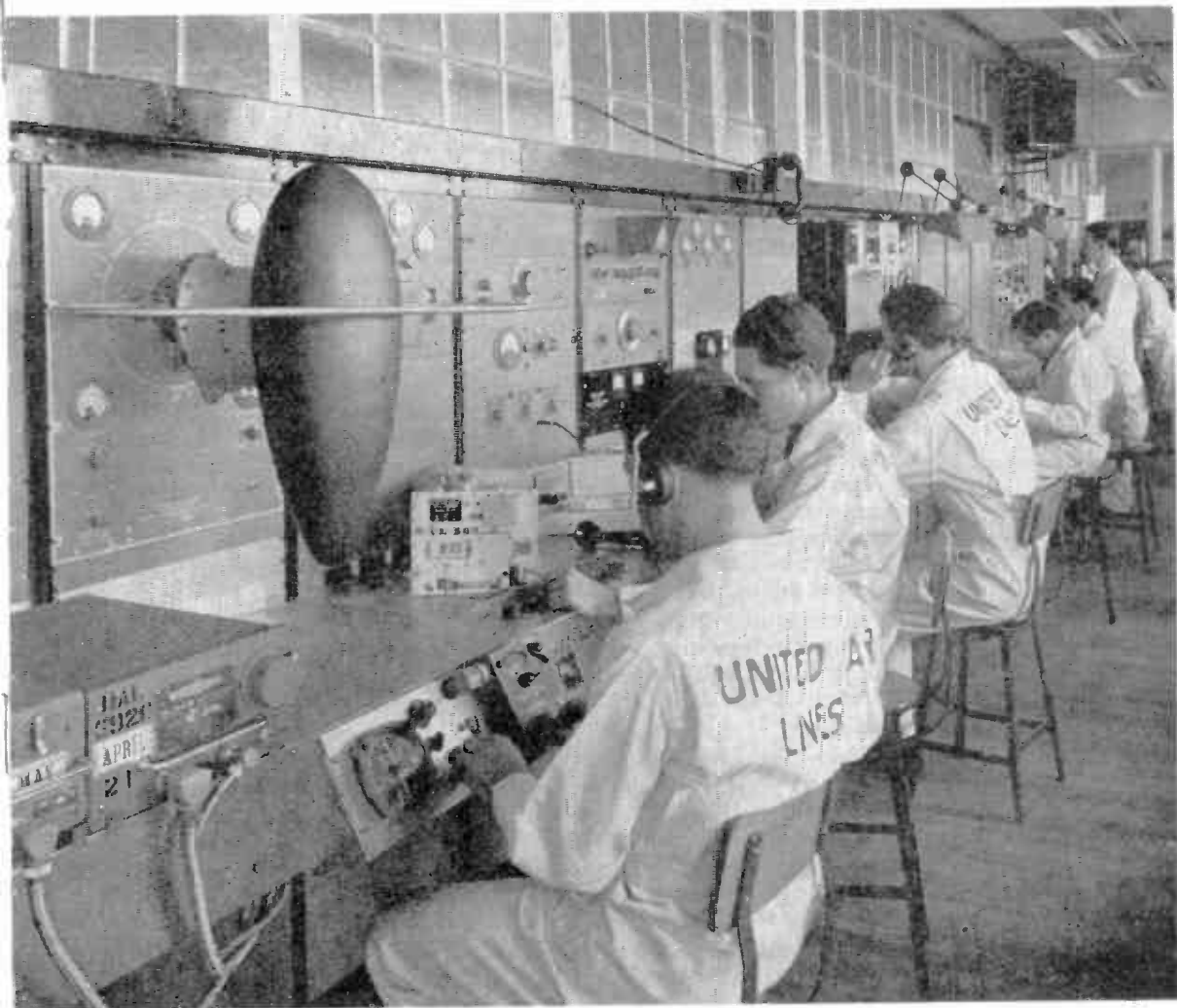


NATIONAL RADIO NEWS



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Do a Little Post-War Planning of Your Own

These days we hear and read a great deal about post-war planning. I like to call it "a little thinking in advance" because that is exactly what post-war planning means.

Our immediate job is to do everything possible to help win the war. We are all dedicated to that and most of us are doing our share. Just what constitutes a full share will vary according to a man's opportunity, ability, age, circumstances, and, not the least important, his conscience.

My point is this. While men are putting in long hours in their jobs it is also wise to do some thinking regarding the immediate future—the change from a world at war to a world at peace.

While today there are shortages in all things the day will come when these things will be plentiful again. There will be plenty of gasoline at the filling station around the corner. There will be plenty of groceries just around the corner. There will be automobiles for sale just around the corner. Meats, shoes, clothes—everything will be plentiful again.

But there is one thing that will not be plentiful—it is the "easy to get" pay envelope of today. Good jobs—secure jobs—that pay high salaries will not be so plentiful. After the war men will be picked according to their qualifications and there will be plenty of competition.

The man who has some specialized training will find his place, as always. And the man who has neglected his opportunities for training again will find his place too. Men will be graded according to their qualifications and paid for what they are worth.

When that time comes you want to be ready. The wise man is doing his preparing *now*—in his spare time. He is looking ahead to the time when money will not be as free and easy as it is today.

Study in your spare time like you never studied before! Common sense tells you that the time is not far off when you will be glad you did.

E. R. HAAS,
Executive Vice President.

Opportunities In Aviation For Radio Technicians

by L. L. MENNE, Editor



L. L. Menne

SUCH wartime electronic developments as radar altimeters, the new and super-accurate Ultra-high frequency (uhf) direction finders, the profile-tracing form of radar used for seeing landmarks through clouds, darkness, smoke or fog, the new CAA-developed blind-landing system and a host of other new radio facilities for flying will require the services of thousands of well-trained radio technicians for installation and maintenance of their corresponding commercial versions in civilian aircraft after the war. Nevertheless, aviation for some years to come will still be giving the highest percentage of its many choice radio jobs to technicians trained in handling ordinary aircraft radio equipment. As proof of this, the Civil Aeronautics Administration now has plans ready for increasing the capacity of present aircraft radio navigation facilities by at least four times. Furthermore, if the expressed expectations of Glen A. Gilbert, chief of the CAA Air Traffic Control Division, are anywhere near what is to come, the improvements now planned will be merely stop-gaps for a tremendous expansion of aviation radio.

Three Kinds of Jobs

In general, large commercial airlines employ three distinct groups of technicians to keep both their ground and flying radio equipment in good working condition with a minimum of layover time for planes due to radio troubles. First, there are the line service technicians—the boys who get into the plane itself at the end of a run and check all radio and affiliated gear right on the spot. Next come the shop technicians, who take over any units of equipment pulled out of a plane for repair or routine maintenance procedure, and

also rebuild or revise the transmitters, receivers and other removable equipment from time to time to incorporate desirable new circuits and features. Last come the project technicians, who work in planes most of the time and make major changes in the “fixed” radio equipment of the plane.

All three types of jobs involve considerably more than replacing a burned-out tube or resistor or resoldering a broken wire. The Civil Aeronautics Administration fully recognizes this need for adequate radio repair and maintenance facilities, and requires that airlines applying for certification shall show a maintenance manual or suitable equivalent that definitely describes the maintenance methods, procedures and techniques to be used in keeping in operation the radio navigation facilities and equipment of the company applying for scheduled flight approval. Furthermore, these procedures are checked regularly by governmental authorities such as the FCC checks practices of radio stations; if deviations are found, embarrassing questions are asked.

In addition to technical and personal qualifications, each technician assigned to aircraft radio maintenance for commercial airlines must hold at least a second-class radiotelephone license. Although there are equal opportunities for the fast-thinking, energetic and easy-to-get-along-with man, the slow-but-sure worker with patience and methodical ways, and the man with leadership and creative instincts, versatility of personality is highly desirable. This is particularly true on smaller airlines or at the smaller radio maintenance stations where a man may be needed and used for all three types of work in a single day.

Familiarity with the requirements for each type of aircraft radio technician will enable the newcomer in this field to analyze his own aptitudes and choose the type of work for which he is best suited.

Duties of Line Service Technician

For the man who must go into a plane at the end of its run and quickly and accurately diagnose



Courtesy United Air Lines

Shop technician adjusting a 10-frequency combination transmitter and receiver used on mainliners of United Air Lines for communication between planes and ground stations.

every irregularity in the operation of each and every radio component in the plane, the ability to think and act quickly is just one requirement. Since he will work side by side with other types of aircraft technicians, he must be cooperative and cheerful. Since he may often be on the flying field in view of passengers and onlookers, he must present a neat appearance at all times. Although his duties seldom involve anything more than replacing a defective unit by loosening its disconnect plugs and mounting bolts, he must know for certain that the unit in question is defective, and must be sure that its replacement will remedy the trouble. This job will certainly appeal to those who can appreciate and enjoy the air of excitement and tenseness that often pervades a busy modern airport, particularly when ceiling is zero and planes are coming in "on the glide beam."

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Duties of Shop Technician

From the plane, defective units are generally brought in to the airport radio shop by a small tractor, electric truck or hand truck, accompanied by the report of the line service technician and perhaps also the comments of the plane's radio operator. Now technical knowledge and ability to handle tools, machinery and precision test equipment become important. The repair work requires consistent and deliberate thinking, much patience, planning ahead and sometimes the origination of new ideas for locating, analyzing and repairing an unusual trouble. The slow and careful man who likes to adopt his own steady gait without undue pressure from anyone is valuable at bench work like this. If he also has a creative instinct and an analytical mind, he will eventually find himself assigned at times to highly interesting jobs of rebuilding completely some unit of aircraft radio equipment. In effect, the shop technician runs his own life to a great extent, independent of those about him, and with no need to make the quick decisions so necessary for "through service" work in planes.



Courtesy United Air Lines

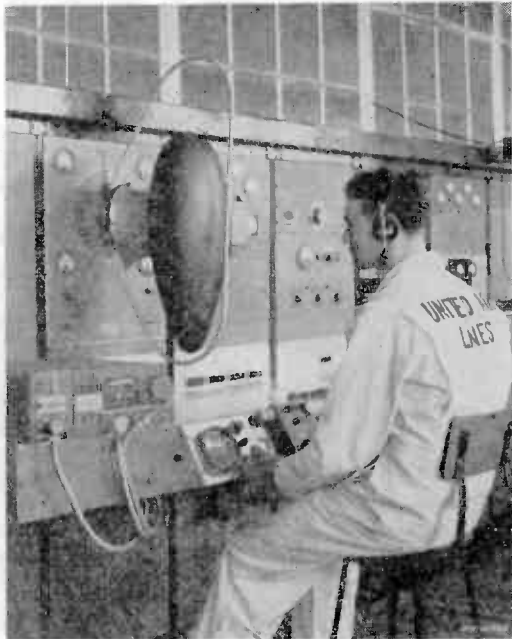
This communications laboratory technician, H. N. Wilcox, is using a vibration generator he developed himself for testing aircraft radio equipment under conditions considerably more severe than are encountered in flight. A radio receiver is here being given the works, with compressed air providing the shimmying action.

Duties of Project Technician

The work of a project technician usually keeps him in planes themselves, at the times when the planes have been ordered into the shop for an engine change, general overhaul or the repair of some other major component. The extra time available thereby is utilized for installation of new radio units, alteration of existing installations and such major overhaul and repair jobs as are needed on the radio equipment more or less permanently attached to the plane.

The project technician must cooperate to a high degree with other technicians working in the plane, and must work accurately and fast enough so the radio department cannot be blamed for slowness or mistakes that hold the plane out of service. He thus requires a combination of the qualities of the other two types of technicians, plus a general understanding of the functions and importance of all airplane controls and the fundamentals of airplane design. He must have a healthy respect for important rivets, braces, gussets and other structural members so that he will not unwittingly drill a hole, bend a part or

otherwise alter some structure that may weaken the plane or cause failure of its controls. When changes are required for installation of some new radio unit, he must first obtain proper authority for making the necessary mounting provisions. Since much of the work will not be readily accessible once it is done, it must be of high quality and require no further attention.



Courtesy United Air Lines

One of the most interesting duties of a shop technician at the central maintenance base of United Air Lines in Cheyenne, Wyoming is testing and adjusting automatic direction finder antennas and indicators on this special test panel.

Before the war, project technicians were changing about 25 percent of the entire radio installation on a plane each year in the interests of modernization and improved performance. With such replacements largely held down to basic requirements of safety by wartime shortages, this percentage replacement figure will undoubtedly skyrocket for the first few years after the war.

Duties of Maintenance Foreman

Supervising the work of the three types of technicians at an aircraft radio maintenance station is the maintenance foreman, who usually also is responsible for the entire electrical systems in the planes, the electrical and radio communication facilities in airport buildings assigned to his airline, and the emergency repair of ground radio



Courtesy United Air Lines

Specialized test units like this microphone and headset tester are developed and used by the communications laboratory of an airline. The instruments are placed in the soundproof box, and recordings of the results are produced automatically by a fountain pen on the paper roll above.



Courtesy United Air Lines

A section of the communications laboratory of United Air Lines in Chicago. Here radio technicians have at their command a wide variety of precision machine tools and test equipment with which to experiment and develop new projects.

station equipment. The dual nature of his duties is logical because any good radio man can handle ordinary electrical work, and the converse is seldom true. The foreman must give proper instructions to his technicians on correct electrical and radio maintenance procedures for each type of equipment encountered, must act in an advisory capacity when technicians require assistance, and must be able to suggest improved servicing methods and apply them to new equipment designs. His executive duties include assigning the radio technicians to the various crews, and arranging for rotation of shifts so each man spends enough time in the shop to become familiar with radio maintenance problems currently encountered. Routine and bookkeeping duties include contacting other maintenance stations at regular intervals to exchange information on inspection and servicing, maintaining proper spare equipment and parts at strategic stations on his divi-

sion, preparing all forms and records required by company and governmental authorities, and contacting and instructing flying personnel in connection with operation of radio equipment.

Research Opportunities

Communications laboratories are maintained by some of the larger airlines in order to handle operating service problems requiring laboratory equipment, work out the engineering aspects of such changes in equipment as seem desirable from time to time, and carry out development work on problems involving too small a market to interest aircraft radio manufacturers. Here is an excellent opportunity for the man with better-than-average radio knowledge—one who has thoroughly mastered the theory of circuit operation and has a certain amount of mathematical background. The work often involves flying, for

much of this special research must be done under actual flying conditions. The once-serious static electricity problem on planes was solved by men associated with a communications laboratory of this type.

Salaries are Attractive

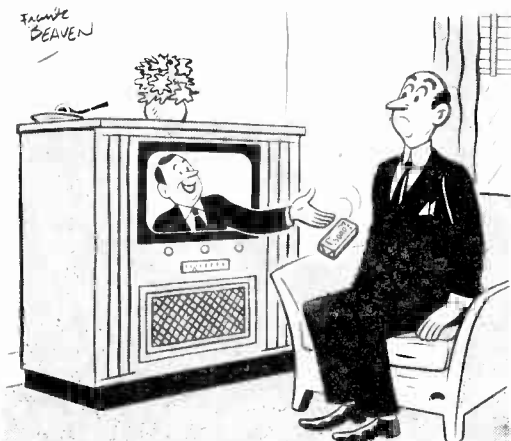
Radio maintenance technicians usually start as helpers or apprentices. Raises come periodically in most airlines until the rank of full technician is attained. After that, promotion to master technician and to supervisory duties is generally dependent entirely upon individual ability. Rates of pay may vary greatly in different companies but comparisons are difficult because duties likewise vary. On the whole, the salaries of aircraft radio technicians are highly attractive.

The knowledge of radio theory and mechanics required in aircraft radio work cannot be acquired in a short time. Experimental work with radio parts is extremely valuable, hence experience as a radio amateur or experimenter gains considerable recognition when supplemented by a thorough radio training program such as that offered by N.R.I.

In conclusion, those seriously interested in aviation as the starting place at least for their career in radio can well learn now the maxim of all aviation personnel: *Anything worth doing at all is worth doing well.* Your work must be perfect at all times, because on it depends the lives of others.

n r i

Ah! Television



Courtesy of Radio-Craft Magazine

"Here is your sample of Radio Soap."

Radio Industry Continues "All-Out" War Effort

by John Ballantyne, President Philco Corporation

Throughout the year 1944, the radio industry continued its "all-out" war effort and increased its total production in terms of dollars by 20% to approximately \$2,700,000,000, as compared with the preceding year. Measured in physical terms, the increase in production was even greater, for the Army and Navy received the benefit of lower costs on many pieces of equipment as the year progressed, and greater efficiency and production short-cuts were developed.

National security requirements make it impossible to tell in detail of the radio industry's contribution to victory at this time. When the whole story is revealed, however, it will be found that radar, with its almost supernatural powers, was one of the most decisive weapons in the hands of our Army and Navy. The development of this equipment in collaboration with Army and Navy scientists and its manufacture on a mass production basis represent the greatest single achievement in the history of the radio industry. It is a source of satisfaction that Philco, through its research laboratories and production lines, has been able to play a leading part in providing these weapons for the United Nations.

There has been no production of civilian radio receiving sets since early in 1942 and the needs of the public for new equipment are constantly growing more acute. Of the 59,000,000 receivers in use in homes, offices, and automobiles in 1942, thousands are going out of service daily due to obsolescence and shortages of tubes and other repair materials and a scarcity of technical service men in many areas. It is estimated that the pent-up demand for radio receivers at the present time amounts to between 20,000,000 and 25,000,000 units as compared with the industry's all-time high production of 13,100,000 sets in 1941. When the nation's war needs are met, the radio industry and its distributors and dealers should be assured of several years of active, profitable business in making up wartime shortages and giving the public the benefit of the latest developments in FM and television.

n r i

Former Teacher Commends N.R.I. Lessons

"The lessons sent me deserve commendations for clarity of presentation and arrangement of essential factors. They are definitely jammed with essentials in very simple presentation. I have had twelve years of experience in teaching and administration in secondary school work and feel that I might, therefore, take the liberty of making the above comment."

Student Harold F. Weiler, Fairfax, Virginia.

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Adding Extension Loudspeakers

by WILLARD MOODY

N.R.I. Consultant



Willard Moody

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 room 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.

The magnetic type is also easy to install but has a tendency to overload and rattle on bass notes. This type of speaker also requires no field and therefore is convenient to install.

When the loudspeaker is used in a room where the noise level is high, people are dancing and

talking, a high volume level may be 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.

A reasonably large speaker is desirable.

The various types of speakers in common use in radio receivers are the permanent magnet dynamic, magnetic and electrodynamic. Probably, the electrodynamic is used more than any other. The receiver will have provision for energizing the field coil of its own 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 speakers of the following types: magnetic, permanent magnet dynamic and separately excited electrodynamic. 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. In general, p.m. speakers are available from parts supply houses but in some cases speakers in good operating order, used speakers, may need to be employed in view of parts shortages caused by the war.

Adding A Magnetic Speaker. The addition of a

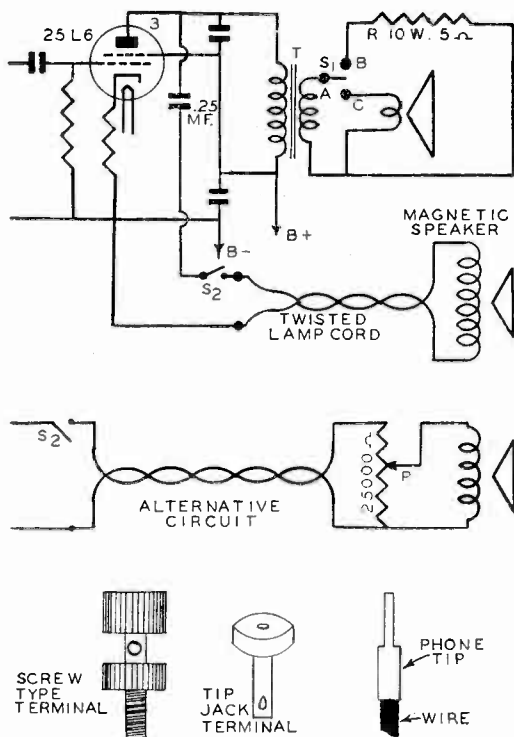


Fig. 1

magnetic speaker to a single-ended output stage, of a typical radio receiver using a type 25L6 in the output stage, is illustrated in Figure 1. Switch S1 is a single pole double throw switch. When the Arm (A) is thrown to position B, the radio loudspeaker is disconnected and the 5-ohm resistor is placed in the circuit.*

The resistor is necessary to stabilize the circuit and to maintain a normal load on the output transformer T. If switch S1 is thrown to position B, the radio speaker will be in the circuit and sound coming from it will be heard. The extra loudspeaker may be turned off or on as desired by means of switch S2. With the switch open, the extension speaker does not produce a signal and with it closed there is reproduction from the extension speaker.

A series blocking condenser is used to keep d.c. voltage out of the signal circuit. The condenser

*A 5-ohm, 10-watt resistor is specified. This value is convenient and in most cases will work fairly well. However, for best results the resistor R should have a value equal approximately to 1.5 times the voice coil d.c. resistance of the radio loudspeaker. As an illustration, if you have a voice coil with a resistance of 4-ohms, the resistance would be multiplied by 1.5 to get 6-ohms and a resistor having a value of 6-ohms would be used for R. It should be a 10-watt type.

allows the a.c. signal current to flow and signal voltage to be applied to the extra speaker. The condenser prevents the d.c. from getting through to the loudspeaker circuit. A twisted cable having a length of twenty or thirty feet may be used without cutting signal strength appreciably.

To prevent blasting of the speaker, it may be necessary to use a volume control as shown in the lower part of Figure 1. The potentiometer P may have a value of approximately 25,000 ohms. Tip jacks can be used for connecting the speaker and the ends of the twisted wires may be fitted with phone tips which are soldered on. The tips are then plugged into the tip jacks. If you wish, screw type terminals may be used. It would be possible to solder the connections but this might lead to inconvenience in the event the connections must be broken or taken off temporarily for repair purposes later on.

Parallel type cord is not satisfactory for extensions because of the high distributed capacity between the wires. This capacity in effect is equivalent to a condenser shunted across the speaker terminals. Bypassing of the higher frequency signals results.

The wire should be fairly heavy to limit the loss of signal power in the conductor resistances. A twisted antenna cable, having small diameter conductors and high resistance, is not satisfactory.

Identification of the pin terminals of the output tubes as the case may be is important. Pin terminal No. 3 of the 25L6 is the plate terminal. You should, however, refer to a tube chart whenever you find it necessary to identify the pin terminals. The 25L6 is frequently used in the output stage of an a.c.-d.c. set. Other tubes, however, which are commonly employed are the 25A6, 43, 50L6, 35L6 and 35A5.

The circuit illustrated in Figure 1 also could be used with other output tube arrangements employed in a.c. operated radios. This will be explained later on in this article.

As an illustration, the 6F6 commonly is used in a.c. receivers and pin terminal No. 3 on this tube also is the plate terminal. One side of the speaker circuit would connect to the output tube plate and the other would go to B— or the radio chassis.

If the output stage is a push-pull type, the circuit of Figure 2 may be used. This is an unbalanced circuit but the quality of reproduction will be fairly good and the distortion usually will be very slight and unnoticeable. Only one blocking condenser, C, is required and the circuit is relatively easy to get working. If desired, a push-pull arrangement, shown in the lower part of Figure 2, may be used. Switch S1 and the 5-ohm, 10-

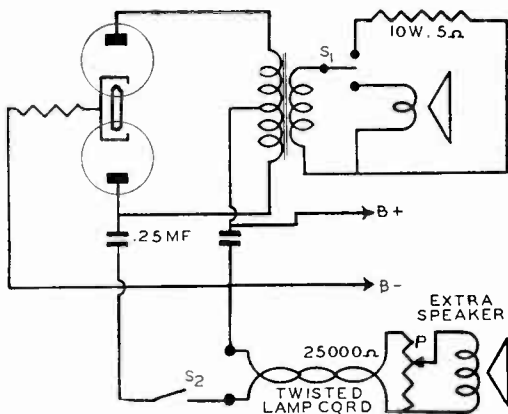


Fig. 2

watt resistor are omitted if the owner of the radio does not require provision for switching on and off the main loudspeaker used in the radio itself. Due to the limited power handling capability of the magnetic speaker and the fact that its fidelity is not as good as that of a permanent magnet dynamic, the addition of a p.m. speaker may be desired in place of the magnetic. P.M. speakers, however, usually are more costly and cost is a definite factor in this 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 3 is suitable. If switch S1 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 S2 controls the extra speaker. With S2 closed, the extra speaker is supplied audio power and will be heard. With S2 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 satisfactory from a practical viewpoint and on the basis of experience are entirely workable.

Switch S1 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 3. 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 rear of the front 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 very difficult and the mounting job should be done by qualified automobile mechanics. Work on the upholstery may be required.

Using the circuit in Figure 3, and the voice coil connection, it makes no difference whether the output stage is single-ended or push-pull because of the fact that the secondary of the output trans-

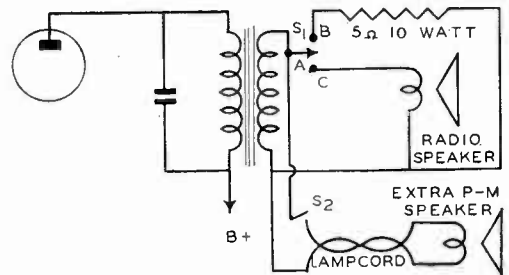
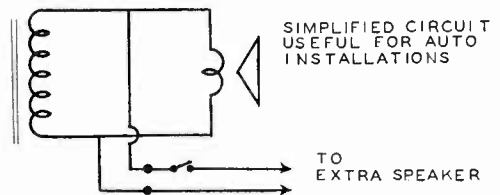


Fig. 3



former, 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

In Figure 4 and Figure 5, 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. Alternative arrangements are indicated at the bottom parts of Figures 4 and 5.

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 6. 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

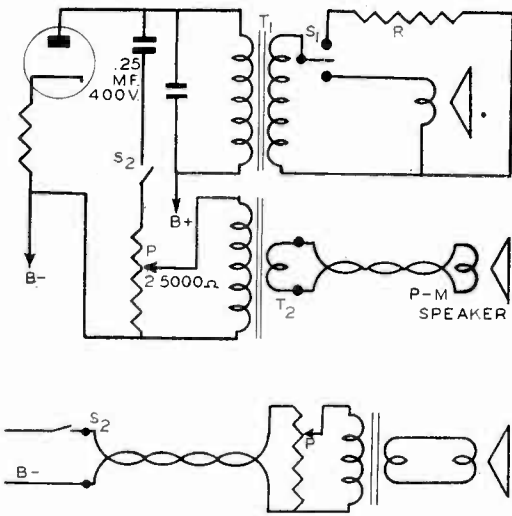


Fig. 4

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 be quite noisy in operation. A means of getting around the difficulty and using standard volume control circuits is illustrated in Figure 4. 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 S1 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 T1 is used for matching the output tubes to the original loudspeaker and T2 is an output transformer on the extra loudspeaker. T2 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 45s, 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 5 is used. Output transformer T1 matches the output tubes to the regular speaker which is a part of the radio and output transformer T2 matches the tubes to the extension speaker. Switch S1 serves as it did in the previous examples to turn on or off the main loudspeaker. Switch S2 permits turning on or off the extension speaker. By means of potentiometer P, the signal level at the extension speaker can be controlled.

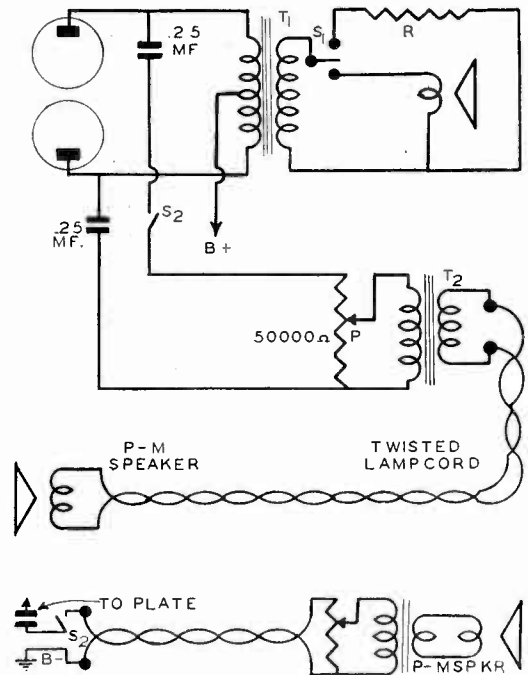


Fig. 5

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 mak-

ing 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

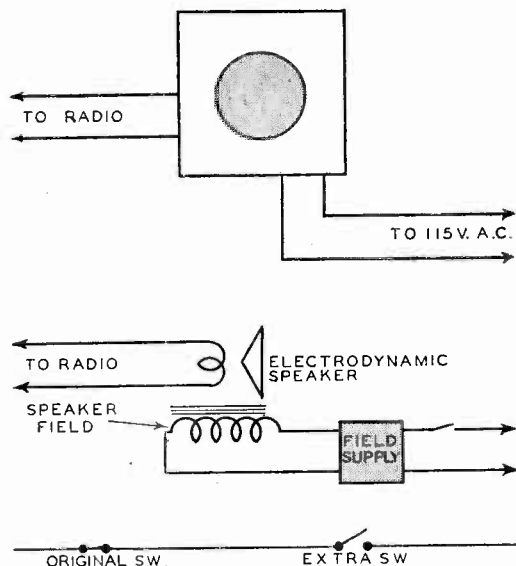


Fig. 6

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 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 6 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 power 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 magnetic 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 7. 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 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 8. 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. When p.m. speakers are used, similar cabinets may be employed for housing the speaker and keeping dirt and dust off the speaker cone and parts. Usually, it will not be desirable to have a closed back for the cabinet because of the tendency such a back

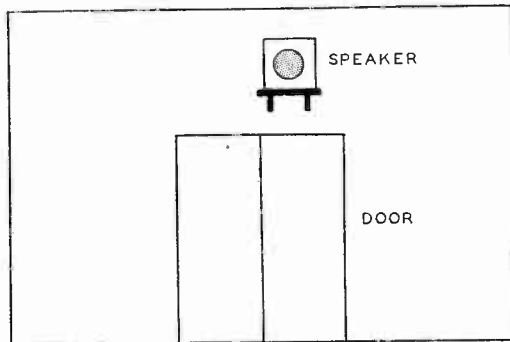


Fig. 7

would have to cause excessive boominess and a muffled 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 9. 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

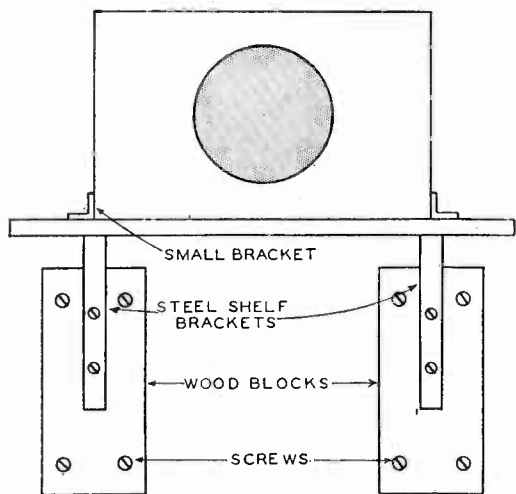
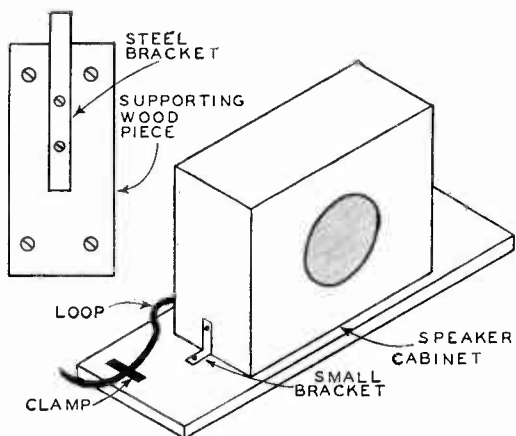


Fig. 8

at the top, bottom and side. For mounting purposes, the use of a pair of 2" x 4" wooden stand-off 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, wood-saw, 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 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 drill 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 it so that a circle is marked out on the board. A keyhole saw may now be used to draw 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

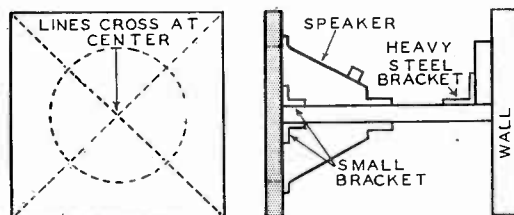
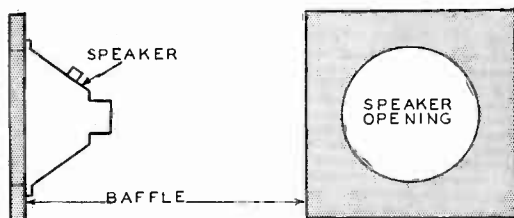


Fig. 9

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 in normal times but because of war conditions may not be available now.

A speaker may be mounted in the side of an artificial fireplace as shown in Figure 10. 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 10. Using the top mounting, no 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.

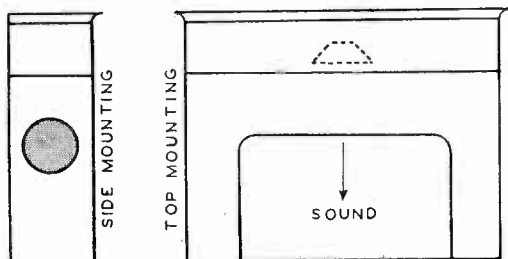


Fig. 10

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 11. The speaker is located

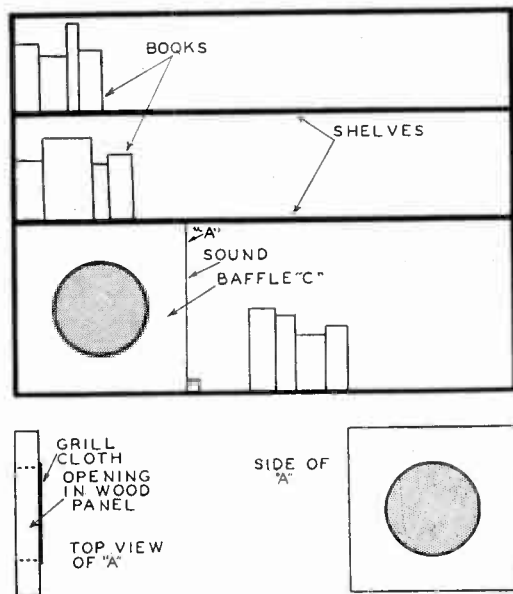


Fig. 11

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 book-shelf 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.

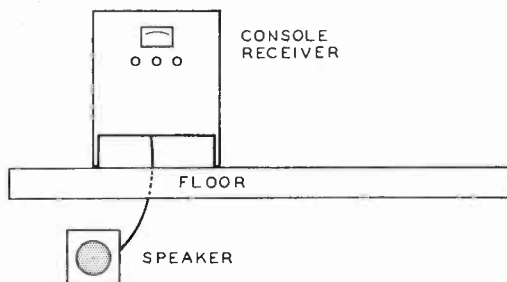


Fig. 12

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 12. 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 —

Our Cover Photo

Radio-electric department of the big maintenance base operated by United Air Lines at Cheyenne, Wyoming. Clean uniforms, comfortable working positions and modern fluorescent lighting are just a few of the advantages of working for a big airline. The photo is used through the courtesy of United Air Lines.

Tube Testing Procedure

The exact procedure for operating a tube tester will vary with the type of tester. Similarly, the setting of the controls will depend on the tester type. You should always be sure to follow the manufacturer's instructions exactly. However, in general, the following procedure will be used with most types of tube testers:

1. Turn on the tube tester, then rotate the line voltage adjustment control knob until a pointer comes to rest behind an illuminated shadowgraph scale (or, in other types of testers, until the meter needle comes up to a mark on the scale.) The voltages applied to the filament and tube elements depend on this procedure.

2. Look up the tube type on the tester instruction chart, and set the filament control for the proper filament voltage. Set the circuit selector switch to the "short test" position. Plug in the tube. After the tube has warmed up, check the line voltage adjustment and, if necessary, reset the control.

3. Now test for shorts or leakage. Depending on the tester, this may be done by rotating a selector switch through various positions: by moving toggle switches according to the tester instructions; or by depressing push-buttons, one at a time. Watch the neon lamp for a glow, indicating leakage or a short circuit. As you go through each of the short-testing positions, tap the tube lightly with a lead pencil, or thump it by flicking your finger against it, to see if vibration will cause shorts or leakage. If there are shorts, the tube is bad and should be replaced, and no further tests are necessary.

4. Having passed the short test, the tube may be checked for "quality." Properly set the load control according to the manufacturer's instructions and then throw the circuit selector (or toggle or push-button) switch to the proper position. The tester may now automatically indicate the tube quality on the meter scale, or it may be necessary to depress a button to get the reading.

5. If the tube gives an indication in the GOOD region of the meter scale, make any special tests the tester provides (such as a check for gas or for noise.)

War Time Radio Servicing Pointers

Servicemen today find that it is necessary to make full use of the technical knowledge gained by a study of radio lesson texts, such as those you are studying, in the process of learning radio in the proved and successful manner of N.R.I. training.

First of all, you should become acquainted with the general characteristics of the various types of tubes. Use your lessons as reference texts and, in addition, refer to tube charts of manufacturers to secure information on the characteristics of the various types of tubes. You will find it quite necessary, in these days of tube shortages, to make tube substitutions, and such substitutions may be made efficiently only if you have the necessary technical knowledge.

Learn what we mean when speaking of mutual conductance, emission, amplification factor, plate resistance, filament voltage and current. Appreciate the importance of properly choosing tubes which have the same filament current rating if the tubes are to be used with the filaments connected in series. If tubes are used which have filament current ratings that are not the same, some sort of series-parallel arrangement must be worked out. In the preceding issue of N. R. News, we gave you information on making tube substitutions, and in the future there will be presented further data of the type that you need. Watch for it.

In addition to knowing tubes, you should have a good working knowledge of Ohm's Law—you should know not only how it is applied but equally important—why it is applied, and when to apply it.

Ohm's Law states, simply, that the current in a circuit is proportional to the applied voltage. In practical cases we know that a circuit has resistance and we may say that the amount of current that flows in the circuit is equal to the voltage divided by the current. If we wish, we may calculate the amount of current that will flow in a circuit when we know the voltage and resistance, but Ohm's Law can also be applied to determine the amount of voltage in a circuit when the current and resistance are known—simply multiply the two values of current and resistance. If we want to calculate the amount of electrical power that is expended in a resistance, we need only multiply the voltage across the resistance by the current through it. The power rating of the resistor should be approximately twice the dissipated power. As an illustration, a power dissipation of 10 watts would call for a resistor rated at 20 watts. Using such a unit, there would be no danger of overheating of the resistor and it could be operated safely. Experienced servicemen have no difficulty making such calculations and after proper study you will find the work easy and interesting.

DONATE YOUR BLOOD
TO
THE RED CROSS

Voltage Measurements in Radio Servicing

by J. A. DOWIE

N.R.I. Chief Instructor



J. A. Dowie

THE expert radio serviceman uses voltage measurements to determine rapidly and accurately the condition of a radio receiver. Some of the principles of such measurements will be discussed here.

The first concept to keep in mind is the development of a potential by a battery or other source of voltage, such as the power supply system in a radio. This voltage is applied to a load through a series resistance. The fundamental circuit is shown in Fig. 1. A voltmeter may be connected across the source to measure the source potential, across the load to measure the load voltage or potential, and across the series element to measure the voltage drop across that particular portion of the circuit.

If the voltage across the load is zero, the following conditions may be found:

1. No source voltage due to a source defect.
2. No continuity in the series element. Higher than normal voltage drop across the series element.
3. No load voltage due to a short circuit across the load.

A mental picture of the above basic circuit should be carried in mind when troubleshooting.

If the load voltage is lower than normal, but not zero, the trouble may be:

4. Lower than normal source voltage.
5. Higher than normal series resistance and larger than normal voltage drop across the series resistance.

6. Lower than normal load resistance or a leakage resistance in parallel with the load.

If the load voltage is higher than it should be, the trouble may be:

7. Higher than normal source voltage.
8. Lower than normal series resistance.
9. Higher than normal load resistance, or higher than normal shunt resistance across load.

We can illustrate all of the above enumerated conditions by reference to the diagram of a typical radio receiver. In Fig. 2 we have the Emerson model 36. A 6D6 is used as a mixer, 6D6 as an i.f. amplifier, 76 as a triode detector and a 42 as a power output tube.

Suppose that we take condition No. 1, "no source voltage due to a source defect." We may consider the source terminals to be the output terminals of the B supply, with the source voltage appearing across the 6 mfd. output filter condenser. If there is no voltage across the 6 mfd. unit we may look for a breakdown in the 6 mfd. condenser. A new unit can be tried and the voltage measurement is repeated. If, now, the voltage is normal it is clear that the original 6 mfd. condenser is defective and must be replaced.

If replacing the condenser does not correct the difficulty, we may find that the shunt .1 mfd. unit is defective and replacement of it can be tried. If the output voltage is still zero, and we have reason to believe the remainder of the circuit is all right and that the defect lies in the power supply system itself, we may check the voltage across the input filter of 8 mfd. If it is

not considerably higher than the output voltage, replacement of the 8 mfd. unit can be tried. If the voltage across the input filter condenser is much higher than normal and the voltage across the output filter is zero, the trouble very likely is a poor connection in the power supply, between the rectifier filament and the output filter, or an open in the speaker field.

a poorly soldered joint. Assuming there is a source voltage across the output filter condenser and no voltage on the 42 plate, we may well suspect an open in the primary. The primary can be tested with an ohmmeter or it may be checked with the voltmeter itself. Unsolder the plate lead of the primary and connect it to the plus side of the voltmeter; connect the negative side of the voltmeter to ground. If a reading is not obtained,

Assuming no voltage is obtained across the input filter condenser, but that the 80 rectifier tube lights up and tests o.k., we may check for a.c. plate voltage on the rectifier. In the preceding measurements, d.c. voltages were checked. The voltages on the rectifier plates are a.c. voltages and an a.c. meter must be used for test purposes. One side of the meter may be connected to ground and the other side to each rectifier plate in turn, to check the voltages. If no voltage is obtained on a plate, turn off the power and carefully check the wiring to make sure the electrical connections are good. If you suspect the high voltage winding is burned out, test it with an ohmmeter. Be sure the receiver is turned off, and disconnected from the power line, when using the ohmmeter. This precaution is necessary to prevent damaging your test instrument.

Now, let's take an example of case No. 2, "No continuity in the series element." If, in Fig. 2, we have no plate voltage on the 42 the trouble may be due to an open in the primary of the output transformer, or due to a poor connection in the plate circuit, such as might be caused by

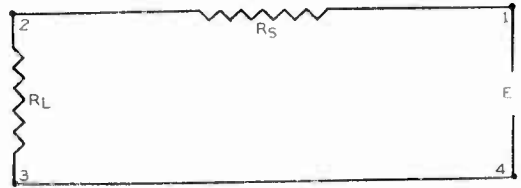


Fig. 1

the primary is open and a new transformer will be required to restore operation of the radio. But how, you may wonder, did the primary "go?" What made it fail? Of course, it might have failed due to corrosion and chemical action, or it might have failed as the result of a breakdown in the .006 mfd. condenser in the plate circuit. This would be typical of condition No. 3, a short circuit across the load being responsible for no load voltage. We would visualize the plate of the tube as one terminal of a load resistance and

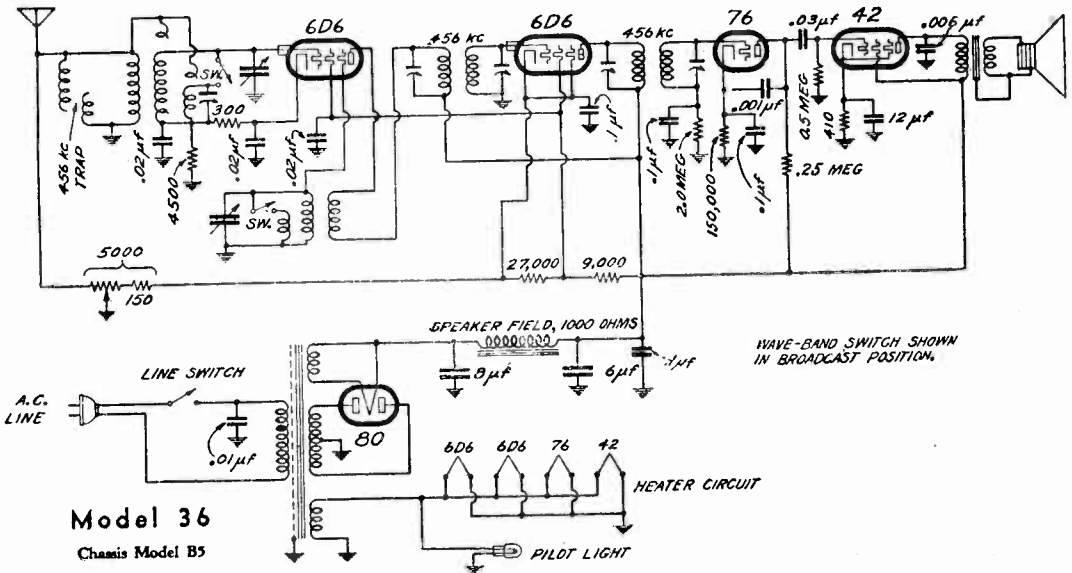


Fig. 2

chassis ground would be the other terminal. Referring to Fig. 1, the primary of the output transformer would be equivalent to series element R_s , and the plate circuit would be R_L . The total resistance of the plate circuit, of course, would be made up of the tube's plate-cathode resistance and the resistance in series with the cathode circuit, which is a 410 ohms unit.

To make certain that the new transformer will not be damaged we should check on the condition of the .006 mfd. condenser and we can do that by using an ohmmeter and measuring its leakage resistance or by using the series voltmeter connection. For example, the plate end of the .006 mfd. unit may be disconnected from the 42 plate circuit and can be connected to the negative end of the voltmeter, the positive side of the voltmeter going to B plus; if a reading is obtained, the condenser is defective and should be replaced.

In making measurements we may find on many occasions that condition No. 4, "lower than normal source voltage" will be found and we can, of course, easily check on the condition of the source—the power supply—by connecting the d.c. voltmeter across the output of the supply. A lower than normal voltage at this point may indicate leaky filters, loss of emission in the rectifier tube, lower than normal line voltage, shorted turns in the power supply transformer or a breakdown in the .1 mfd. output condenser and a step by step trouble-shooting technique must be used to run down the trouble and isolate it, as previously described. However, assuming the source is all right and the load voltage (the plate voltage on an amplifier tube) is lower than it should be, we may encounter condition No. 5, "Higher than normal series resistance." Referring again, to Fig. 2, we seldom find a higher than normal plate load resistance in any stage except the 76 detector stage. The carbon resistor used as a plate load may heat up and change value, or it may change value due to chemical action and age. If the change is in an upward direction, the plate voltage will be reduced, since increasing the value of the series element raises the total circuit resistance. We can readily check the resistor by trying a new unit and again measuring the plate potential, or simply observing how the radio works.

Let us now consider condition No. 6, "Lower than normal load resistance or a leakage resistance in parallel with the load." This condition is very important in practical radio servicing work and we will find it desirable to thoroughly understand it.

We may consider, first of all, the output tube. How can the load resistance of the circuit be reduced? Bear in mind that in this analysis, when we speak of load resistance, we are refer-

ring to an equivalent resistance that may be connected between plate and chassis ground. The plate-cathode resistance of the 42 tube is controlled by the plate and screen voltages and the bias on the tube, and to some extent by the filament voltage and the emission. Assuming the tube is in good condition, that it lights up and has normal emission, we may consider what will happen if the plate voltage is lower than it should be. With a reduced negative bias on the grid, the plate-cathode resistance of the tube would be decreased and the plate voltage would go down. The tube itself is the load for all practical purposes and the 410 ohms resistance absorbs a negligible amount of power in comparison with the tube power. Therefore, if we found a lower than normal plate voltage we might check the bias to make certain that it is not too low. The bias voltage on the 42 is the d.c. voltage across the 410 ohms cathode resistance. The positive side of a d.c. voltmeter may be connected between the 42 cathode and ground to check the bias. The opposite would also hold true—higher than normal bias potential being responsible for higher than normal plate voltage, which will be discussed shortly. The reduction in the bias might be due to a lowering of the value of the cathode resistor or excessive leakage in either the 12 mfd. cathode resistor bypass or the .03 mfd. grid condenser. If the grid condenser is leaky, the net negative grid bias, between cathode and grid, will be reduced and the plate and screen currents will rise, so that the cathode circuit current is higher than normal. The result is that the voltage across the cathode resistor is higher than normal, while the negative bias is below normal! Therefore, when you suspect a leaky grid condenser in the circuit don't place too much reliance upon the cathode resistor voltage test—also test for bias voltage directly between grid and cathode or try a new grid condenser. The cathode bypass could be checked by substitution, the voltage measurement being repeated, or could simply be cut out of the circuit temporarily while you checked the bias voltage across the 410 ohms unit. The .03 mfd. grid condenser could be tested by measuring the voltage across the 0.5 megohm grid resistor with the condenser in the circuit. If a voltage is obtained and disconnecting the condenser from the grid circuit causes the voltage to disappear, the grid condenser is defective and should be replaced. If the voltage remains, on the other hand, the output tube is probably gassy and it should be replaced. A gassy output tube would have a lower than normal plate-cathode resistance and would tend to draw an excessive amount of current from the power supply—thus reducing the plate potential and the B supply potential.

An example of a leakage resistance in parallel with the load has been given previously—the breakdown, or the lower than normal resistance, of the .006 mfd. plate condenser would be in effect a shunt around the plate circuit of the

output tube and would lower the output tube plate potential.

In the case of a higher than normal plate potential on an amplifier tube, we may find that condition No. 7 is encountered—higher than normal source voltage. This may be due in some cases to the opening of a bleeder resistance connected across the output of the B supply and such a resistance may be tested for continuity with an ohmmeter or by means of the series voltmeter connection. That is, one side of the resistor would be connected to the negative terminal of the voltmeter and the other side would go to the chassis ground. The positive side of the meter would connect to B plus and the meter should be set on a high enough voltage range to avoid burning it out. We may find in some cases that a higher than normal source potential is due to higher than normal line voltage being applied to the primary of the power transformer and to check the line voltage we need only connect an a.c. voltmeter directly across the primary of the power transformer.

The load voltage may be higher than normal because of condition No. 8, "lower than normal series resistance." Referring to Fig. 2, if the plate load for the 76 detector changes and becomes lower than normal in resistance value, the plate voltage on the tube will be higher than it should be. A more important condition, and one quite frequently encountered in practical work, is condition No. 9, "higher than normal load resistance or higher than normal shunt resistance across the load." The higher than normal load resistance may be due to a bias value that is too high. For example, in Fig. 2 an increase in the value of the 42 cathode circuit resistance would mean that the plate potential of the output tube would go up. One reason is that the plate current would be reduced and the $I \times R$ drop in the resistance of the primary of the output transformer would be cut, leaving more voltage available for the plate. If the emission of the tube drops off with age or the filament voltage is reduced, the amount of current flowing in the plate circuit and through the output transformer primary will be reduced, with a consequent rise in the plate voltage.

In the 76 plate circuit, it may often be found that a very high plate potential is found on the tube when the tube burns out or loses emission. If the cathode circuit resistance of 150,000 ohms changes to a much higher value, the plate potential of the tube will rise because of the decreased $I \times R$ drop in the plate resistance of .25 megohm.

In the preceding discussions, we have touched upon the causes of incorrect operating voltages. As a final word, we may stress the importance of making measurements with respect to polarity. In general, the negative side of the voltmeter will connect to the chassis or B— side of the circuit and the positive side of the instrument is con-

nected to the various screens and plates. Polarity, of course, is not important in using a.c. instruments.

We have seen just how voltage measurements may be used in checking a standard radio receiver having a full wave rectifier power supply; now let's see how voltage measurements may be used to test a typical a.c.-d.c. receiver, the Emerson DB-296, shown in Fig. 3. The output voltage of the rectifier may be tested by connecting the voltmeter across the input filter condenser C20. The positive side of the meter goes to the rectifier cathode circuit and the negative side of the meter connects to the on-off switch. The output voltage in a typical case may be of the order of 90 to 100 volts and if it is much lower than that the filters are probably defective and should be replaced; if replacement brings up the voltage the new condensers very obviously are necessary and should be permanently installed in the circuit. The a.c. input voltage to the rectifier may be tested with an a.c. voltmeter. Connect the instrument between the rectifier plate circuit and the on-off switch. Normally, the voltage will be in the neighborhood of 115 volts. It may be approximately 115 minus the voltage drop of about 6 volts in the pilot lamp circuit. If the pilot lamp is burned out and there is no a.c. plate voltage, before installing a replacement lamp and again attempting to operate the set check the condenser marked C14 for a short circuit. This may be done with an ohmmeter. Assuming the condenser is all right, the pilot lamp may be replaced. It is assumed that you have tested the 35Z5 tube, but if there is any doubt concerning the condition of the tube, be sure to test it. Filament circuit continuity may be tested by taking the tube out of its socket, checking between terminals 2 and 3, and 2 and 7. If the 2-3 section is burned out but 2-7 is all right, shunt a 40 ohm 5w. resistor across 2-7 to continue operation of the tube and pilot lamp. The remainder of the set with the exception of the tube filaments that are connected in series may be tested in just the same way as in the preceding a.c. receiver; for example, a breakdown in C19 would mean that no plate voltage would be available for the output tube and we would reason in exactly the same way as we did previously in making measurements.

The filament circuit, however, is somewhat different. In this set, the filaments are connected in series and the failure of a single filament would mean that no voltage would be available for the remaining filaments. Suppose, for example, that the voltage measured between point 2 and point 1 in Fig. 4 is very high, nearly equal to the line voltage—what would this tell us? The fact that there is a high voltage between 1 and 2 shows that the voltage drop between 2 and 6 is much lower than normal and therefore the tubes are not conducting the normal current in this section of the circuit. Further, we know that a 6 volt tube would not, normally, have a high

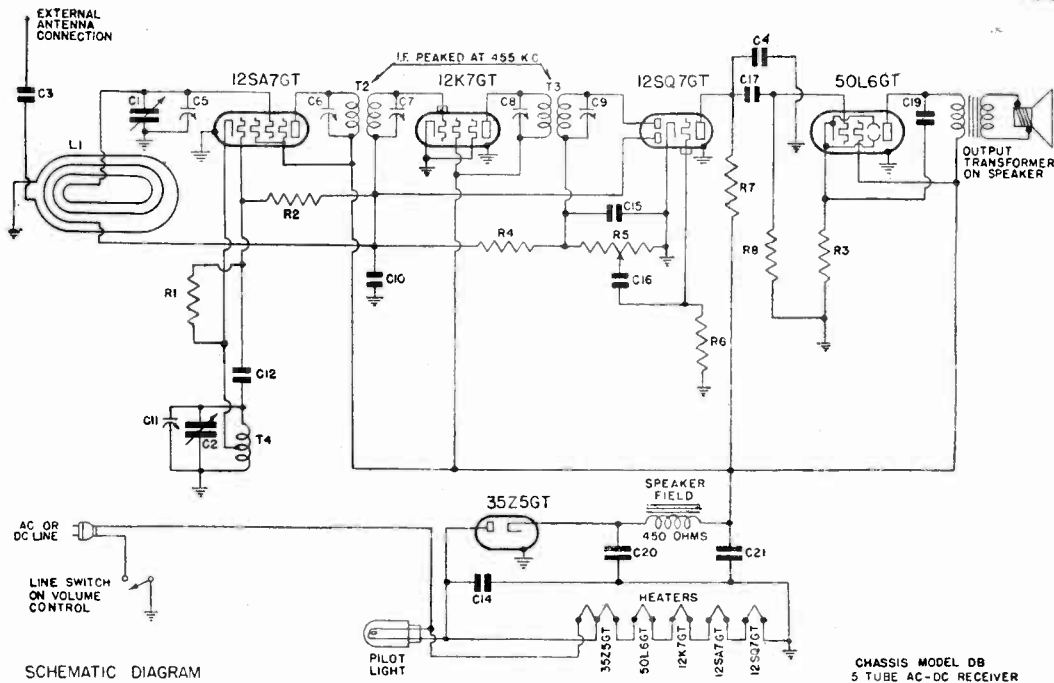


Fig. 3

potential of 115 volts applied to its filament. We would logically suspect, then, that the tube was burned out. If the voltage was very high between points 3 and 1, the voltage between 3 and 6 would be much lower than normal. The trouble might be a break in the circuit between 3 and 1, due to a failure of the 12SA7 or 12SQ7. The test could be continued simply by checking the voltage between 2 and 1. If it is high between these two points, we have circuit continuity through the 12SA7 and the defect is in the 12SQ7; if there is voltage between 3 and 1, but not between 2 and 1, the 12SA7 is burned out.

The filament circuits of three-way portable receivers are somewhat similar to those of a.c.-d.c. sets in that the filaments are series connected when the radio is operated on the power line. This is shown in a typical case for the Emerson DF-302 illustrated in Fig. 5. Here, the filaments are in series with the cathode circuit of the 70L7GT beam power tube which is used as an output tube on a.c. while the 3Q5GT tube is used as an output tube only on battery operation.

When the 70L7GT pentode warms up and a cathode current flows in the tube circuit, the amplifier tube filaments pass the current and also warm up. If any one of the tubes burns out, the remaining tubes will not receive normal filament voltage since the circuit is a series type.

A lack of voltage for the tube filaments is often due, in this set, to a breakdown in condenser C24. If, in checking the circuit, you find that you do not have a voltage of about 6 volts across C24, the trouble may be excessive leakage in the con-

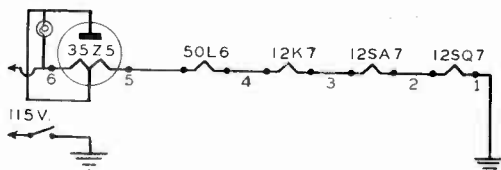


Fig. 4

denser and you can try another one—repeating the measurement. If voltage is now obtained, the condenser used as a replacement is necessary and should be left permanently in the circuit.

Suppose, however, the voltage is considerably higher than 6 volts across the condenser marked C24. What could the trouble be? We might find in many cases that it is due to a defect in C19 in the plate circuit which, if leaky, would result in the application of a high voltage to the C24 unit, from the plate side of the circuit. This,

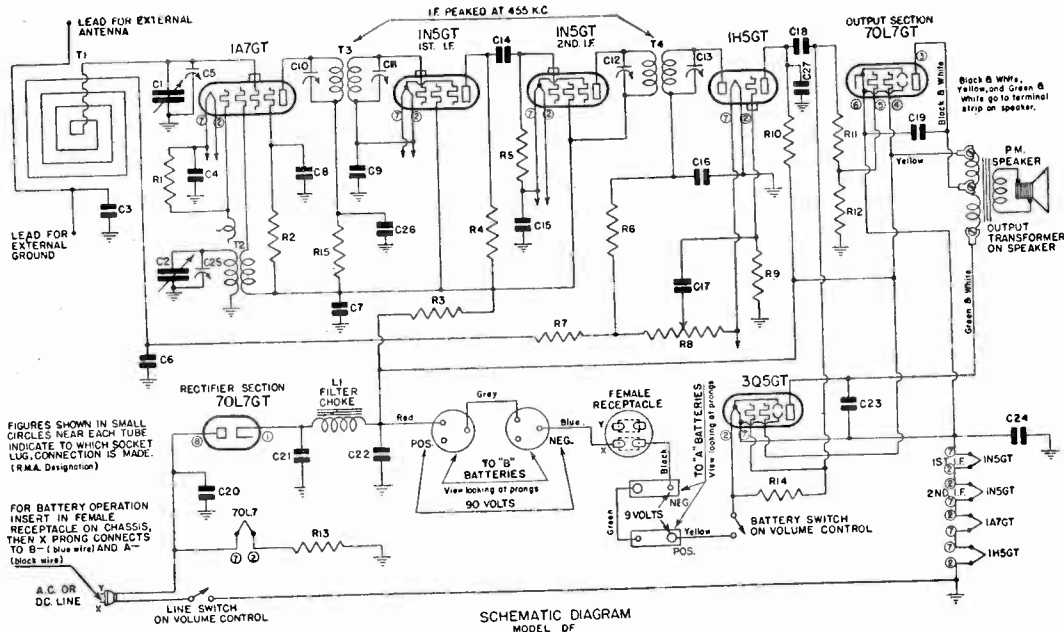


Fig. 5

very likely, would eventually cause failure of the C24 condenser. It would also result in burning out replacement tubes installed in the set. Therefore, before replacing tubes in a circuit of this kind it is always good practice to carefully check the circuit with a voltmeter or to make resistance measurements. Voltage tests are made with the radio turned "on" and resistance tests are made only with the power off. A breakdown in C23 might cause similar trouble and this condenser, too, could be tested either by the substitution method or by using an ohmmeter. Or, if you wish, you may disconnect the plate end of the condenser and connect it to the negative side of your d.c. voltmeter, then connecting the positive side of the meter to the plate circuit. The receiver should be turned on when making this test and using a voltmeter. If the meter indicates a voltage, the condenser is leaky and should be replaced.

The other circuits of the set could be tested in exactly the same manner as indicated previously for the other receivers, bearing in mind that in this set a half-wave rectifier type arrangement is used. If you found that no d.c. output voltage was obtained from the rectifier and that the tube did not light up you might well suspect something wrong in the filament circuit of the rectifier tube; the trouble might be that you had an open filament or an open in R13. If a high voltage is obtained across R13, much higher than normal, and there is no voltage drop across the

rectifier filament, the trouble would be a burned out R13 resistor. If no voltage was obtained across R13 and the voltage drop across the tube filament was much higher than normal, the trouble would be a burned out tube. This assumes, of course, that you have a line voltage of about 115 volts across C20. If no voltage is obtained here, the trouble may be an open in the line cord, an open in the on-off switch or a lack of voltage at the electrical outlet.

The voltage across the on-off switch would be much higher than normal if the switch were open and if the switch is all right the trouble very likely would be a line cord break. Assuming that you have voltage at the electrical outlet, look for an open in the line cord.

— n r i —

Assistant to Chief Engineer

"Have been employed for the past two years as Assistant to the Chief Engineer at Radio Station WHJB in Greensburg, Pa. Handle both transmitter and associated audio equipment, also patching for remote programs. Find the work very interesting. Knew nothing about radio when I enrolled for the N.R.I. Course. Later passed FCC examination for both first class telephone and second class telegraph license. I don't know where one could find a better investment than your Course."

Cecil J. Giunipero, Greensburg, Pa.

NEWS OF THE RADIO WORLD

BY

Willard R. Moody

Radio broadcasting's twenty-fifth anniversary will be celebrated this year by the entire manufacturing and broadcasting industry. The silver anniversary will be exploited in magazines, newspapers, and radio programs.

— n r i —

Disc recording was popular with the U.S.O. in 1944. The 3000 units in this country and off-shore bases used 170,000 discs for recording. Servicemen visiting the U.S.O. clubhouses found record playing to their liking. They used 60,000 playing needles, 8000 recording needles, and 20,000 new records.

— n r i —

An increase of over 3,000,000 radio families in 1944 was revealed by the Research Department of the Columbia Broadcasting System recently, which completed a survey of radio ownership in this country. There are now, according to the survey, over 32,000,000 radio families. In 1940, there were only about 28,000,000.

— n r i —

Around 100 manufacturers are expected to make home receivers in the postwar era.

— n r i —

Railroad radio is playing an important role in the Ordnance Department of the Army Service Forces. Two-way communication systems between locomotives and a central train dispatching point have been operated with considerable success. Experimenting with the system began a year and a half ago at the Savannah Ordnance Depot, between the engineer of a locomotive and the train dispatcher at the depot. Today, a number of the depots have this method of communication. A distance of 30 miles is usually covered from the dispatcher's office in the depot to the train.

— n r i —

Broadcasting via the power lines is the feature of an unusual collegiate network, the Inter-Collegiate Broadcasting System, that may soon offer radio networks lively competition. Established some years ago, the System includes many colleges in the New England sector and one in Alabama.

— n r i —

The recent national bond drive brought one of industry's old-timer's Atwater Kent, back to the limelight. Mr. Kent, who was quite a radio magnet back in 1925, purchased \$300,000 worth of war bonds to engage Arthur Treacher, the screen actor-butler, as a butler for him at a special party. Many radio and screen celebrities attended the party.

Page Twenty-two

A walkie-talkie served to prevent excessive loss of life and property during a recent fire in New York City. A fireman in a burning building notified those below by means of the walkie-talkie that highly inflammable material stored in lofts nearby would be ignited if additional water and auxiliary pumping equipment were not put into action immediately.

— n r i —

War shortages crop up in strange materials. Mica, for example, is scarce. It is used extensively as electrical insulation in war products, such as capacitors for radio equipment. Because of the mounting demand, manufacturers were desperate. A four-man technical mission flew to London to help ration the world's supply between the United States and Great Britain. The shortage was serious. The War Production Board, convinced that much mica was classified too low when judged by appearance alone, asked Bell Telephone Laboratories to develop a new method of electrical tests, which the Laboratories accomplished. The new tests were made available to manufacturers in this country and abroad—the supply of usable mica being increased 60% and a difficult situation was relieved.

— n r i —

At the present time, experimental radio telephone systems are in operation in New York. Regular dial telephone sets are used. Car occupants can, by radio, be connected to any telephone in the city. These experiments are being conducted to determine whether or not post-war radio telephone service will be practical and there is a strong likelihood that such service will be adopted after the war.

— n r i —

Eighteen years ago the first radio range system was set up by Ford and a Ford plane made a daring round-trip flight through a snowstorm from Dearborn to Dayton, guided solely by radio. The original Ford radio beacon essentially was the one in use today, with two sending loops set at an acute angle, transmitting signals alternately. From one was sent the letter "A", dot dash. From the other, the letter "N", dash dot. These signals interlocked to give the pilot an "on course" hum. Basic patents have been issued to Ford on this greatest navigation aid, but in the interest of safer air travel, Ford recently made these patents available to the Air Transport Industry without charge.



RADIO-TRICIAN

REG. U.S. PAT. OFF.

Service Sheet

Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

RCA VICTOR

"Little Nipper—2nd" Models 9TX-1, -2, -3, -4 and -5

Alignment Procedure

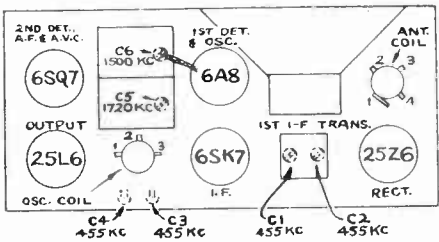
Output Meter Alignment—Connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test-Oscillator—Connect the low side of the test-oscillator to the receiver chassis, through a .01 mfd. capacitor, and keep the output as low as possible.

Steps	Connect the high side of test-oscillator to—	Tune test-osc. to—	Turn radio dial to—	Adjust the following for max. peak output—
1	6A8 1st-Det. grid cap. in series with .01 mfd.	455 kc	Quiet point at 1,600 kc end of dial	C1, C2, C3, C4 (1st and 2nd I-F transformers).
2	Antenna lead of ant. trans. in series with 100 mmfd.	1,720 kc	Full clockwise (out of mesh)	C5 (oscillator)
3		1,500 kc	Resonance on 1,500 kc signal.	C6 (antenna)

Precautionary Lead Dress

1. Dress 1st I-F plate and grid leads against chassis and away from each other. Dress plate lead from 6SK7 close to chassis.
2. Dress electrolytic capacitor against rear apron.
3. Keep leads away from adjusting screws to allow easy access.
4. Dress output plate lead along front apron and away from 6A8.
5. Dress parts at ends of chassis to clear cabinet bosses.



Power-Supply Polarity—For operation on d-c, the power plug must be inserted in the outlet for correct polarity. If the set does not function, reverse the plug. On a-c, reversal of the plug may reduce hum.

Resistor in Power Cord—The power cord contains a resistor which becomes warm during operation.

Antenna—The set is equipped with length of antenna wire. Do not connect the antenna to ground. If an outdoor antenna is used, it should not be longer than 100 feet, including lead-in. If it is longer, connect a 100 to 200 mmf. capacitor in series with the lead-in.

Readers who file Service Data in separate binders remove page carefully, trim on dotted line for same size as data published heretofore.



Marcel Ravera

N.R.I. students and graduates often apply their technical knowledge in unique and interesting ways. Take for example, Marcel Ravera of Ridgefield Park, New Jersey. He breaks into print this month because of a very nice cabinet he built for his N.R.I. Tester as shown in his test panel in the above photograph.

On the left, we see an accurate signal generator which is a great help in properly aligning radio receivers and making stage by stage tests efficiently. In the center is our own N.R.I. Tester which finds practical and useful application in radio servicing. This instrument is, as you know,

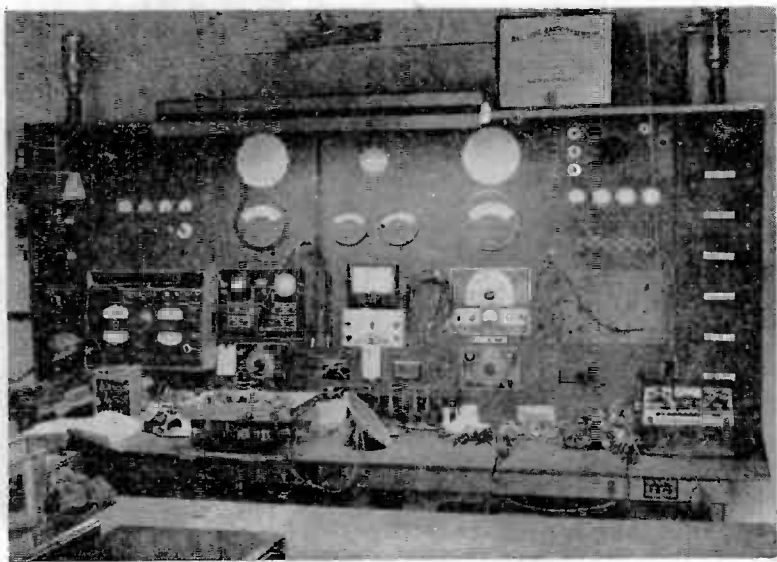
built from parts supplied to students in their second experimental kit. The Tester is a combination vacuum tube voltmeter and multimeter. The cabinet is Mr. Ravera's own idea and was designed and built by him. It is made to slide in and out and is open at the top for calibration.

To the right of the N.R.I. Tester is a standard tube tester used for checking tubes of radios that are to be serviced.

The arrangement of the test panel is indicative of good taste, ingenuity and practical utility.

— n r i —

This photo shows the very fine test bench in the Radio shop of August Ketelhut of Benton Harbor, Michigan. It was taken by James Cada of Berwyn, Ill., who, with Mrs. Cada, visited Mr. Ketelhut. Both Mr. Cada and Mr. Ketelhut are former chairmen of Chicago Chapter and are great friends.





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



Chas. J. Fehn, 1945 President of the N.R.I. Alumni Association

A Message From The Alumni President

As it would be impossible to meet and greet all members of the Alumni in person, I am using the medium of the NEWS to let you know that I appreciate the honor you have bestowed upon me. I wish to thank each and every one of you.

The National Radio Institute is unique among correspondence schools in that it has an Alumni Organization which is active. It possesses that spirit which inspires us to continue to work for our Alma Mater. This is best reflected by the activities of the local Chapters of the Alumni and through the medium of National Radio News, a publication small in size but full of interesting subjects and information for Alumni members and students as well.

Although I cannot boast of having completed an array of correspondence courses as can Past President, Dr. Charles B. Thompson, I did complete one other such course prior to N.R.I., but the latter holds first place. For the average person, the N.R.I. offers about the clearest course in Radio, covering all the necessary fundamentals and keeping pace with the fleet progress of Electronics. It is designed to help you get actual experience so necessary to ultimate success, even though you be located thousands of miles away.

So fellow Alumni, let's keep up the old spirit of moving forward. Those of you who are within commuting distance of a Chapter and not yet a member should join and pass your experiences on to others and they in turn will give you the benefit of theirs. You will find our members all good fellows.

Likewise, I suggest that you who are students, when you have finished your course, join the Alumni. I am sure you will not regret it. If you are fortunate enough to be located near a Chapter, it will be mighty helpful to join and meet others of like mind.

Finally I wish to convey my very best wishes to all the National Officers, the Officers and members of all the Chapters, and especially to my nast worthy opponent, Mr. Harry R. Stephens. I look forward to the day when he also shall be President of our Alumni Association.

CHARLES J. FEJN

New York Chapter Hospitality

I am very happy to hear that Charles Fejn was elected President of this fine association. It must make him feel very proud to be President. I know I was. I will always remember the very nice things that transpired during the year that I was in office. I do hope that the organization will call on me in the not too distant future again

to hold office in this splendid association. I have made many new friends and the medallion I received upon completion of my term will always remind me of a very happy year spent as the President of the N.R.I.A.A.

I want to mention an incident that happened at our Christmas party held last December 21, 1944. About 9:30 P.M. a Canadian soldier walked into our meeting place. Frank Zimmer greeted him cordially and learned that he was Mr. Herman W. Genschorek of Vancouver, B.C., a graduate of good old N.R.I. He was welcomed with open arms by everyone present. Toward the close of the party we got him on the platform and he gave a fine little talk. He explained that he was given a five day furlough. He was stationed in Kingston, Ontario and in five days he could not get home to British Columbia so he came to New York and directly to the New York Chapter. To help brighten his Christmas, Frank Zimmer invited him to his home for dinner. Mr. Pete Peterson and his family also were dinner guests of the Zimmers and all had a grand time. Mr. Genschorek is a great fellow and we do hope he returns for another visit.

LOUIS J. KUNERT

Acknowledges New York Hospitality

Greetings to the N.R.I. Alumni Association. During Christmas leave from the Army camp here at Kingston, Ont., I was able to visit New York City and be lucky enough to land there on a meeting night of the New York Chapter. Thanks to the latest copy of the NATIONAL RADIO NEWS I was able to find the location of the meeting and for the first time attended a gathering of N.R.I. men. I was well received and had the opportunity to meet the 1944 President, L. J. Kunert, Chairman Bert Wappler, other officers and members and make the acquaintance of William (Pete) Peterson and Assistant Secretary, Frank Zimmer. I was much impressed by the enthusiasm and progressive spirit of the chapter officers who, with the cooperation of the members, make the New York Chapter a note-worthy success.

This has aroused spirits to the point where I hopefully suggest that something definite be done to start a N.R.I. Alumni Chapter or Chapters here in Canada, possibly in my home city of Vancouver, B.C. I shall contact you after the war on this matter and obtain your help if you think this is a good idea.

W. H. GENSCHOREK

Visitor: Are your father and mother in?
Skippy: They was in, but they is out.
Visitor: They was in. They is out! Where's your grammar?
Skippy: She's upstairs.

New York Chapter

Here is a brief resume of our activities covering recent meetings.

Officers elected for the year 1945 are as follows:
Chairman—Bert Wappler
Vice Chairman—Pete Peterson
Secretary and Treasurer—L. J. Kunert
Assistant Secretary and Treasurer—Frank Zimmer.

Pete Peterson presided at several of our meetings. At one he gave an excellent talk on common radio faults. He discussed the various jobs he had repaired during the preceding week. His talk was very interesting. At another he talked on Tube Substitutions. Following this Mr. Joel Robinson gave a short talk on "Revamping Transformers".

In line with our new policy Pete Peterson is on hand at eight o'clock for the purpose of answering any questions our members may wish to put to him before our regular meeting starts. From the looks of things Pete is going to be mighty busy for the first half hour or so.

New York Chapter is just full of talent. We have uncovered another very capable speaker in Mr. Eugene L. Williams. He told us all about

a set tester that he had made up. His talk was very interesting especially so because he explained each step as he went along by taking apart the set tester and showing our members just what made it work. These are the kind of talks members like and we are going to have many more of them. Mr. Williams, by the way, comes from Hillside, New Jersey, which is quite a distance from New York City, but he has been present at every meeting since he joined the Chapter. It should be added that before making his talk, Mr. Williams passed diagrams among the members. These diagrams he had himself prepared as a special aid to our members.

Following talks of this kind we always have our good old-fashioned service forum which is presided over by Pete Peterson. This is perhaps the most popular part of our meeting.

New members join our Chapter almost every meeting. All N. R. I. students and graduates in this area are invited to join our Chapter. We are going along at a lively pace and any serious-minded N. R. I. member in this section can profit by attending our meetings. We meet every first and third Thursday of the month at St. Mark's Community Center, 12 St. Mark's Place (between 2nd and 3rd Avenues) New York City.

LOUIS J. KUNERT, *Secretary*.

— n r i —



Detroit Chapter Meeting

Standing—McMaster, Anderson, (in rear), Fitzgerald, Sawyer, Balsevicz, Mills, Fouke, Hasen, visitor, Kennedy, visitor, Lewis, visitor. Second row seated—visitor, Stracka, Bourseleth, Guyton, Upham, Oliver, Bandos, Briggs. Front row—Stanish, Genta, Chase, Rissi, Bisaga, Hiller, Ankeny, visitor.

Detroit Chapter

Henry Rissi spoke to us on "Professional Radio Servicing Techniques." We are very fortunate to have a man of the experience of Mr. Rissi to speak to us so frequently. We always get a great deal out of his talks.

At another of our meetings, our good friend Earl Oliver, past president, past chairman, past secretary and still very much present when the roll is called, presided and delivered the talk of the evening. At still another meeting the service forum was conducted by our good friend Charles Mills, also a past chairman. Mr. Mills used our RCA demonstrator.

Chairman Chase announced that the subject for discussion at our next meeting will be "How Operating Voltages are Obtained from an A. C. Power Line." This subject is taken from a N.R.I. text book.

Our most recent member is Mr. Clarence McMaster.

Meetings are usually held at our headquarters at 2500 Jos Campau. Special meetings are held in Radio establishments occasionally. Therefore, if you live in this area and are interested in attending our meetings we suggest that you send your name and address to the undersigned at 5910 Grayton Road, Detroit 21, Mich. A cordial welcome is extended to all N.R.I. men to meet with us.

HARRY R. STEPHENS, *Secretary.*

Chicago Chapter

The following were elected officers for the current year:

Chairman: Charles Kadlub, 2026 W. James St., Chicago 9, Illinois.

Vice Chairman: Theodore Gabriel, 5125 W. 30th St., Cicero, Illinois.

Secretary: Lloyd C. Immel, 2306 W. 51st St., Chicago 9, Illinois.

Treasurer: Steve Bogner, 4443 W. Cortez St., Chicago 51, Illinois.

Librarian: Harry Andresen, 3317 N. Albany Ave., Chicago 18, Illinois.

Sergeant at Arms: Leo Senglin, 912 Barry Ave., Chicago 14, Illinois.

The officers were installed at our meeting of March 14, 1945.

It was voted to make memberships effective from January 1 to December 31 on the basis of \$3 dues for the year. New members may join our Chapter any time during the year and their dues will be figured on a prorata basis. That is to say, a member joining April 1 will pay for nine months of the year, or a member joining July 1 will pay for only the remaining half of the year and etc. The dues are very reasonable and

are only to pay for postage, rent of meeting place and minor expenses incidental to our meetings.

We meet once a month on the second Wednesday at 2759 S. Pulaski Road. In April, however, we will meet at Tony's Radio Shop, 3200 So. Morgan St. Tony Kapischke is a member.

Have you received one of the attractive new notices of meetings? If not, it is because your name is not on the list in the hands of Secretary Immel. We suggest that you send your name and address to Lloyd Immel, 2306 W. 51st St., Chicago 9, Illinois, if you would like to be notified of meetings.

LLOYD C. IMMEL, *Secretary.*

Baltimore Chapter

Officers for 1945 are as follows:

Chairman: E. W. Gosnell.

Vice Chairman: H. J. Rathbun.

Secretary-Treasurer: G. Phillips.

Recording Secretary: P. Marsh.

Librarian: G. H. Leidig.

Publicity: L. Arthur.

Sergeant-at-Arms: J. Clark.

The spirit of our members is remarkable. Our attendance is surprisingly even owing to the fact that a group of regulars are always on hand. We have taken in a few new members and any N.R.I. men in this locality who would like to join will be most welcome. Our group is not too small or is it too large to give plenty of personal attention to any member who may want information at any time.

Our meetings are held at Redman's Hall, 745 West Baltimore Street, on the second and fourth Tuesday of each month.

G. PHILLIPS, *Secretary.*

On Board Ship with Merryman

"Well, sirs, I have great news for you. I am on the same ship with Mr., or rather Chief Earl A. Merryman, the Secretary of the Alumni Association. He is my Chief. He is really a swell fellow. If all of the Officers are like him, the Alumni Association just has to be a wonderful organization."

BRAWLEY T. MARZE, S2/C.

The boy who believes that his parents, or the government, or anyone else owes him his livelihood and that he can collect it without labor will wake up one day and find himself working for another boy who did not have that belief and, therefore, earned the right to have others work for him.

GENERAL DAVID SARNOFF,
President, Radio Corp. of America.

Phila-Camden Chapter

Our meetings are held on the first and third Thursday of each month at our headquarters located in the post office building, 4706 Comly Street, Philadelphia 24, Pennsylvania. The welcome mat is always out for students and graduates of National Radio Institute who may like to visit us. We are always glad to accept new members. Make a note of the date and drop in to see us. You will like our fine group of good fellows.

The following new members were recently accepted—John Stewart, Chester Klabe, W. C. Hooton, Edgar Boyer, Edward McGinley, Edward Rood, Frank Janda, and David Chalmers. Yes sir, Philadelphia-Camden Chapter is growing.

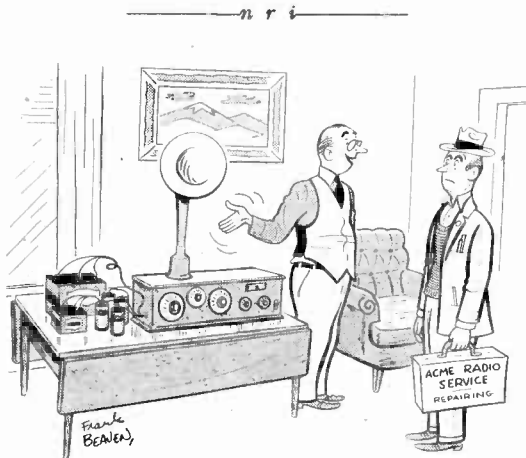
We have a regular program which we follow. The first meeting of the month, which is held on the first Thursday, is our business meeting. The business is brief and then the rest of the evening is devoted to technical discussions. The second meeting which is held on the third Thursday of the month is given over entirely to radio servicing. Our members bring their balky radios here and under the capable supervision of Harvey Morris and John McCaffrey the trouble is located and the radio is repaired. If you live in this area and want to learn radio servicing from experts, this is a good way to do it.

Our three musketeers, Arnott, Armstrong and Tice, are sporting some new testing equipment.

The radio servicing business is certainly paying off for these fellows.

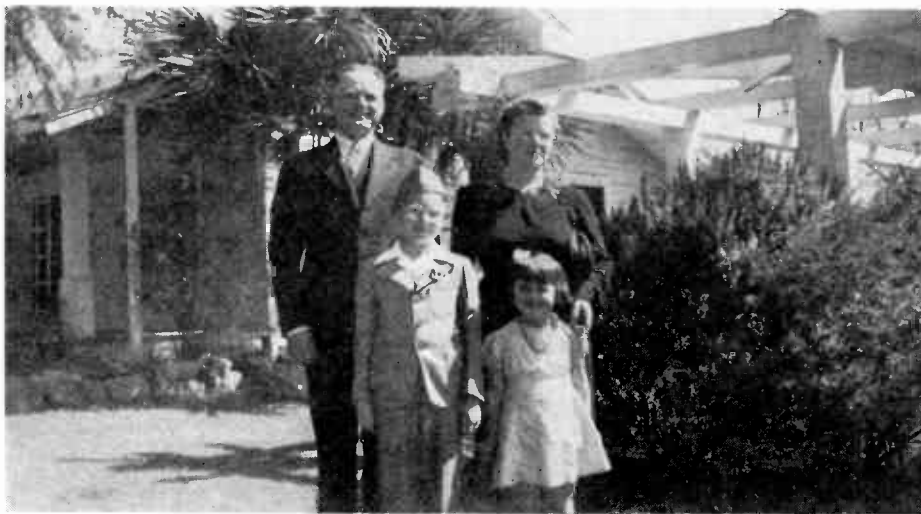
Attendance has been very good throughout the winter. This speaks well for the loyalty of our members because there were times when winter weather made transportation very bad. Our attendance is steadily on the increase.

HARRY J. SCHNEIDER, *Recording Secretary.*



Courtesy of Radio-Craft Magazine

"I want it changed to F.M.!"



The new N.R.I. Alumni Association Vice President and his family, Mr. and Mrs. Oliver B. Hill, son Raymond and daughter Diane, photographed at their home in Burbank, California.



Here And There Among The Alumni Members

Raymond Ess, Jr., of Mt. Morris, New York, graduated in 1936. Three months later he was selected out of several other servicemen to work in a Radio repair shop. After working

there two years he decided to go in business for himself. He set up his shop in the home of his parents. In 1941 he rented a store, from which his business has grown into an up-growing and thriving establishment—finest equipment available—large stock of parts and all paid for.

— n r i —

Charles Jackowski, 7939 Exchange Ave., Chicago, operates the Beachview Radio Service. His place of business is adjacent to the largest theatre in the community. Jackowski, with the aid of his helpers, repaired more than 900 radios in 1944.

— n r i —

Have a nice photo showing E. G. Riggle, of Canton, Ohio, on a golf course. He is shown in a foursome with some Westinghouse big shots. These fellows work long hours but have a little time for everything. It is all in how well one can organize his activities.

— n r i —

Wallace A. Roos, of Houston, Texas, serviced 1025 Radios up to the time he completed the Course in November 1944. The young man is a whiz for turning out work.

— n r i —

Clay S. Scott, of Warsaw, North Carolina, is in the Maritime Service. Says N.R.I. training has helped him a great deal. He was making \$100 a week in Radio before he went to sea. He likes the Maritime Service with all its adventure.

— n r i —

I. T. Martinez, of Sabinal, Texas, is a Radio Mechanic at an airfield near his home. Good pay—interesting work—life is sweet for Martinez.

— n r i —

Kenneth C. Sanford, of East Liverpool, Ohio, had a nice Radio business. Uncle Sam beckoned and Sanford went into the Navy where he passed the Radar test and was given a rating. He plans to re-open his shop when he returns. Two fine youngsters are hoping that will be soon.

— n r i —

Clyde J. Burdette, of Spartanburg, South Carolina, is Chief Engineer, Broadcasting Station WORD, with four assistant engineers. Not bad for a fellow who graduated in 1942.

— n r i —

Had a nice letter from Don Quade, N.R.I. Instruction Department, who is somewhere in the European theatre of war. Don is in the thick of things but holding up very well in spite of all

the hardships. He's a great guy with a swell little family and we are all looking forward to his return.

— n r i —

It's Major George B. Rohrich now. Many of our graduates will remember Major Rohrich as the man who conducted our Laboratory Page before the war. Rohrich, a veteran of World War I jumped right into this scrap as a Signal Corps Officer. His promotion to Major will please many of our readers.

— n r i —

Mr. Snorri P. B. Arnar, Reykjavik, Iceland, sent us a beautiful photo album, leather bound, containing more than 200 scenes in Iceland. It is a much appreciated keepsake.

— n r i —

Bernard Hiller is beating the drums for Detroit Chapter. Hiller writes to say that he cannot understand why anyone privileged to join the N.R.I. Alumni Association would fail to do so. Thanks for those kind words, Hiller.

— n r i —

Bert Wappler, Chairman of New York Chapter, who is a designer and producer of Radio equipment for the medical trade, is now compelled to get along without the help of his son, who has joined the Navy. The young man did remarkable instrument work and Bert will miss him for the duration.

— n r i —

George J. Bugiak, of Sunland, Alta., Canada, is a Sergeant, Wireless Operator, Royal Canadian Air Force.

— n r i —

Graduate Joseph Miller, of Cincinnati, has given 13 pints of blood to the Red Cross. Mr. Miller writes "as a challenge to the membership—my record of blood donations is 13—and the donations are not entirely for patriotic reasons. There are relatives and friends I would like to see again." A fine record, Mr. Miller.

— n r i —

Mrs. Elizabeth C. Tweedell informs us that her son and our fellow member, Irvin Tweedell, of Opelousas, La., is a war prisoner in Germany.

— n r i —

Vincent Echevarria, of Brooklyn, is employed in the Signal Corps repair shop in Brooklyn as a civilian radio technician. He sent us a page from "Port News" containing a photo of Echevarria working on a receiver while John Kendall, in the same picture, works on a transmitter. Mr. Kendall, by the way, is an old-timer, having graduated from N.R.I. in 1921.

— n r i —

Peppy letter from Raymond M. Chang, Honolulu, Hawaii. Doing nicely in a downtown Radio shop.

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NATIONAL



RADIO NEWS



FROM N.R.I. TRAINING HEADQUARTERS

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J. B. STRAUGHN, TECHNICAL EDITOR

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This contented looking chap is Harry R. Stephens, Secretary of Detroit Chapter. Harry has a nice Radio shop in his home.