called a *signal generator*. As we have mentioned, radio circuits have to be adjusted to work together in order to get the maximum results. With age, the circuits will get slightly out of adjustment; the signal generator is used to supply an electrical signal which will help you to adjust (or "align") the radio properly.



One type of signal generator.

These three items—the multimeter, the tube tester, and the signal generator—are the basic pieces of test equipment which all servicemen must have and use. It is possible to carry on a large servicing business with no more equipment than these three items. On those rare occasions when you encounter a part which you cannot check in some manner with this equipment, you can always substitute for such a part another known to be in good condition, and see whether the radio then works properly. If it does, you have located the trouble.

As your business grows, you will find that there are other testers of various types which can speed up your service work. This supplementary equipment can be purchased from your earnings as you go along, and is described in your regular Course.

The Professional Serviceman. The true professional serviceman has a thorough knowledge of radio parts and circuits. From this knowledge, he first tries to reason out the most probable faults. However, if this step fails, he does not have to test all seventy or eighty parts in the radio receiver, because he knows methods of *isolating* the trouble to a small group of parts. These processes of isolation allow him to concentrate on just the three or four items which could be causing that particular trouble, thus limiting the amount of testing he has to do. This excludes the element of luck, and makes it possible for him to service receivers in a minimum of time.

The professional knows that radio parts are

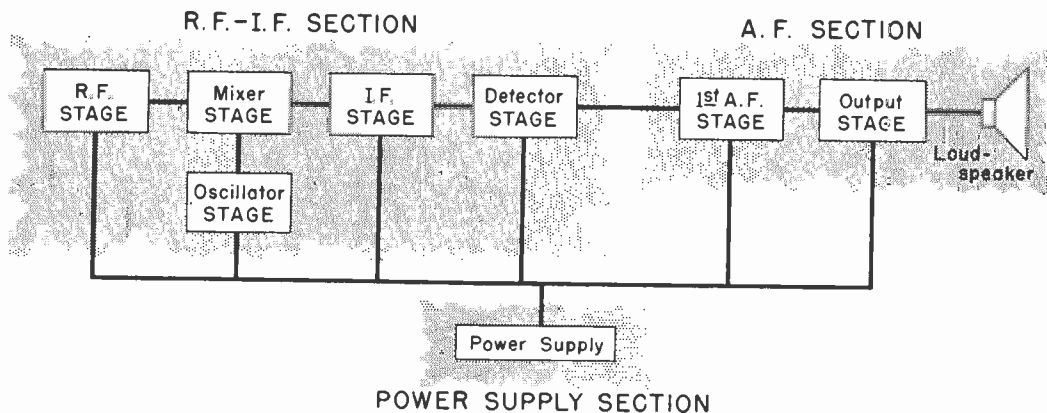


FIG. 5. This diagram gives the basis for the quick professional methods used in the isolation of troubles. Notice that the radio stages are grouped into sections. A single test (or a simple series of tests) will show in which section the trouble exists. Then, other tests will further localize the trouble to the defective stage. There are a number of systems of localization, and they are all covered in the Lessons on Radio Fundamentals. Some are better for one kind of trouble than for another; you would follow a different procedure when working on a "dead" receiver than you would when working on one with distortion, for example. To use any of the systems you must know how the radio should function—in fact, the more you know (and the better you know it) the faster you can service receivers.

grouped in arrangements, called circuits. Each circuit is a complete path for an electrical current flow. Then, he knows that these circuits are grouped in units called stages, and that stages are grouped into subdivisions called sections of the radio receiver.

Even the most elaborate radio can be broken into three sections, as shown in Fig. 5. Sections usually contain from one to five stages, and each stage may have five or six circuits. However, by making a few simple tests, the expert is able to isolate the trouble to a section, then to a stage, next to a circuit, and finally, to the defective part.

For example, a test can be made at the input of the audio section which will show at once whether the a.f. (audio frequency) and power sections are working. If they are o.k., then the trouble must be in the r.f.-i.f. (radio frequency-intermediate frequency) section, so we can ignore all the parts in the a.f. and the power supply sections. A few tests in the r.f.-i.f. section will lead to the defective stage, then to the defective circuit in the stage.

Before it will be possible to isolate troubles in this time-saving professional manner, one must have a thorough understanding of the operation of radio parts and their combinations in



Another graduate, and his simply-constructed bench. There is no need for an elaborate bench when getting yourself established. You will soon receive an RSM Booklet giving detailed plans for simple workbenches that you can build.

circuits, stages and sections. Only then is it possible to take full advantage of observable symptoms and to reason back to the probable cause of the condition.

Even the professional still has to know how to test radio parts. It is true that he tests fewer of them while locating the trouble, but he must

know all about radio parts and their particular weaknesses.

Getting Started. Most servicemen start out as spare-time technicians. Radio is a rather remarkable field, in that you do not need to set up an elaborate service shop to start in business. Once you have learned how to test parts, and have collected the basic pieces of test equipment and a few tools, you are ready to make a start—at least as a radio mechanic. From the earnings on your first few jobs, you can stock a few parts and begin to add to your collection of tools and test apparatus.

At the same time, you will be continuing your studies. You will be learning more about radio circuits and stages, how to get customers, and how to charge for your services. You will be moving by easy stages into the semi-professional classification. Thus, all at the same time, it is possible to build up your knowledge, build up a stock of parts and equipment, and build up your reputation. By the time you have become a professional serviceman, you will be well prepared to compete with any serviceman on either a spare-time or full-time basis.

— n r i —

How to Get Along With Others

DR. JAMES F. BENDER

Director, The National Institute
For Human Relations.

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"If people would only be a little more friendly . . .", said my discouraged friend, coming away from a disappointing interview. Yes, if people would only be a little more friendly, the obstacles to good human relations would be gone with the wind, and all of us would lead happier, healthier, and more successful lives. Friendliness, costing nothing, pays dividends like a mountain of gold. That's why we have a puzzle on our hands: Why isn't there more friendliness in the daily lives of all of us?

The vinegar voice—the grouching about little things that don't matter anyway—the thoughtlessness we heap upon those who care for us—the gruff question and the gruff answer, these are the gremlins that need our attention if we would get along well with others.

This business of friendliness is largely a matter of habit, one of the easiest to cultivate for

those whose hearts are in the right place. Of course, if the heart sags out of line, the first thing to do is set it right.

That means wanting all our relatives, co-workers, and acquaintances to succeed and be happy. One of the poets calls it wishing everyone "the open doors of life."

The next step toward the jackpot of friendliness is to build the habit of being friendly. Tonight perhaps, before going to bed, many a thoughtful person will say to himself, "Starting right now I'm going to increase my friendliness both on and off the job." Maybe he says it aloud to himself ten times before rolling over for a good sleep. Maybe he says it silently like a prayer. And then in the morning he renews the promise first thing.

At breakfast, he notices he isn't as cross as usual, and the second cup of coffee tastes better than it has for a long time. On his way to work he thinks, "I'm going to make it my business today and every day to be friendly because it's the right thing to do. Maybe things will look up for me. Anyway, it's worth a try!" Result is, he's in just the right frame of mind for courting friendliness. His "Good morning" has a ping of warmth unnoticed before. His smile, less mechanical and not so stingy, carries the visual message of friendliness. There's something about his voice that tickles your eardrums. And it's all as natural to him as bees to blooms because his now-found friendliness is rooted in sincerity. By cultivating the spirit of friendliness we can make the world of Sunday and Monday a much better one.

Suppose our friendly person works in a factory. He does his share to make his department known for its team work and good-will. Suppose she is a secretary in the office. You know her by the gracious things she always finds to say about her associates. Suppose he is a salesman, or she a telephone operator. They extend the friendliness of their company to all clients, and seek to understand their problems and be of service. When folks like these troupe home at night, tired as they often are, they do everything to ease the petty frictions that sometimes crop out in the best of families. A sharp word across the table is turned into a joke. Annoyances are never worth ill-will. Their friendliness is rooted in the other fellow's welfare.

And have you ever noticed that the person who makes a practice of friendliness is invariably popular? So, learn the luxury of increasing friendliness. It's the truest mark of civilized man and woman who, come to think of it, are the god and goddess of friendliness in this animal world.

An Icelandic Success Story

ON the twenty-seventh of December, 1944, Mr. Snorri P. B. Arnar of Reykjavik, Iceland, celebrated the tenth anniversary of his graduation from NRI. He celebrated in a well-designed and well-equipped workshop in which he is doing a rushing servicing business.

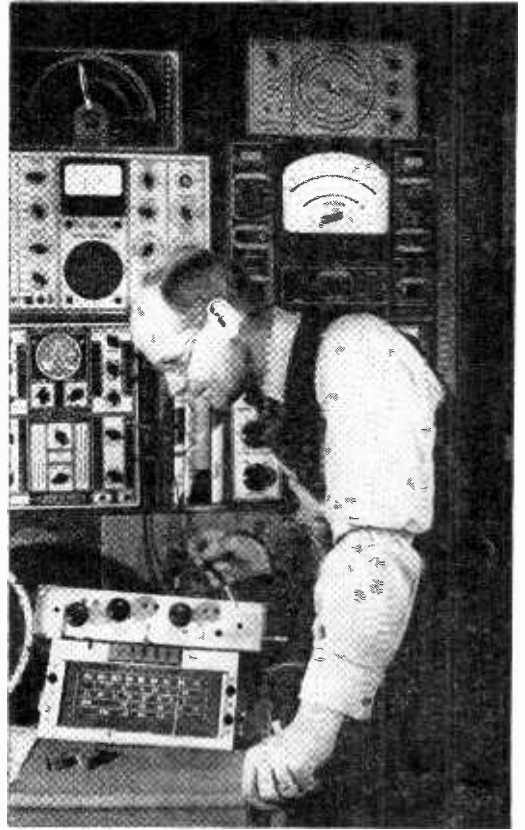
The success which Mr. Arnar has attained is due in a large measure to his determination, energy and ambition aided by NRI training which enabled him to master the fundamental principles of Radio. Such training was unavailable to him in a resident school because of geographical distances. The NRI home-study course which is not tied down by distance or locale, opened to him the vast field of radio servicing.

Picture, if you will, the romance that lies in this story of a man thousands of miles away, a man who is determined to learn, who spends his spare time working towards advancement and who, finally, after real effort, crashes through to outstanding success. This success is concretely illustrated by his well-equipped workshop and by his independence.

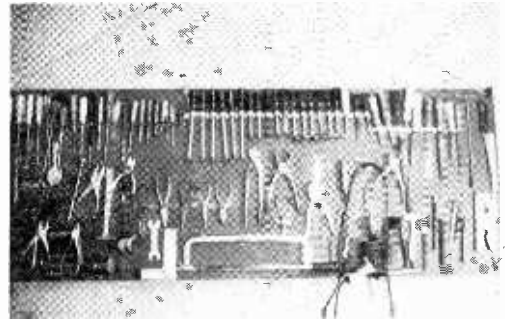
Wouldn't it be a pleasure to tackle a tough servicing problem in the workshop pictured here? The test panel, which could be only partially illustrated, is equipped with some of the best types of servicing equipment which were available before and during World War II. Mr. Arnar has now on order twelve hundred dollars' worth of new test equipment, equipment which he has paid for from his profits and which will enable him to give his customers even better service.

To his right as he works at his bench is a completely equipped tool rack with a specific place for each and every tool. This makes it easy to quickly and safely find the correct tool for each job. To his left is a tier of drawers to stock small parts and hardware. His complete line of replacement parts is easily available in a stock section to the left.

This is what Mr. Snorri P. B. Arnar of Reykjavik, Iceland, did with the NRI home-training course of 1934. While he has been making the most of the opportunities which presented themselves, NRI, too, has been striding ahead. The lessons which you are now studying have gone through many revisions so that you will be acquainted with the very latest information available in this vast field. There is no reason why you, or any man, possessed of a sincere desire to have success, cannot achieve that success—for today opportunities in Radio are greater than they ever were, and tomorrow they will be even better. Count yourself fortunate that you have taken up the study of Radio; and make the most of your opportunity.



Mr. Snorri P. B. Arnar of Reykjavik, Iceland, at work in his shop.



Tools on a special table-board hanging on the wall, as here illustrated are much easier to locate than if kept in a drawer.

Typical Public Address Amplifying Equipment

By WILLARD MOODY

NRI Consultant



PUBLIC address amplifiers may be used for a variety of purposes, but the average radio serviceman who does this type of work is concerned chiefly with low-power amplifiers that are suitable for department store sales demonstrations, church bazaars, night clubs, dances, and wherever a number of people may gather in small groups. In hotels, at banquets, the noise may be fairly high and a speaker would find it difficult to make himself heard above the clatter of dishes, conversation, etc., so that a p.a. amplifier in such circumstances readily proves its value.

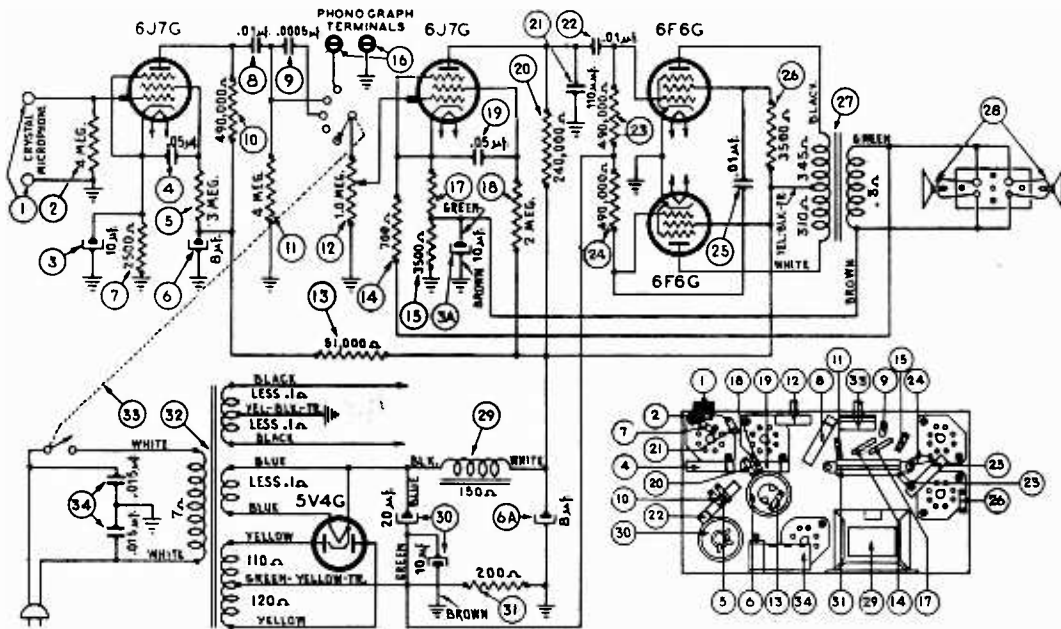
A number of amplifier circuits may be used. The amplifiers are not built by the serviceman because of the superiority of commercial equipment and the reasonable cost of it. Portable amplifiers which can be set up for a definite engagement can be purchased in normal times. At present, amplifiers and other radio equipment may be difficult to obtain because of war shortages, but in many large cities the newspapers carry advertisements in the classified section, offering p.a. amplifiers of the low-power type for sale, and some radio distributors may be able to supply you with used equipment that is in good working order.

The beginner in servicing may be able to obtain one of these amplifiers and set it up, to realize a profit, since the amount of technical knowledge required to install the apparatus is not very great. Servicing the equipment is a different matter, and if the amplifier develops inherent troubles the serviceman must know the technical answers to the servicing questions that arise.

Before the equipment can be serviced, you must know the basic principles that govern its operation. The purpose of this article, primarily, is not to give information on servicing the apparatus, but to lay the groundwork for such servicing work by acquainting you with the types of circuits that are commonly used in p.a. equipment designed for portability and low-power applications, the type of equipment most often encountered by the average technician. Fundamentally, a p.a. amplifier has much in common with the audio amplifier of an ordinary radio receiver. The p.a. equipment, however, is characterized by greater voltage gain and larger power output; it's the big brother of the receiver audio amplifier.

In Fig. 1, a typical public address amplifier is shown. The amplifier is a.c. operated from a 115-volt power line. Five tubes are used in the chassis, a 5V4-G rectifier supplies the d.c. operating voltages, and the other tubes function as audio amplifiers. The output voltage of a microphone (a "mike") is applied to terminals 1. The signal is built up by the 6J7G and fed to the next 6J7G which further raises the signal level. From the plate of the second 6J7G, we go to one of the upper 6F6G grids and R_{21} . The output voltage of the upper 6F6G is fed to the upper half of the primary of output transformer 27.

The variation in the grid voltage causes a variation in the screen current through R_{20} and a signal voltage is developed across R_{20} . The voltage is then applied to the other 6F6G grid through condenser 25. The phase of the voltage is shifted 180 degrees. The phase shift takes



**PHILCO MODEL 905
PORTABLE SOUND AMPLIFIER**

FIG. 1.

place in the upper 6F6G in the diagram. The signal voltage on the 6F6G grid connected to condenser 22 is passed to the 6F6G tube and appears at the screen grid connection of the tube, at R_{25} , at a larger signal voltage value and shifted in phase 180 degrees. Thus, a signal is applied to the grid of the 6F6G connected to R_{21} . This signal is 180 degrees out of phase with the signal on the opposite grid, the grid connected to R_{23} . Accordingly, the conditions for pushpull operation are attained, with the grid voltages 180 degrees out of phase. The phase inversion system used is novel and unusual. It is used in some Philco receivers as well as in this amplifier.

The output voltage of a crystal mike will be much lower than that of a crystal record player. Because of the higher output level of the record player, we find that we need not use the first voltage amplifier tube on record-player operation. Thus, the record player can be con-

nected to terminals 16. Switch 33 is set to position 5, connecting the arm to the top terminal, for record-player operation. This switch, too, is somewhat unusual. First, let us study the connections when the switch is adjusted to position 1. Then, the switch in the primary of the power transformer is open and the amplifier is turned off. Further, potentiometer 12 is not connected to a source of signal voltage. On position 2, the amplifier is turned on and the switch in the primary circuit of the power transformer is closed. This switch remains closed for all positions except "OFF" position. The tubes light up and after a brief warm-up period, the amplifier is ready for operation. The potentiometer, however, is not connected to a signal source and the amplifier does not have any audio output, beyond the residual hum and noise which is very small. On the next position, potentiometer 12 is connected for mike operation to the preceding 6J7G voltage amplifier tube, through condensers 8 and 9.

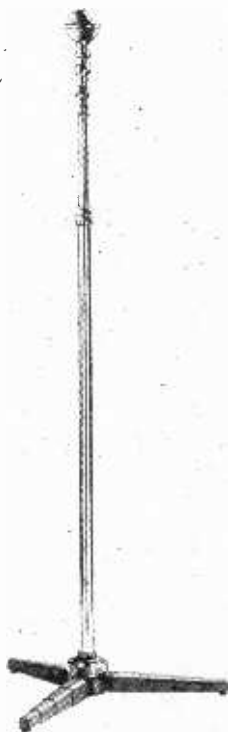


Public address amplifiers are often used for building up the sound levels of an orchestra's musical instruments.

The frequency response of the amplifier is then somewhat high pitched, because the reactance of the series condensers is low at high frequencies but fairly high at low-audio frequencies, thus favoring the transmission through the system of high audio frequency signals. In effect, we then have a tone-control action. On the next switch position, which is number 4, we find that mike operation is obtained and the potentiometer R_{12} is coupled to the plate circuit of the mike voltage amplifier tube by condenser C_8 . This condenser has a sufficiently large capacitance value to permit passage of the audio signals at high and low frequencies covered by the amplifier, without undue attenuation of the lower frequency components. The tone then appears to be deeper than it was for the preceding switch position. This action is advantageous because it may be found in some locations that squealing and howling due to acoustic feedback can be cut down by using this switch position.

On the next and last position of the selector switch, which is number 5, the phonograph is connected to R_{12} . No tone control action is provided on phono operation. The tone can be controlled by shunting a .0001-mfd. condenser across the phono terminals if the pitch is too high, and the condenser value that works best can be determined by experiment.

A typical crystal microphone is shown at left. A mike of this kind may be used with modern audio amplifiers. The three photos on these pages are through the courtesy of Montgomery Ward.



The frequency response and fidelity of the amplifier is unusually good for equipment of this kind. The use of negative feedback, plus careful circuit design, may account for the quality of tone. Referring to the output circuit, and the secondary of transformer 27, which is the output transformer, it can be seen that provision is made for the operation of two permanent magnet dynamic loudspeakers. The use of p-m speakers is a great convenience, since connecting the speakers may be accomplished by simply running twisted wires to each speaker, and no special wiring for field supplies is necessary. Part of the audio voltage supplied to the loudspeakers is fed back into the second voltage amplifier stage. This voltage appears across resistor 17 which is in the 6J7G cathode circuit. The voltage is out of phase with the signal on the grid of the 6J7G and accordingly negative or inverse feedback action results, tending to straighten out the frequency response of the amplifier and to limit the amount of distortion produced in the amplifier. Resistor 14 in conjunction with resistor 17 is a voltage divider, connected across the voice-coil circuit. Resistor 17 is not bypassed with a condenser, since we want the inverse audio voltage to appear across it. Resistor 15, which is used exclusively for biasing the tube, is shunted with a low reactance condenser to keep the audio voltage across the bias resistor low in value. If too much feedback is used, the gain of the amplifier will be greatly reduced, and just the right amount is necessary, that amount being determined by the ratio of R_{14} to R_{17} , which has been worked out by the design engineers.

Negative or out of phase feedback has been illustrated. If the feedback is in phase, or positive, regeneration and uncontrolled oscillation will result, so that the amplifier squeals or howls. This condition can arise if the leads to R_{14} and R_{17} , coming from the voice-coil circuit, are accidentally reversed. The correct connections can readily be found by reversing the leads and noting the results. If the tone is better with the reversed connections and the squeal disappears, the connections are correct. If the squealing becomes more intense, and distortion is heard, the connections are reversed and should be changed—the squealing originally noticed may be due to some other cause, such as acoustic feedback or an open bypass condenser.

In high gain audio amplifier systems, decoupling networks consisting of combinations of resistance and capacitance are used to secure stable operation. Examples are C_6 and R_{23} , C_4 and R_5 , C_{10} and R_{18} . Oscillation may develop if the power supply has a high impedance, and the impedance to the flow of signal current between B plus and B minus is kept low by output filter condenser 6A which also serves to keep the hum voltage across the output terminals of the B supply low in value.



Sound systems may be used for making special announcements at club meetings and are useful for sales demonstrations in department stores.

The input filter condenser is a 20-mfd. unit; while the condenser shunted across R_{23} , is a 10-mfd. type. Bias for the output tubes is developed across R_{23} , since the electron flow is from the center tap of the high-voltage winding to ground through R_{23} . The junction of R_{23} and R_{21} , therefore, is negative with reference to ground, so that a bias potential acts effectively in series with the power output tube grid circuit. Incidentally, note the important fact that the negative terminal of the 10-mfd. unit connected across R_{23} goes to the center tap and the positive goes to ground. The negative terminal of the 20-mfd. input filter condenser connects to the center tap and the positive terminal goes to the rectifier filament circuit. The positive terminal of the output filter condenser goes to choke 29 and the negative terminal is connected to chassis ground.

The amplifier described was intended primarily for portable work and therefore the circuit design was made very simple. Using a simple circuit, the number of parts can be kept few in number and the weight of the equipment can be kept within reasonable limits. In Fig. 2, the circuit diagram of an amplifier which may be used for general low-power installations is shown.

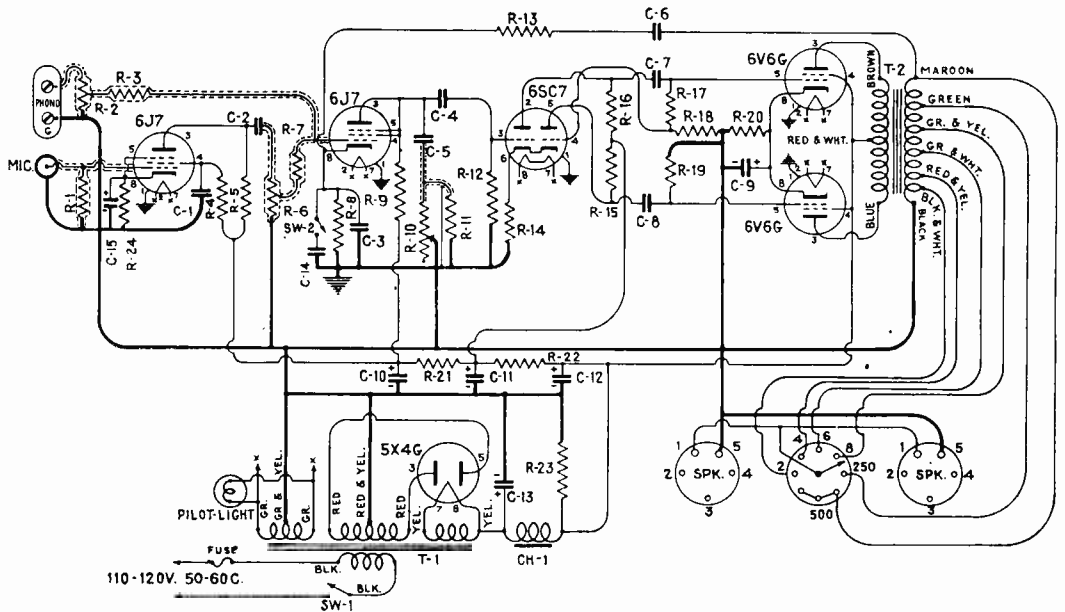


FIG. 2. T-30W14 Amplifier, Thordarson.

Thordarson 14-Watt Amplifier

This amplifier, shown in Fig. 2, uses 6 tubes and has provision for connection to a number of different load impedances. An impedance match to the load, which may be the input of an audio line or a speaker voice coil circuit, can be made by selecting the proper tap on the output transformer. The output transformer is supplied signal power by the 6V6G tubes which are operated in pushpull. These tubes are supplied audio driving voltage for their grids by the 6S7 which, in turn, is driven by the preceding 6J7. On phono operation, the 6J7 which has its grid connected to R_7 is driven directly, while on mike operation an additional stage of voltage amplification, using a 6J7, builds up the signal level.

The signal passage can readily be seen by starting at the source of signal voltage and working back to the output tubes. A mike may be connected to the jack marked MIC. The signal voltage of the high impedance mike, which may be a crystal type, is fed to R_1 and the first 6J7 builds up the level so that a much larger voltage appears across R_5 . Voltage from the plate is applied through C_2 to R_6 . Resistor R_7 is in series with the arm of R_6 . This resistor prevents short circuiting the grid of the tube to ground when minimum volume is used

on mike operation. Thus, the mike channel gain can be cut to zero by setting R_6 so that the arm is close to chassis ground. At the same time, if desired, the volume level of the phonograph can be raised, by moving the arm of R_2 to a position higher above chassis ground. In this way, electronic mixing can take place in the second 6J7 voltage amplifier tube. Or, the phono can be faded down and the mike faded in, if desired, by controlling the settings of R_2 and R_6 .

The signal voltage on the grid of the tube is governed by the settings of the volume controls. In addition, the signal voltage appearing between the grid and cathode of the second 6J7 voltage amplifier tube is governed by the setting of switch S_2 . With the switch open, the capacitance value in shunt with R_3 in the cathode circuit is only .003 mfd., which is the capacitance value of C_2 . This condenser has a high impedance at low frequencies and therefore the voltage at low frequencies across R_3 is larger than it is at high frequencies. Since this voltage is out of phase with the grid voltage, degeneration or negative feedback occurs. The gain of the amplifier system, accordingly, is reduced greatly at the low frequencies, giving the output a high pitched sound. The negative feedback voltage is partially due to the potential appearing across R_3 as the result of current

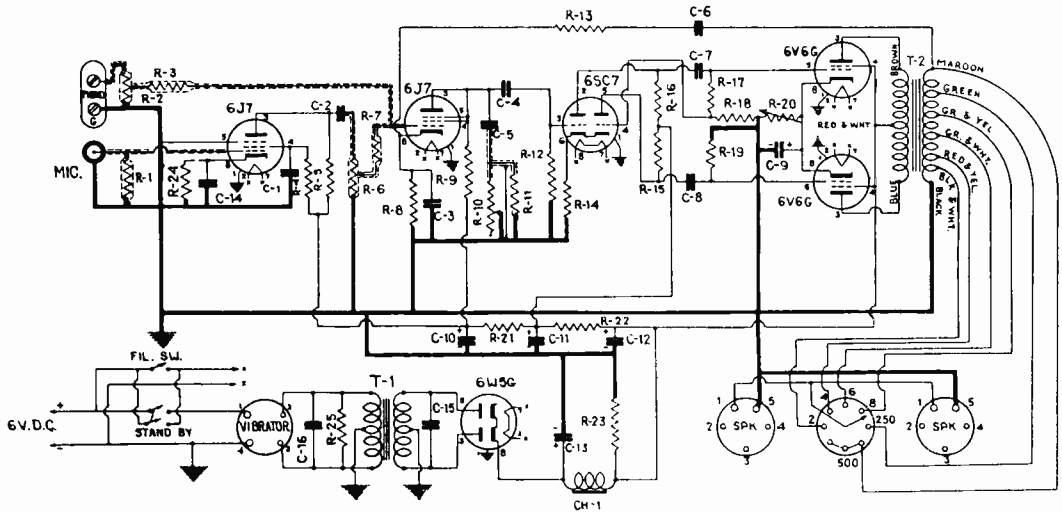


FIG. 3. T-30W12 Amplifier, Thordarson.

feedback, since the voltage is due to cathode current, and the negative feedback voltage is also due to voltage feedback through C_6 and R_{13} . The signal voltage appearing across the secondary of output transformer T_2 is applied through C_8 and R_{13} to the cathode of the second 6J7 voltage amplifier tube for inverse voltage feedback.

When switch SW_2 is closed, condenser C_{14} , which has a capacitance value of .02 mfd., is connected in the circuit and the net impedance across the terminals of R_8 is lowered, so that not as much degeneration takes place at low frequencies as it did with the switch in the open circuit position.

Tone control action, or control over the frequency response of the amplifier, is also afforded by means of condenser C_2 and resistor R_{10} in the plate circuit of the second voltage amplifier tube. Decreasing the value of R_{10} makes the condenser C_2 more effective as a shunt for the signal current from plate to ground. As the condenser has a fairly small capacitance value, .03 mfd., its effect is most noticeable at the higher audio frequencies, tending to give a decreased treble response when the resistance R_{10} is lowered in value.

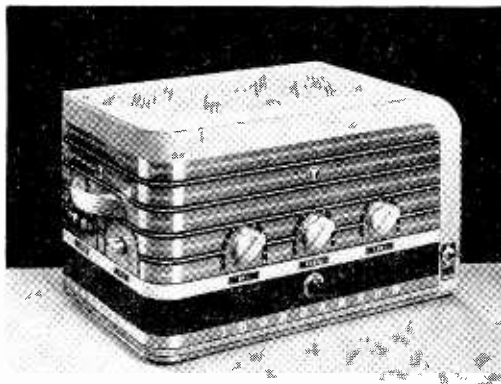
From the plate of the 6J7 we go to C_4 and the grid of the 6SC7, pin terminal number 3. The audio voltage appearing across R_{12} is amplified by the 6SC7 and is much larger at plate P_2 . The signal voltage of this plate is applied to the grid of the 6V6 through C_7 , and a signal current flows in R_{17} and R_{18} . The voltage across

R_{18} is applied to the other grid of the 6SC7, pin terminal 4. The tube then builds up the signal and a larger voltage appears at plate terminal P_5 . This voltage is applied to the 6V6 grid through C_8 . A signal current flows in R_{19} accordingly. The voltages on the 6V6 grids are 180 degrees out of phase, since the triode section of the 6SC7, connected to socket terminals 4 and 5, shifts the phase 180 degrees. The first section of the 6SC7, 3-2, serves as a voltage amplifier and the twin section 4-5 serves as a phase inverter.

The signal voltages of the 6V6 output tubes are fed to the primary of T_2 and secondary voltages are induced. Thus a voltage is applied to the load which may be a voice coil circuit or an audio line. Speaker sockets are provided for connection purposes. Plugs can be inserted in the speaker sockets to connect the voice coils or to connect audio lines to T_2 . A rotary switch is used for changing the connections. Terminals 1 of the sockets connect to the arm of the switch. Terminals 5 connect to the chassis and the lower terminal of the secondary of T_2 . When the switch is set in the first position, or on terminal 2, an output impedance of 2 ohms is offered by the amplifier to the load circuit. Four 8-ohm voice coils in parallel, as an example, could then be matched. If the switch is set on the next position, an output Z of 4 ohms is obtained and two 8-ohm coils in parallel could be used. Impedances of 2-4-6-8-250-500 ohms can be matched by means of the universal output transformer supplied with the amplifier. The 250- and 500-ohm taps would be used in matching audio transmission lines in public

address work which may have values of 250 and 500 ohms.

Power for operation of the equipment is supplied by means of a full wave rectifier power



This is a photo of the Thordarson T-30W12 Amplifier, a modern public address amplifier. Note the streamlining and general appearance, indicative of good equipment and modern design.

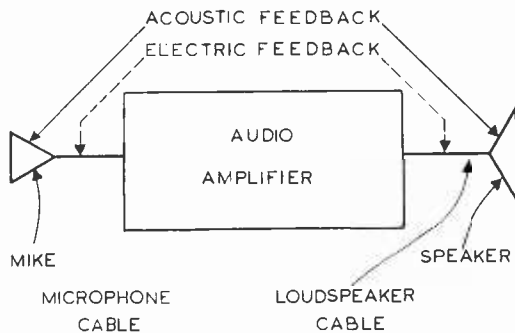


FIG. 4.

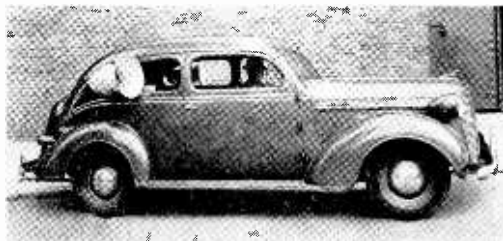
supply system, using a 5X4G tube. The bias for the output tubes is a self-bias, established by current flowing in R_{20} which causes a voltage to be developed across the terminals of R_{20} . The equipment is turned on and off by SW_1 in the primary circuit of the power transformer.

A Mobile Amplifier

A somewhat similar amplifier, but designed for service on a storage battery power supply, is shown in Fig. 3. This amplifier has a rated

output of 12 watts. A non-synchronous vibrator is used. The 6W5G functions as a full wave rectifier. The circuit action is substantially the same as that of the preceding amplifier which has just been discussed. An adjustment of the bias, in this amplifier, however, is provided by means of R_{20} in the cathode circuit of the power output tubes.

In the operation of amplifiers it will be found that there is a definite tendency for squeals and whistles to develop. Usually, this is due to no inherent fault in the amplifier, but simply to the fact that sound waves coming from the loudspeaker may feed back into the mike to form a feedback loop and thus to produce



Courtesy Lafayette Radio Corp.

Mobile sound equipment is often used for street advertising and special announcements.

oscillations. The feedback can be minimized by proper placement of the loudspeakers and mike. In Fig. 4, the feedback is shown. By keeping the mike and speaker cables well sepa-

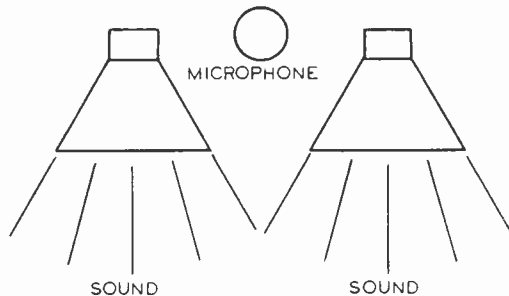


FIG. 5

rated and by shielding the mike cable, the electrical feedback can be minimized. Also, the tubes and amplifier are usually well shielded to prevent stray hum and noise pickup. The position of the mike, in practical work, may be determined experimentally for best results. As an illustration, in Fig. 5 the mike

is placed so that the sound waves produced by the loudspeakers will have a minimum reaction on the mike. If the loudspeakers are used in boxlike baffles or horns, the radiation of sound will take place, for the most part, from the front of each speaker and the rear end radiation will be low. If the loudspeakers are placed as shown in Fig. 5, with the axis of each unit parallel, the sound feedback will be minimized, assuming the room has no peculiar reflection properties. In a car or sound truck, using the portable equipment, merely shutting the glass windows in the car or truck will cut down on the acoustic feedback, since the sound waves will not find it an easy matter to get back from the loudspeakers to the mike, assuming of course that the mike is inside the vehicle.

The best position for the mike can be found by trying the mike in a number of positions and observing the results. In certain positions a high intensity squealing sound may be heard. In others the operation will be quiet.

— n r i —

News of the Radio World

The RKO Television Corporation has devised a color chart for use by Du Mont in a television studio. Viewing the chart on a monitor screen, a television director is able to see at a glance which colors will give a blending or contrast effect on the home television receiver screen. Since red, green, blues and yellows look one way to the eye in the studio and another way over the iconoscope, one of the chief problems that has presented itself in the production of television programs has been the selection of proper colors for television broadcasting.

That there is a great interest in television is very evident from the fact that there are at present 112 applications pending before the Federal Communications Commission for the establishment of commercial television transmitters. Many additional applications are before the Commission for experimental television transmitters and radio relay stations.

F.M. radio equipment will be installed in major Pacific Coast war centers to speed the operation of street cars and buses. Priorities and F.C.C. permission have been secured for the spending of approximately \$40,000 on a two-way radio system on the Los Angeles transit line. The F.M. set-up will include a 250-watt F.M. station for communication with emergency trucks, supervisors, automobiles, motor coaches and street cars.

The Ion Spot, that dull brownish blur that develops in the center of a Television picture tube after a few hours use, was one of Television's most baffling problems. Caused by the bombardment of negative ions on the fluorescent screen, the Ion Spot creates a serious blemish

in the Television picture. Philco Research Television engineers decided to do something about it and invented an electron gun with an Ion Trap that deflects the ions before they can reach the screen. This is a comparatively recent development that will make post-war Television sets better.

The International Detrola Corporation, Detroit, Michigan, intends to enter the Television field post-war. The Detrola Corporation is planning to establish a radio transmitter which will serve an extensive Michigan-Ontario, Canada, area.

Even the most beautifully engineered record changer is home equipment. As such it has to be proof against little Willie, a saboteur at heart, Uncle Bill who is all thumbs, and Aunt Edna who just loves music but is just plumb careless. Pre-war changers were good. Post-war changers will be better. Modern engineering developments will make it possible as a result of war research.

Dr. W. W. Hansen, Research Engineer at Sperry Gyroscope, was recently awarded the Morris N. Liebman Memorial prize by the Institute of Radio Engineers, "for the application of magnetic theory to radiation, antennas, resonators and electron bunching; and for the development of practical micro-wave equipment and technique."

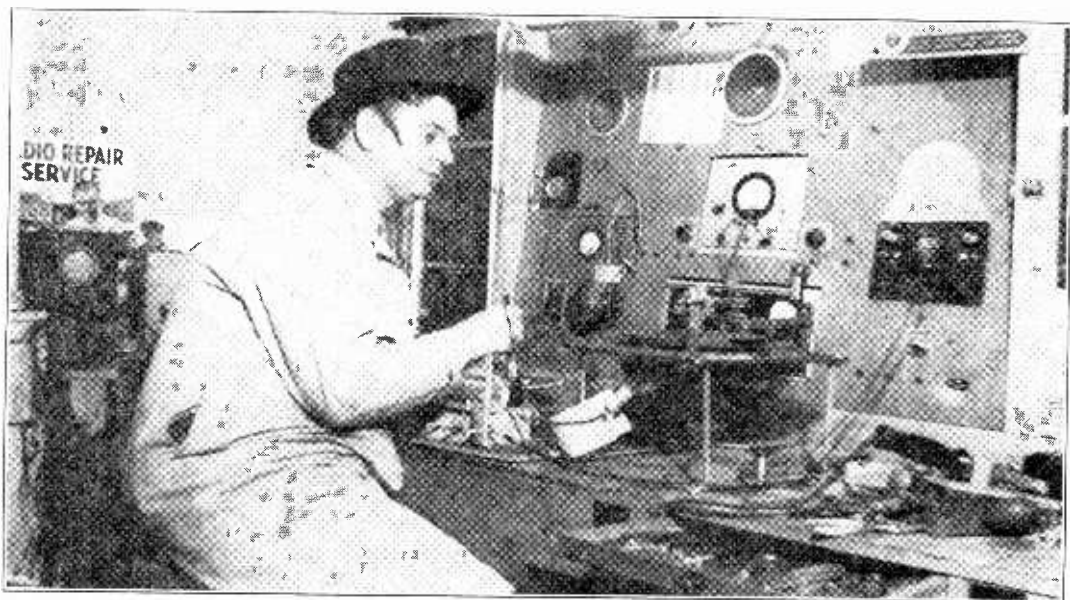
A new capacitor designed for ultra-high frequency radio power equipment such as television and F.M. transmitters has been developed by the Aerovox Corporation, New Bedford, Massachusetts. Losses are extremely low due to the use of a highly refined sulphur dielectric.

A tropical dry battery that is said to provide four to six times the operating life of a normal battery, has been developed by Samuel Ruben in association with P. R. Mallory and Company, Inc., for the Signal Corps. The dry cell is said to have a long shelf life and will stand high temperatures. Individual cells are hermetically sealed.

A super loudspeaker that is said to carry speech for three miles under average weather conditions has been developed by General Electric. The speaker power is less than 25 watts and under good conditions the sound has been heard up to eighteen miles.

Hammarlund "Super-Pro" receivers, familiar to amateur radio operators, have been on duty continuously twenty-four hours a day for over four years in the C.A.A. installation at LaGuardia Airport in New York.

Copper wire gold plated is now used in precision radio headphones, indicating meters, sensitive relays, vacuum tube grids and filaments and in fractional horsepower motors.



Harold E. Chase, of the CE Service, Detroit, at work in his shop.

EFFICIENCY IN A RADIO SHOP

THE NRI Alumni Association is proud of a number of growing chapters in various parts of the country. One such chapter is located in the great metropolis of Detroit. For the past two years the chairman of this chapter has been Mr. Harold E. Chase. This story is about Mr. Chase and his thriving Radio service business at 15731 Grand River Avenue.

Mr. Chase and his partner have a rapidly expanding business. Your editor recently visited this establishment and was very much impressed with the neatness of the shop and the efficient methods which are employed.

Their aim is to save time, wherever it is possible and all cards, records and shop layout have been designed with this in mind. When a Radio job is received it is given a number on a form consisting of four parts. One is a white form which is the customer's bill. (See Figure 1A.) The next attached form, carrying the same number, is printed on pink paper and is the customer's receipt. (See Figure 1B.) The third form, also carrying the same number, is printed on yellow paper and is for filing. (See Figure 1C on page 24.) The fourth form

(Figure 1D) printed on somewhat heavier paper, is the shop card which stays with the Radio until it is billed by the bookkeeper.

Note again form 1B, the customer's receipt which, as previously mentioned, is printed on pink paper. Note that there is a distinction between a "fixit" job and a general repair job. This is pointed out to the customer who is given to understand that a "fixit" job carries no guarantee whereas a general repair job carries a full ninety-day guarantee. The customer is required to place his signature on these forms to avoid misunderstanding later.

When the set is taken in, the shop card stays with it so that time, parts, etc., can be noted as it progresses. The white and yellow copies are put on a work schedule board to stay until their turn, then are moved to an "in work rack" or "waiting parts rack." When the job is complete it is billed and put on "delivery rack."

The accompanying photo shows Harold E. Chase at work servicing an automatic record.

changer. The bench is the rough work or assembly bench. Here, tubes are checked and replaced, and new dial lamps are installed in receivers. Mr. Chase considers it good business practice to replace the lamps even though the old ones are still working, since the cost of replacement is low and the life of a pilot lamp usually is short. Here, too, the radio chassis are cleaned up and simple tests are made. If new tubes are required and tube replacement does not clear up the trouble, the set is brought to the technical test bench, not shown in the photo, where it is given further tests.

All the work on the first bench is done by an assistant, while the technical work of servicing

meter, watt meter with switch, resistance bridge and a capacitor analyzer as well as other miscellaneous devices. Also note the shallow tool drawer at the right of the bench. This arrangement makes it possible to have the bench top clean of tools and yet have all tools laid out in their proper places within easy reach. On top of the bench is the power pack for car sets. There is also a car battery and charger under the bench to use in connection with car sets. All cabinets and cabinet hardware stay in set bins as this work is done in the back near the bins. This means the technician bench holds only chassis, speaker and chassis parts. There are small numbered boxes in each bin for the hardware. The bin number

RADIOS *White Paper* **CE** No 1551
 Service
 15731 GRAND RIVER Phone: Vermont 7-5930

MODELS and SUPPLIES

NAME	PHONE
ADDRESS	ZONE
DATE	PICKED UP PROMISED

GUARANTEE

ALL GENERAL REPAIR JOBS CARRY OUR 90-DAY, LIKE NEW GUARANTEE
 WE ASSUME NO RESPONSIBILITY ON "FIXIT" JOBS FOR OTHER PARTS

GENERAL REPAIR "FIXIT" OK'D BY

NO.	PARTS USED	PRICE INSTALLED
1	COMPLETE ANALYSIS	
2	PICK-UP and DELIVERY	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
	CUSTOMER BILL	TOTAL

FIG. 1A.

RADIOS *Pink Paper* **CE** No 1551
 Service
 15731 GRAND RIVER Phone: Vermont 7-5930

MODELS and SUPPLIES

NAME	PHONE
ADDRESS	ZONE
DATE	PICKED UP PROMISED
DE AD	FADFS HUM DISTORTS SOUFALA
MARK	MODEL SERIAL CW
PARTS MISSING	BROKEN YEARS

GENERAL REPAIR "FIXIT" OK'D BY

GUARANTEE

Since all parts in a radio are part of the complete circuit it is not possible to guarantee a job unless all parts and sections are tested.

A Fixit job means make play with the least time and material. We assume no responsibility for other parts. A General Repair carries a full 90-day Guarantee.

Custom Check

RADIOS ARE SOLD FOR REPAIRS AFTER 30 DAYS

FIG. 1B.

is done on the second bench by a trained expert. A glimpse of the technical bench is given at the left of the photo. On the technical bench, Rider manuals are at hand as well as proper test apparatus for servicing. The NRI Tester forms a part of the test setup.

There is also a vacuum tube voltmeter constructed by Mr. Chase, test speakers, output

appears on all set receipts and shop cards so the chance of lost hardware is minimized.

We shall be very glad to have information from other NRI members who have something to contribute for the benefit of our readers. Photographs are always very welcome. We particularly like those which show the student or graduate at work at his bench.

RADIOS

Yellow Paper

G E
Service

Nº 1551

BIN

15731 GRAND RIVER

Phone: Vermont 7-5930

MODELS and SUPPLIES

NAME	PHONE			
ADDRESS	ZONE			
DATE	PICKED UP	PROMISED		
DEAD	FADES	HUM	DISTORTS	SQUEALS
MAKE	MODEL	SERIAL	SW	
PARTS MISSING	BROKEN	MARS		

GENERAL REPAIR "FIXIT" OK'D BY _____

NO.	PARTS USED	PRICE INSTALLED
1	COMPLETE ANALYSIS	
2	PICK-UP and DELIVERY	
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
	TOTAL	

FILE COPY

FIG. 1C.

Cardboard Paper

TUBES BY **Nº 1551**

DISMANTLED BY _____ INSTALLED BY _____

CHASSIS CLEANED _____ BILLED BY _____ BIN _____

SERVICE TIME _____

NAME	PHONE			
ADDRESS	ZONE			
DATE	PICKED UP	PROMISED		
DEAD	FADES	HUM	DISTORTS	SQUEALS
MAKE	MODEL	SERIAL	SW	
PARTS MISSING	BROKEN	MARS		

GENERAL REPAIR "FIXIT" OK'D BY _____

NO.	PARTS	LABOR	TOTAL
1	COMPLETE ANALYSIS		
2	PICK-UP and DELIVERY		
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
	TOTALS		

SHOP CARD

FIG. 1D.

Our Cover Photo

Electronic "eyes" of all shapes and sizes, these are radar tubes made by General Electric to "show up" enemy planes and ships. Anne Farina, G.E. employee, holds largest tube of its kind. Planes and ships miles away show up on face of the tubes as dots and streaks, and land objects in outline.

Tubes like these are applicable to post-war television sets. Mass production by U. S. manufacturers like General Electric will drastically reduce prewar price which will be among factors that will bring about reasonably priced television sets. Tubes shown on cover range in face size from twelve to three inches.



H-m-m. Can't concentrate, eh? What you need is something to take your mind off your business.

Number, Please!

"How are you this evening, honey?"
 "All right but lonely."
 "Good and lonely?"
 "No, just lonely."
 "I'll be right over."

Keep your War Bonds now—they will keep you later.



N.R.I. ALUMNI NEWS

Charles J. Fehn	President
Peter J. Dunn	Vice-Pres
Earl R. Bennett	Vice-Pres
F. Earl Oliver	Vice-Pres.
Oliver B. Hill	Vice-Pres.
Earl Merryman	Secretary
Louis L. Menne	Executive Secretary

NOMINATIONS FOR 1946

PEACE—it's wonderful! And now for a good old-fashioned election of officers to serve our Alumni Association during 1946. The first step is to call for nominations.

Most of our members know the procedure we follow to elect our officers. But let us go over it briefly for the benefit of those of our members who joined the Alumni Association during the current year and who will vote for the first time.

Our Constitution provides that two months prior to January 1 of each ensuing year, nominations for the various offices shall be called for from the membership through the columns of NATIONAL RADIO NEWS. Our Constitution further provides that one month prior to January 1 of each ensuing year, the two nominees for each office shall be submitted to the entire membership. The membership shall in return submit the ballots properly marked, voting for one nominee for each office.

In accordance with this procedure, it is our custom to call for nominees for the approaching year in the issue of the NEWS corresponding to this one, then in the next issue of the NEWS present the two nominees for each office for the election of one to take office on January 1.

All present officers may be candidates to succeed themselves, except the President. The President is limited to a term of one year, thus opening the way for other worthy candidates to be elevated to this position of honor.

Good and faithful Charley Fehn of Philadelphia still has the balance of this year to serve as President after which he will join that fine group of past-Presidents, namely John E. Fetzer, K. W. Griffiths, T. J. Telaak, Peter J. Dunn, Earl R. Bennett, Clarence Stokes, Dr. George B. Thompson, Edward Sorg, F. Earl Oliver, and Louis J. Kuerst.

Charley Fehn is expected at headquarters in

Washington within the next few weeks. Executive Secretary Menne also plans to visit Phila-Camden Chapter to do honor to that local for developing Mr. Fehn, who earned his spurs as Chairman and Treasurer of Phila-Camden Chapter. In fact, whenever anything is going on there we will find Charley Fehn heading a committee and digging in to make the affair a success.

In addition to President, we will elect four Vice-Presidents. The eight men nominated for Vice-President will be named in the ballot to appear in the next issue of the NEWS and then the four receiving the highest number of votes will be declared elected. You are requested to nominate four candidates for Vice-President.

Of course we will also elect a Secretary and Executive Secretary. Earl Merryman, who has been Secretary since 1929, is again a candidate for re-election. Earl was recently discharged from the Navy. He had quite an experience in the various Pacific campaigns and made an outstanding record.

Louis L. Menne, our Executive Secretary, likewise is a candidate to succeed himself. He is well known to our members through his contacts, by mail, and through visits to local Chapters.

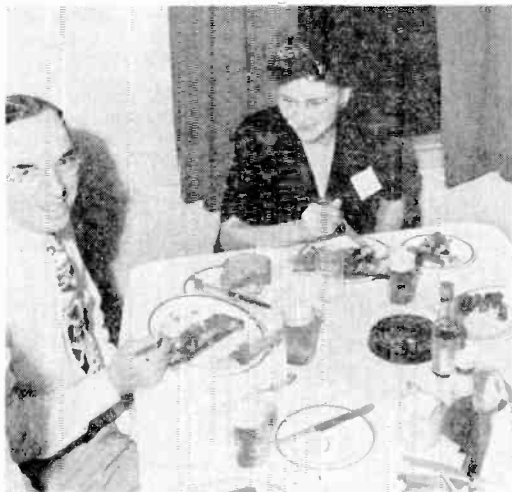
In order that our members may have a wide list of candidates to choose from, we are submitting the names of members located in various parts of the country. These are submitted merely to be of assistance to you. Do not hesitate to vote for someone whose name does not appear here, if you care to do so. Any member of the Alumni Association may be a candidate for office. Use the ballot on pages twenty-nine and thirty.

Gorden E. DeRamus, Selma, Ala.
 Don Smelley, Cottondale, Ala.
 H. E. Nichols, Lowell, Ariz.
 Edgar E. Joiner, El Dorado, Ark.
 P. Rochelle, Little Rock, Ark.

Oliver B. Hill, Burbank, Calif.
 John Jerry, San Francisco, Calif.
 Dr. Geo. B. Thompson, Los Angeles, Calif.
 P. A. Abelt, Denver, Colo.
 A. H. Wilson, Canon City, Colo.
 W. R. Haberman, Bridgeport, Conn.
 M. E. Perkins, Bristol, Conn.
 Joseph Snyder, Danbury, Conn.
 Wm. F. Speakman, Wilmington, Del.
 Lambert P. Ayres, 3rd, Millsboro, Del.
 J. J. Jenkins, Washington, D. C.
 Robert E. Many, Washington, D. C.
 Clyde D. Kiebach, Washington, D. C.
 Wm. G. Spathelf, Washington, D. C.
 Glen G. Garrett, Bonifay, Fla.
 Austin L. Hatch, Ft. Lauderdale, Fla.
 Stephen J. Petruff, Miami, Fla.
 W. P. Collins, Pensacola, Fla.
 Chas. W. Hardigree, Macon, Ga.
 R. R. Wallace, Ben Hill, Ga.
 L. E. McAllister, Mt. Berry, Ga.
 John C. Bills, Boise, Idaho
 Arvil H. King, Montpelier, Idaho
 Arthur E. Miller, Cicero, Ill.
 Earl R. Bennett, Evanston, Ill.
 Arthur Miller, Cicero, Ill.
 Harry Andresen, Chicago, Ill.
 Harold Bailey, Peoria, Ill.
 Lowell Long, Geneva, Ind.
 G. H. Millsbaugh, Anderson, Ind.
 Chase E. Brown, Indianapolis, Ind.
 Russell Tomlinson, Marion, Ind.
 Raymond L. Drake, Cedar Falls, Iowa
 E. C. Hirschler, Clarinda, Iowa
 O. L. Kirkpatrick, Augusta, Kans.
 Louis A. Harrison, Ellis, Kans.
 Wm. B. Martin, Kansas City, Kans.
 K. M. King, Wichita, Kans.
 Wm. S. Nichols, Cynthia, Ky.
 Robert Steidle, Latonia, Ky.
 S. E. Banta, Gonzales, La.
 L. H. Ober, Alexandria, La.
 Lawrence Merz, New Orleans, La.
 Peter J. Dunn, Baltimore, Md.
 E. W. Gosnell, Baltimore, Md.
 J. B. Gough, Baltimore, Md.
 Samuel Robinson, Hagerstown, Md.
 G. O. Spicer, Hyattsville, Md.
 Austin Vachone, Bath, Maine
 Harold Davis, Auburn, Maine
 Ralph E. Locke, Calais, Maine
 Laurence E. Grant, Belmont, Mass.
 Louis Crestin, Boston, Mass.
 A. Singleton, Chicopee, Mass.
 Omer Lapointe, Salem, Mass.
 O. A. Grendahl, Duluth, Minn.
 Arthur J. Haugen, Harmony, Minn.
 J. I. Layman, Hector, Minn.
 A. R. Stewart, Staples, Minn.
 F. Earl Oliver, Detroit, Mich.
 J. Stanish, Detroit, Mich.
 Harry J. Stephens, Detroit, Mich.
 Frederick Gaul, Freeland, Mich.
 Orlando E. Irwin, Jr., Vicksburg, Miss.
 Robert Harrison, West Point, Miss.
 Orville Cook, Springfield, Mo.
 C. S. Burkhart, Kansas City, Mo.
 A. Campbell, St. Louis, Mo.
 C. W. Wichmann, Inverness, Mont.
 Carl M. Darner, Sweet Grass, Mont.
 V. S. Capes, Fairmont, Nebr.
 Albert C. Christensen, Sidney, Nebr.
 C. D. Parker, Lovelock, Nev.
 Ellwood C. Lisenbee, Wells, Nev.
 C. Parker, Lovelock, Nev.
 Arthur Cornellier, Dover, N. H.
 Clarence N. George, Dover, N. H.
 E. Everett Darby, Woodsville, N. H.
 J. A. Stegmaier, Arlington, N. J.
 E. Fonseca, Union City, N. J.
 Delbert Delanoy, Weehawken, N. J.
 Claude W. Longstreet, Westfield, N. J.
 Ewell Wilkinson, Carlsbad, N. Mex.
 George Baun, Hagerman, N. Mex.
 John E. Kreitner, Buffalo, N. Y.
 Alfred R. Guiles, Corinth, N. Y.
 Jesse O. Starr, Dobbs Ferry, N. Y.
 L. J. Kunert, Middle Village, L. I., N. Y.
 Charles W. Dussing, Syracuse, N. Y.
 Irvin Gardner, Saratoga, N. C.
 Max J. Silvers, Raleigh, N. C.
 Arvid Bye, Spring Brook, N. Dak.
 Jacob J. Knaak, Cleveland, Ohio
 H. F. Leeper, Canton, Ohio
 Chas. H. Shipman, E. Cleveland, Ohio
 Byron Kiser, Fremont, Ohio
 P. E. Traylor, Maysville, Okla.
 R. E. Fullhart, Bartlesville, Okla.
 Emil Domas, Dale, Oreg.
 George H. Newton, Eugene, Oreg.
 Elmer E. Hartzell, Allentown, Pa.
 Chas. J. Fehn, Philadelphia, Pa.
 William Dyson, Pawtucket, R. I.
 James F. Barton, Greer, S. C.
 Joel J. Lawson, Aberdeen, S. Dak.
 Chester Warren, Lead, S. Dak.
 Argil Barnes, Jonesboro, Tenn.
 J. E. Collins, Paris, Tenn.
 H. A. Gilmore, Amarillo, Texas
 Richard Mallard, Dallas, Texas
 L. H. Watkins, Ogden, Utah
 Walter Leland, Orleans, Vt.
 J. W. Gladden, Alexandria, Va.
 A. P. Caldwell, Buchanan, Va.
 T. E. Ellis, Richmond, Va.
 R. E. Sawyer, Vancouver, Wash.
 Alfred Stanley, Spokane, Wash.
 J. V. Williams, Bellingham, Wash.
 R. A. Heise, Wheeling, W. Va.
 Wm. Wiesmann, Fort Atkinson, Wis.
 J. C. Duncan, Duncan, Wyo.
 Robert Kirkman, Calgary, Alta., Canada
 M. Martin, New Westminster, B. C., Canada
 E. D. W. Smith, Winnipeg, Man., Canada
 John T. Dixon, St. John, N. B., Canada
 Russell Burhoe, Woodstock, N. B., Canada
 Donald Swan, Springhill, N. S., Canada
 G. C. Gunning, Smith's Falls, Ont., Canada
 E. Bergerson, Sherbrooke, P. Q., Canada
 J. W. Meadwell, Saskatoon, Sask., Canada



Detroit Chapter has a dinner party in Windsor, Ont., Canada. Reading from left to right, front row: Bisaga, Genta, Stephens, Chase, Oliver, Lewis, Upham, Evans; second row: Mrs. Stephens, Mrs. Chase, Guest of Lewis, Mrs. Bisaga, Menne, Mrs. Lewis, Mrs. Hasen, Mrs. Upham, Mrs. Oliver, Stanish; third row: Mrs. Genta, Rissi, Mrs. Hiller, Hiller, Mrs. Quinn, Quinn, Mrs. Clow, Clow, Mrs. Kennedy, Mrs. Guyten, an unidentified friend; back row: Mrs. Rissi, Mrs. Evans, Budge, Mrs. Budge, Fitzgerald, Mrs. Fitzgerald, Guyton, Kennedy, and Hasen.



That efficient Secretary of Detroit Chapter, Harry R. Stephens and Mrs. Stephens.



Charming Mrs. Chase and Harold E. Chase, retiring Chairman after two very successful years.



Vice President F. Earl Oliver, Mrs. Oliver, always smiling, past Chairman John Stanish, Mrs. and Mr. Clow.



Left to right: Mrs. Upham, Mr. Upham, Jack Hasen, and Mrs. Hasen. After the party broke up the Hasens, who live in Windsor, held open house for those who did not want to go home. Mrs. Hasen is a charming hostess. Jack, by the way, was the big gun on the arrangement committee.

(Below) Mr. Arbie Evans, the magician, who made things appear and disappear. He was great. A man like Evans could be the solution to the scarce Radio parts problem. Here he is filling a bucket with half-dollars he grabbed out of the air.



Detroit Chapter

The first fall meeting is scheduled for Friday, September 28. All members will receive written notices of date and place of meetings. Mr. Henry Rissi will be the speaker on this occasion. He knows Radio and knows how to talk in Radio servicemen's language.

We expect a good attendance at our opening meeting. We hope to meet some of the NRI men in this area who may have been discharged from service and are now ready to get back into stride.

Detroit Chapter took a vacation during July and August. Our last meeting, before vacation, was a social affair. To be specific it was a dinner party at the *Rendezvous* in Windsor, Ont., Canada. The *piece de resistance* was a juicy steak. And what a steak, with everything else that goes to make a tasty dinner. The setting, where the beautiful wide Detroit River flows into Lake St. Clair, was perfect.

After dinner we were entertained by Mr. Arbie Evans, a magician to whom we extend a big vote of appreciation for a very interesting performance.

It was an enjoyable evening, thanks to our fine Chairman, Harold E. Chase, and his committee.

There is much pressure being exerted upon Jim Quinn to accept the Chairmanship of our Chapter next year. Jim will make a dandy.

All NRI men, students and graduates alike, are

invited to attend our meetings. Because not all of our meetings are held at our regular place, it is requested that a post card with name and address be sent to the undersigned so that information regarding meetings may be sent from time to time. Address—5910 Grayton.

HARRY R. STEPHENS, *Secretary.*

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Chicago Chapter

Mr. D. S. Hill of Supreme Instrument Co., spoke to us on testing equipment. He had just returned from a conference at the factory in Greenwood, Mississippi, where he met many of the officials and engineers. Consequently he had first-hand information and gave us a fine talk on post-war testing equipment.

This meeting, by the way, was held in the offices of The Radolek Co., 601 W. Randolph St. After the meeting, Mr. Milton Coleman took the entire group through the building on a visitors' tour.

Mr. Coleman also donated a Cabinet Repair Kit and a fine metal speed drill holder which were used as door prizes. Mr. B. T. Lacy drew the Cabinet Repair Kit and our Chairman, Mr. Charles Kadlub, drew the drill holder.

Past Chairman Harry Andresen has been very helpful to members by supplying them with Radio diagrams which he gets from headquarters by special request.

For the first time in many years, Chicago Chapter did not have a summer picnic. This was always a great event. Now that the war is over, we expect to have a full schedule again.

Our next meeting is scheduled for Wednesday, October 10. The place will be announced by Chairman Charles Kadlub, through the Secretary, who will mail notices to members.

Chicago Chapter has big plans. If you live in this area, we invite you to get on the band wagon and go along with us. Send name and address to the Secretary at 2306 W. 51st St., Chicago.

LOYD C. IMMEL, *Secretary.*

— n r i —

Directory of Officers

(To Serve Until December 31, 1945)

- President Charles Fehm, Philadelphia, Pa.
- Vice Presidents—
- Peter J. Dumm, Baltimore, Md.
- Earl R. Bennett, Evanston, Ill.
- F. Earl Oliver, Detroit, Mich.
- Oliver B. Hill, Burbank, Calif.
- Secretary—Earl Merryman, Washington, D. C.
- Executive Secretary—L. L. Menne, National Headquarters, Washington, D. C.

Nomination Ballot

All Alumni Association Members are requested to fill in this Ballot and return it promptly to National Headquarters. This is your opportunity to select the men who you want to head your Association. Turn this page—the other side is arranged for your selections.

After the ballots are returned to National Headquarters they will be checked carefully and *the two men having the highest number of votes* for each office will be nominated as candidates for the 1946 election. The election will be conducted in the next issue of NATIONAL RADIO NEWS.

The President cannot be a candidate to succeed himself but you may nominate him for any other office, if you wish. You may, however, nominate all other officers who are now serving, for President or any office, or select entirely new ones. It's up to you—select any men you wish as long as they are MEMBERS IN GOOD STANDING OF THE NRI ALUMNI ASSOCIATION. Be sure to give the city and state of your selections to prevent any misunderstanding. A list of the 1945 officers is given in the opposite column.

Detach this slip carefully from your NATIONAL RADIO NEWS so as not to damage the book. Tear off the slip at the dotted line, fill it out carefully and return it immediately to L. L. Menne, Executive Secretary, NRI Alumni Association, 16th and U Sts., N. W., Washington, D. C.

Your signature

City State

(over)

The 1946 nomination is a very important one. Choose carefully the men you desire to handle the reins of the Alumni Association for the coming year. Let's all do our part to help the staff handling the elections, by submitting ballots on or before October 29, 1945.

Nomination Ballot

L. L. MENNE, *Executive Secretary*,
NRI Alumni Association,
16th and You Sts., N. W.
Washington, D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected officers for the year 1946.

MY CHOICE FOR PRESIDENT IS

.....
City State

MY CHOICE FOR FOUR VICE PRESIDENTS IS

1.

City State

2.

City State

3.

City State

4.

City State

MY CHOICE FOR SECRETARY IS

.....
City State

MY CHOICE FOR EXECUTIVE SECRETARY IS

.....
City State

Phila-Camden Chapter

New members, since last report, are as follows: Thomas Smith, Elmer Gunning, H. Kessel, and Ben Rutecki.

Our picnic, as usual, was a grand success. With our wives, children and friends, we drove to the estate of our good friend Clarence Stokes on the Neshaminy. His wide lawn and lovely shade trees provided just about a perfect spot for a picnic. The chapter is indebted to Mr. and Mrs. Stokes for their splendid hospitality in providing everything to make the day a perfect one. (We hope they do not count their chickens).

We played baseball, cards, sang and swam. Chester Klabe, Jr. played the piano-accordion, accompanied by his dad on the banjo and Harvey Morris on the guitar. Not bad, but the highlight was a duo by Milt Tice and Chester Klabe on the same accordion with one on each end. (Ever try that on the piccolo?) And can that Harvey Morris serenade! Mrs. Morris said it was Harvey's persuasive melodies that caused her to say "yes." Now the guy spends all of his time at his Radio bench.

Inside the house, Milt Tice hauled off with some hot stuff on the piano with a few of the boys doing vocals. Included in this group of Crosby's and Sinatras was McAleese, Meili and Ed Rood.

Some of the ladies went for a hike in the woods and got lost. (Strong men to the rescue). Charley Fehn got his shirt tail wet without going near the water.

Klabe was top man in the horseshoe contest and Tice was clean-up man in deuces wild. Refreshments were plentiful and all enjoyed themselves, thanks to the committee of inseparables, Arnott, Armstrong, and Tice—and the Alumni President, our own Charley Fehn, who is always on the job.

Clarence Stokes, who is past chairman and past National President of our Alumni Association, was always regular at our meetings. For the last few years, owing to a war job with the Signal Corps, he hasn't been able to get out—up to now. Imagine his surprise when he met our Librarian, Chester Klabe for the first time to find they served on board the same ship in the Navy, some twenty years ago. A small world.

All students and graduates in this area are invited to attend any and all meetings. The address is Post Office Building, 4706 Comly St., Philadelphia 24, Penna., and the time, the first and third Thursday of each month at 8:00 P.M.

HARRY J. SCHNEIDER, *Secretary*.

New York Chapter

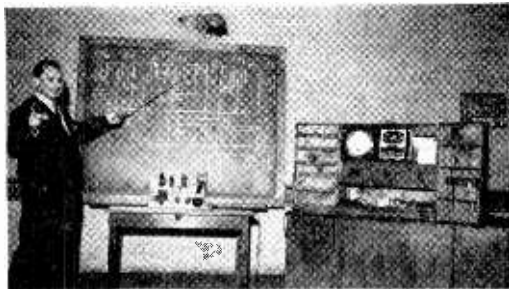
Without leaving our building, we have moved into larger quarters. We simply have taken a larger hall in the same location. We needed more room now that our attendance runs close to 50 each meeting. We are going to build a P.A. system for our new enlarged quarters.

Our Executive Committee has been increased to eight, each having a definite job to do. As a result we have smooth-running meetings.

We are adding to our equipment from time to time. We now have much of the standard equipment and such as we do not have is loaned to us by our members.

Chairman Wappler is a live wire, if ever there was one. Our lectures are arranged with specific plans, blackboard, diagrams, models, spotlights to make it easier to see, in fact, showmanship is used to make the talks more effective.

Chairman Wappler missed one or two meetings



Pete Peterson, Vice Chairman of New York Chapter, making a blackboard talk.

owing to illness. Vice Chairman Pete Peterson stepped right in and took over. Some of the speakers at recent meetings were as follows: E. Williams, on Voltage Dividers; Morris Friedman on Practical Radio Problems; Frank Zimmer, on Repair of a Volume Control; Hans Bockelman on Tubes; and Wm. Fox related an amusing experience he had connecting a turn table to his radio. These were all interesting short talks.

At another meeting, Vice Chairman Peterson talked on Intermittents; Archie Burt on Power Supply; E. Williams on Mathematics and Vice Chairman Peterson answered questions relating to the brief talk he gave at the opening of the meeting.

Mr. Remer, one of our new members, made an inspirational talk, giving our Chapter much credit for the help given him since he joined

with us. James Newbeck, the new member of our Executive Committee, spoke at length on Photo Electric Cells. He is a mighty good speaker. Mr. Newbeck, by the way, was not present when the picture was taken of our Executive Committee. (shown on page 32.)

At still another meeting, Eugene Williams gave a good talk on Currents and James Newbeck spoke on Interference.

Our big social meeting is scheduled for November 15, at which we hope to have Mr. J. E. Smith and Mr. L. L. Menne of Washington present with us.

Meetings every first and third Thursday of the month at St. Marks Community Center, 12 St. Marks Place, between 2nd and 3rd Aves., New York City.

LOUIS J. KUNERT, *Secretary.*

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Baltimore Chapter

Not much on news this time but plenty long on action. We are Radio men, not writers. Any NRI men who attend our meetings are sure to get something worthwhile. That's what counts. Everything else is detail.

At one of our meetings we had a special demonstration of the new Meissner Analyst. Very interesting.

We meet every second and fourth Tuesday at Redmen's Hall, 745 W. Baltimore St. Nice place—nice fellows. Drop in.

L. ARTHUR, *Secretary.*

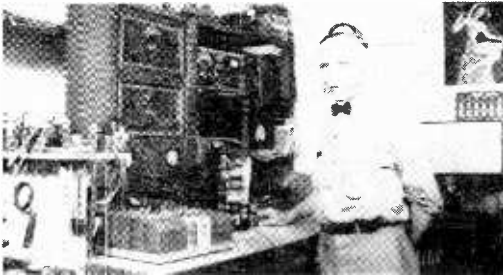
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Alumni Chatter

Ted Telaak of Buffalo, 1937 President of the NRI Alumni Association, was recently elected President of the Radio Technicians Association, Inc., Buffalo . . . Did you notice in last issue, we referred to a member who is radio operator on a freighter of about ten ton—some fun, eh boss—should have said ten thousand ton . . . Jesse D. Starr, formerly of Washington, D. C., is opening a big radio shop in Stamford, Conn.—good luck . . . Nice letter from former Chairman Charley Mills of Detroit Chapter—swell fellow, that Mills . . . Some members, loyal and true, who would make good National Officers are Frank Zimmer of New York, Harry R. Stephens of Detroit, Harry Andresen of Chicago, and E. W. Gosnell of Baltimore—good men, hard workers . . . Charley Fehn, our Alumni President, is coming to Washington for a conference . . . then Menne will return the visit to Philadelphia—then New York—then Detroit—then Chicago—then Baltimore . . . Wonder when Pete Dunn will return from the wars—big doings in Baltimore when he does . . . All you good Alumni members, please be sure to vote . . . and good luck and good health from ye editor, Menne.



The Executive Committee of New York Chapter. These men plan programs, demonstrations, lectures, and socials. They deserve much of the credit for the fine New York meetings. Left to right, seated: Wm. Fox, Chairman Bert Wappler, Hans Bockelman. Standing: Pete Peterson, Archie Burt, Lou Kunert and Frank Zimmer.



Bernard Hiller, a steady member of Detroit Chapter, in his work shop.

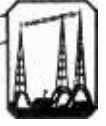


Another Detroit Chapter member. Ray B. Fouke, who has a full-time Radio business in Trenton, Mich.

NATIONAL



RADIO NEWS



FROM N.R.I. TRAINING HEADQUARTERS

Vol. 11 October-November, 1945 No. 11

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L. L. MENNE, EDITOR
J. B. STRAUGHN, TECHNICAL EDITOR

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