NATIONAL RADIO NEWS

IN THIS ISSUE

How To Fix A Radio That Hums

How To Align Radio Receivers

Alumni Association News

AUG.-SEPT. 1946

VOL. 12 NO. 4

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HE WON'T LET GO!

Off the coast of New England a fishing boat was being tossed about in a rough sea. Suddenly a seaman noticed a young man hanging to the mast, lashed by the biting wind. In horror the seaman ran to the Captain and exclaimed, "*Look, Captain, your son is up there in grave danger. If he lets go he'll be dashed to pieces.*"

The Captain looked up and calmly replied, "*He won't let go.*"

There is a moral in that little story. Many of us need to train ourselves to withstand set-backs. We must learn how to meet adversity. In every career, in every business, in every life, problems will present themselves. Some will be trivial. Some will be serious. Some will seem almost insurmountable. It is then we are put to the real test. To yield to strong resistance is a weakness. Someone has well said, "Only the game fish can swim up-stream."

Here and there we find a strong man. His problems are many and no different from those of others. But he keeps on hustling. He knows that he is master of his own destiny. Whatever his future shall be, he knows depends upon him and him alone. While others are willing to float with the tide, he is swimming up-stream. He doesn't know defeat. *He won't let go.*

You're probably heard this philosophy before. But if only one man who reads this will hitch up his belt another notch and say, "I won't let go," this page has been worthwhile. Because, in time, that fellow will be a successful man. I hope it is you.

J. E. SMITH,
President.

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Don B. Looney

How to Fix A Receiver that Hums

By DON B. LOONEY
NRI Consultant

HUM is one radio receiver symptom that cannot be completely eliminated. It is always present to some extent in any receiver operating from an a.c. power line. Therefore, your aim in servicing a set with hum is to reduce the loudness of the hum to an unobjectionable level rather than to remove it altogether.

First, let us see what causes excessive hum. Fortunately, relatively few defects result in hum. Once you have learned what to look for, you will very often find it possible to locate the source of the hum without making any elaborate localization procedures.

Causes of Hum

Hum occurs when any low-frequency a.c. voltage gets into the audio signal circuits of a set and less often, as you will learn, when it enters an r.f. signal circuit. The two most common paths through which hum voltage enters the signal circuits are through a defective filter section of the power supply and through a leak between the cathode and heater in a tube. There are also a few less common paths that we will take up later.

Since the hum voltage is an a.c. voltage, it can be amplified just like any other signal once it gets into the signal circuits. And, naturally, the more amplification it gets, the more noticeable it becomes. For example, a fairly large hum voltage could get into the power output stage without being very noticeable, because there is practically no gain between this point and the loudspeaker. But even a small hum voltage introduced at the input of the audio amplifier would receive enough amplification to be annoying by the time it reached the loudspeaker. Therefore, whether or not a hum voltage is objectionable depends to a great extent upon the stage into which it is introduced.

Now let's study in detail the ways in which excessive hum can enter a signal circuit.

Filter Troubles

At least 75% of hum complaints are caused by a defect in the power supply system. As you know, the filter is intended to smooth out the ripple voltage from the rectifier output to an acceptable level. It is this ripple voltage that causes hum. If the filter becomes defective, more hum or ripple voltage than normal will be applied to the tube electrodes, and the hum level of the set will increase.

You are probably familiar with the difficulties that may prevent proper filtering, but let's review them briefly.

Fig. 1 shows two typical filter systems. An a.c.-d.c. set is shown in A, and a straight a.c. set in B, but the filter circuits could be used in either receiver, provided the condenser voltage ratings are correct. Condensers C_1 and C_2 are electrolytic condensers, connected with the polarities indicated.

Condenser C_1 is not likely to cause much hum. If this condenser loses capacity, develops a high power factor, or opens, there will be a slight increase in the a.c. ripple voltage, but the d.c. supply voltages will be reduced to such an extent that the receiver gain will be sharply decreased. Thus, although some hum may be heard, the chief complaint will probably be weak reception or a dead receiver. (If C_1 develops leakage or short circuits, the rectifier tube will probably be ruined, and the result will be a dead receiver.)

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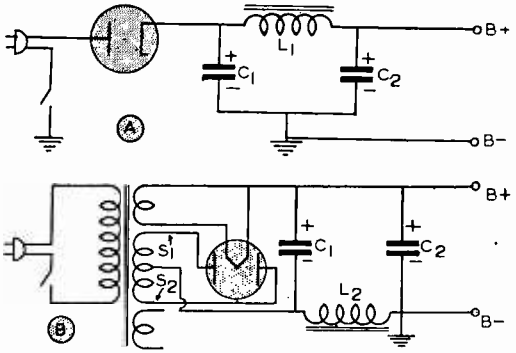

Fig. 1.

Most hum troubles are caused by condenser C_2. When this condenser loses capacity or develops a high power factor, its ability to act as an a.c. voltage divider with choke L_1 decreases, so a greater proportion of the ripple voltage appears across C_2 and is passed on to the tube electrodes. If C_2 opens, the hum will become very strong.

Leakage in condenser C_2 (or leakage in any condenser or circuit in parallel with C_2 at some point farther on in the B supply system) will cause excessive d.c. current to flow through L_1. This will reduce the inductance of the choke coil, making it less effective as a filter component, and so causing greater hum. If C_2 shorts altogether, the set will become dead.

Condensers C_1 and C_2 are frequently in the same condenser block. If leakage occurs *between* these condensers, there may be a shunting resistive path across the choke coil. Such a path will reduce the effectiveness of the choke and may cause hum. A similar shunting resistive path across the choke may exist in the circuit of Fig. 1B if leakage develops from the negative side of condenser C_1 to the chassis. This, too, may cause hum.

Of course, hum may also be caused by short-circuited turns in the choke coil, but such a defect is rare.

Unbalanced Full-Wave Rectifier Tubes. Hum is occasionally caused by unbalanced rectification in a full-wave power supply. In this case, hum voltage gets out into the B supply because of the filter design. In a full-wave circuit like that shown in Fig. 1B, the filter is designed to remove the 120-cycle ripple that is normal for full-wave rectification.* If anything happens to windings S_1 or S_2 of the transformer, or if one-half the tube becomes defective, the tube will still deliver d.c. because one of its plates will conduct current but the frequency of the ripple will now be 60 cycles, instead of 120 cycles. This lower frequency is much harder to filter than is the 120-cycle ripple, and the filter system may not be capable of doing a good job on it. Therefore, this condition may cause hum even though the filter is not at fault.

*This depends on the power line frequency. If the power line is rated at 25 cycles, then *full-wave* rectification would produce a 50-cycle ripple.

Cathode-to-Heater Leakage

Most hum complaints not due to filter defects are caused by cathode-to-heater leakage in tubes. This is an odd trouble because it has to occur in a certain way before it can cause hum, and then may cause hum only in certain stages.

Fig. 2A shows the filament and cathode connections of a typical modern triode circuit. One side of the filament is grounded to the chassis, and the cathode is connected to the chassis through self-bias resistor R_2, which is bypassed by C_1. (As you know, any voltage existing between the cathode and ground is also in series with the grid circuit and the cathode, so the voltage across C_1-R_2 is the d.c. bias voltage for the tube.)

However, let's suppose that some part of the cathode (marked B) shorts to the ungrounded end of the filament (marked D). This will create a path from D to the chassis through the cathode and resistor R_2. This path and the filament are now in parallel, so some part of the a.c. voltage applied to the filament will also appear across R_2. The exact amount across R_2 will depend on whether a complete short or just leakage exists between B and D.

Whether this a.c. voltage across R_2 causes hum depends on the capacity of C_1. If this by-pass condenser has a high capacity its reactance may be so low that little if any a.c. voltage can build up across it and no hum will result. However, if the capacity is low, or if there is considerable amplification between the grid circuit of this stage and the output, a small amount of hum voltage developed across R_2 will be amplified sufficiently to cause hum.

On the other hand, if a short or a low resistance develops between B and E, there will be no hum because R_2 and the filament voltage source will not be in parallel, so there will be no a.c. voltage across R_2. (However, the low-resistance path between B and ground will be in parallel with R_2; this may upset the bias and may cause distortion or oscillation.)

If the filament connections are as shown in Fig. 2B, then a short circuit from the cathode to point A on the filament will not cause hum, because the a.c. potential between A and ground is zero due to the grounded center tap on the filament winding.

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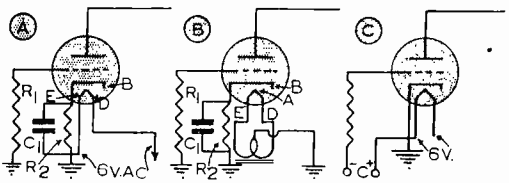

Fig. 2.

Finally, with the connection shown in Fig. 2C, no hum will develop regardless of the amount of cathode-to-heater leakage which may exist, or between what points it occurs, because the cathode is directly grounded, and there is no way for this a.c. filament voltage to get into the grid cathode circuit.

Therefore, cathode-to-heater leakage can exist in some stages without causing trouble and may have to exist in a special manner in other stages before it can cause trouble. (Even so, cathode-to-heater leakage is a very common source of hum in radio receivers.) You can save time by examining the wiring diagram to see which stages may have this trouble—there is no need for checking the tubes in stages where cathode-to-heater leakage cannot cause hum.

The greater the voltage across the filament terminals of the tube, the greater the likelihood of hum, because then there will be a larger a.c. voltage placed across the bias resistor if leakage or a short develops between the tube heater and its cathode. For this reason, cathode-to-heater leakage causes more trouble in a.c.-d.c. receivers than in a.c. sets. As shown in Fig. 3, the potential difference between the tube filaments and ground increases as one progresses down the filament string from the grounded end (as one moves from VT_5 toward VT_1). To compensate somewhat for this, set manufacturers arrange the tube filaments so that the *least* filament-to-ground voltage is applied to the tube that is most likely to cause trouble if it develops cathode-to-heater leakage. Then the next largest filament-to-ground voltage is applied to the second most troublesome tube, and so on.

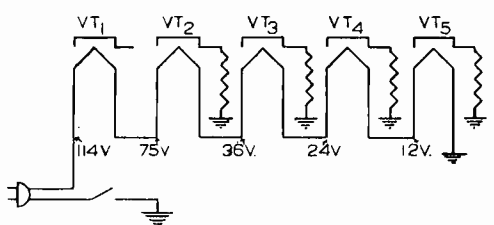

Fig. 3.

Almost always, therefore, tube VT_5 is the first audio tube. Tube VT_4 may be the first detector-oscillator; VT_3 may be the i.f. stage, VT_2 the output tube, and VT_1 the rectifier tube. This odd order of connecting the tube filaments tends to minimize the possibility of hum.

Even though tube VT_2 is the power output tube, this arrangement of filaments results in such a high filament-to-ground voltage that leakage between its cathode and filament may cause a considerable amount of hum. In fact, output tube leakage is the second most probable cause of hum in a.c.-d.c. sets. (A defective filter, of course, is the most probable cause.)

Miscellaneous Causes of Hum

Defective filter condensers and cathode-to-heater leakage account for 90% of the hum trouble you will meet. The remaining 10% have unusual causes—the kind that baffle the radio mechanic but are readily found by a man with professional training.

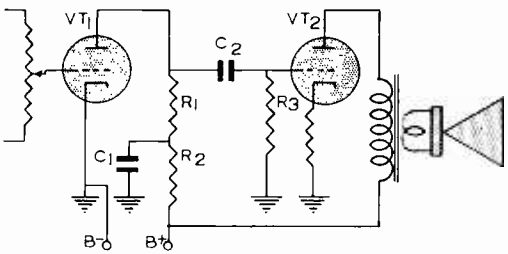

Fig. 4.

One reasonably frequent cause of hum is a defect in a decoupling filter. In the filter shown in Fig. 4, C_1 and R_2 act as a voltage divider to reduce any hum voltage coming from the B supply. If condenser C_1 loses capacity or develops a high power factor (this condenser is frequently an electrolytic condenser), it will no longer act as an effective filter element, and hum voltage will be applied to the plate circuit of tube VT_1.

Inductive and Capacitive Coupling. A.C. electromagnetic fields exist in and around the chassis of any power-line-operated radio receiver. These fields will cause no trouble in a well-designed receiver, but hum may result if anyone tampers with the position of critical leads or removes shielding.

Most trouble of this kind is caused by misplaced grid leads. Unless you notice where a repair has been made in which some critical lead may have been moved, you will first have to use the methods described later to determine which stage the hum enters. Then you can try moving the

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leads in that stage with an insulated stick or alignment tool while the receiver is turned on. If you find a position where the hum disappears, you have solved the problem. Examine the set carefully to see if there is any evidence of shields missing. Also, if the control grid lead should be brought up inside a shield, be sure it is so placed.

Sometimes a receiver owner will tuck lengths of the a.c. power cord "out of the way" inside the radio. The strong a.c. field from this cord may induce hum in some grid circuit. Always pull the cord out to see if the hum decreases, then fold it or tie it up away from the chassis (but off the floor).

Although less common than electromagnetic coupling, electrostatic induction also may cause hum. Electrostatic induction is the result of capacitive coupling between points. If stray coupling exists to a grid lead, for example, and the grid circuit contains a high resistance, then even a small electrostatically induced hum voltage will cause considerable hum trouble. Low resistance grid circuits are less critical. In practically all cases where high resistances are used, the manufacturer minimizes hum by keeping the tube grid leads short and placing them so that they are not easily disturbed. However, if anything happens to increase the resistance of the grid resistor, there may be appreciable hum induced in the circuit. Of course, any change in the grid resistor may also cause overloading of the tube or enough change in the bias so that distortion occurs. You may find that you have a combination complaint rather than a simple case of hum in such cases. This is often an aid in locating the defect, rather than an obstacle.

Hum Caused by Replacement Parts. Improper replacement of parts can sometimes cause hum. A typical example is a loudspeaker cone replacement. If the hum level is normal before the replacement but excessive afterwards, very likely the speaker has a hum-bucking coil—mounted on the speaker field that has been improperly connected to the voice coil. This coil should be connected as shown in Fig. 5—then, any hum

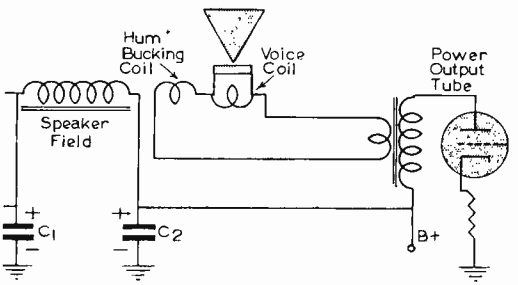

Fig. 5.

voltages induced by the speaker field in both the voice coil and the hum-bucking coil will oppose and cancel each other. If the voice coil leads are connected backwards, the voltages will add, and hum will be increased. Unsoldering the voice coil leads and interchanging them will remedy this condition.

Sometimes a replacement choke or power transformer does not have the complete shielding of the original part. This may allow strong hum fields to escape from the part if it is a power transformer or choke, or to get into the replacement part if it is an audio transformer. In such cases, it is best to get a more nearly exact duplicate if possible, but sometimes proper part positioning will eliminate magnetic flux linkage. Fig. 6 shows an example. Here the hum, due to mag-

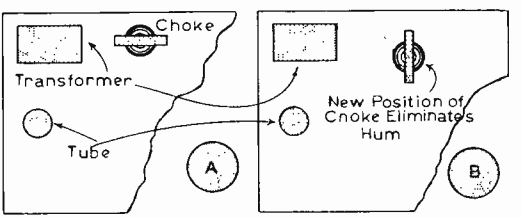

Fig. 6.

netic coupling, that occurs when the parts have the arrangement shown in Fig. 6A can be eliminated by relocating one part (Fig. 6B).

Effect-to-Cause Reasoning

Effect-to-cause reasoning is a very valuable aid in the case of hum. You can use it right away to locate the section where the hum originates.

As you know, hum is a low-frequency a.c. voltage. Therefore, the hum voltage picked up by an r.f. stage cannot pass through the tuned circuits unless it modulates the incoming signal. On the other hand, hum originating in the power supply or in the audio amplifier can be heard whether or not an r.f. signal is being received.

To locate the section in which the hum originates, then, just tune the set so that no station is picked up, and turn the volume control to minimum volume. If the hum is still audible, it must be originating in the power supply or the audio amplifier. If you hear no hum, turn the volume control back to a normal volume level, and tune the set to a station. If you hear hum now, it must be originating in an r.f. stage and modulating the incoming signals. A hum of this sort is called *modulation hum* or tunable hum. Thus, effect-to-cause reasoning plus simple tests will

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enable you to locate at once the section in which the hum originates.

Effect-to-cause reasoning can be brought into use in some sets for a second time once you have learned to recognize hum frequencies. In practically all receivers that use power transformers, the rectifier tube is a *full-wave* rectifier. The fundamental frequency of the hum or ripple produced by this rectifier is twice the frequency of the line voltage. (For a 60-cycle line, this ripple is 120 cycles.) Therefore, if you hear a hum that has a fundamental frequency of 120 cycles, you know that the filter is not removing enough of the rectifier ripple. Your ear should be able to tell the difference in pitch between these two frequencies.

While both 60 cycles and 120 cycles are low frequencies, the 120-cycle hum is a bit higher in pitch. On the other hand, hum caused by cathode-to-heater leakage, an unbalanced rectifier, or electrostatic or electromagnetic pickup from the power line will have the same fundamental frequency as the power line (60 cycles). *Therefore, in a standard a.c.-operated receiver, with a power transformer, 120-cycle hum indicates a filter defect, and 60-cycle hum indicates other troubles.*

Of course, this is not true for a.c.-d.c. receivers and others that use half-wave rectifiers. Here, the fundamental hum frequency is the same as the power line frequency, regardless of the defect.

Basic Testing

As we said, 90% of hum complaints (plain hum—not modulation hum) are caused by defective filter condensers or by cathode-to-heater leakage in an audio tube. Therefore, it is logical to check these suspects first, before making any further localization tests.

The simplest and quickest test for a suspected open or high power-factor electrolytic condenser is to try another one across it. Be sure that the test condenser has a working voltage rating at least as great as that of the condenser under test (450 volts or higher for a.c. receivers, 150 volts or higher for a.c.-d.c. receivers).

The capacity of the test condenser should be near that of the one across which it is connected, but this is not of extreme importance.

To make tests, first turn on the receiver (which must be connected to its speaker). If you can conveniently locate the output filter condenser, shunt your test condenser across it. Watch polarity—the positive terminal of your test condenser must go to the positive terminal of the original, and the two negative terminals also must go together. If it proves difficult to tell which is the output filter condenser, remember that its positive lead goes to the screen of the output tube—so the positive lead of your test condenser may be connected to this point. The positive lead of the input condenser will connect to the rectifier cathode — a point easily identified.

Frequently only partial hum reduction is observed when the output condenser is shunted with one of like capacity. This may mean the input condenser is also defective. If you wish, shunt both condensers simultaneously. Of course, you can't hold all four leads at the same time, but you can temporarily solder in one test condenser and hold the leads of the others in place.

Make sure you test between the terminals of the original condenser. As we said in discussing Fig. 1B, the negative terminal of condenser C_1 is above ground potential. Therefore, you *cannot* consider that ground is one terminal of this condenser; to shunt it, you must locate both terminals of C_1 and connect your test condenser to them.

If the hum is not greatly reduced when you shunt the test condenser across the output filter condenser, then the output filter condenser may be leaky. Shunting it with another is not a test for leakage. You must disconnect the original condenser and check it for leakage—either with an ohmmeter, or by temporarily placing another condenser in the circuit in its stead. Leakage between condensers is not easily checked except by disconnecting both condensers and trying others in their places. (An ohmmeter check is not reliable if the two have a common lead, because a check between the other two terminals will give you a reading whether or not leakage is present.)

If the capacity of the test condenser is far below that of the original condenser, the hum may not entirely disappear. However, any considerable reduction in hum shows that the original condenser should be replaced by one of the proper capacity.

Cathode-to-heater leakage in a tube can easily be found by checking the tube for shorts or leakage in a tube tester. Be sure to check the rectifier tube to see that both halves have approximately the same emission, particularly if it is a full-wave rectifier, and the receiver exhibits 60-cycle hum. In this latter case, also use an a.c. voltmeter to find out if the power transformer is delivering voltage to both plates of the rectifier. Put one voltmeter lead on the centertap of the high voltage winding and the other on one rectifier plate. Note the voltage. Leave the centertap lead in place and shift the other lead of the voltmeter to the other rectifier plate. The two plate voltages should be approximately equal.

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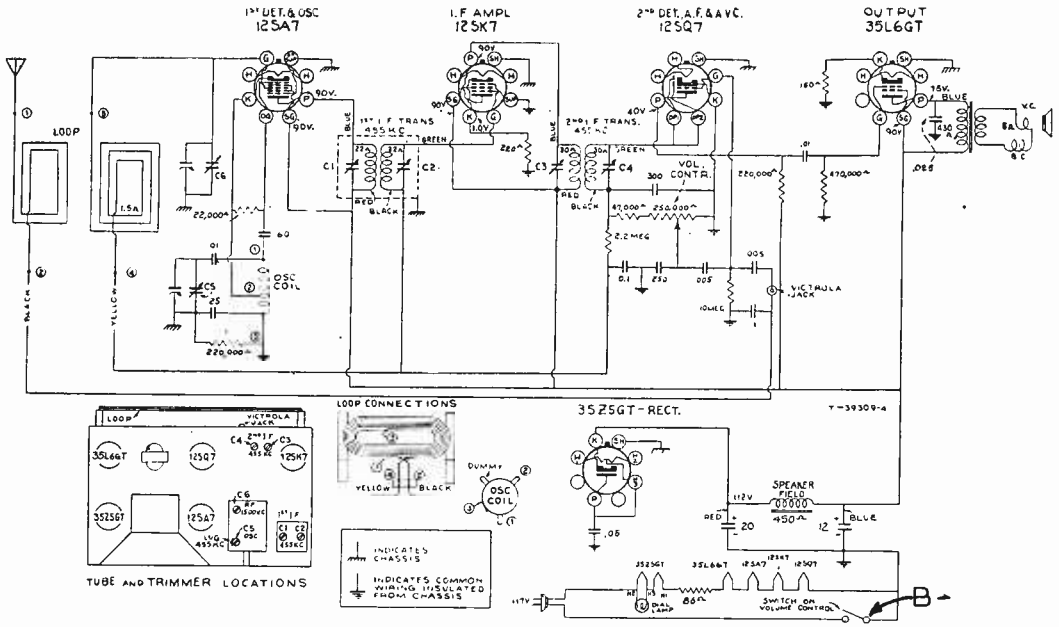

Fig. 7.

Modulation hum is usually caused by the introduction of a hum voltage into an r.f. stage containing a tube that has been forced off the straight portion of its characteristic. If such a stage is over-biased by some defect in the bias supply, for example, it will operate in a non-linear manner; this may permit even a fairly small hum voltage to cause modulation hum. Strong signals or a high hum voltage level may also cause the stage to operate off the straight portion of its characteristic.

Cathode-to-heater leakage is the most usual way the hum voltage enters the stage.

Localized Hum

If you find that the trouble is not caused by a defective filter condenser or by cathode-to-heater leakage in a tube, it is best to determine where the hum enters the signal circuit. The procedure to use depends upon whether you have steady hum or a modulation hum.

Localizing Modulation Hum. Let's see how you could go about locating the stage in which hum modulation starts. Fig. 7, a typical a.c.-d.c. receiver, will serve as our example. At the start you know that the modulation hum originates in the r.f. section—between the loop antenna and the volume control. To make tests, you need a signal generator (abbreviated s.g.) that will deliver either a modulated or an unmodulated signal.

Set up the s.g. to give a modulated signal. Connect its ground lead to the receiver chassis. Place a .05 to .1 mfd. condenser in series with its hot lead (unless this condenser is built into your s.g.) and connect the hot lead to the control grid of the input tube (the 12SA7).

Next, tune the receiver to some point where a station is not picked up, and tune the s.g. to resonance with the receiver, at the same frequency. When the modulation tone of the s.g. is clearly heard, switch the s.g. to deliver an unmodulated signal and increase its output to maximum. The hum will be modulated on this signal and will be heard. Now tune the s.g. to 455 kc. (the i.f. frequency), and touch the hot s.g. probe to the plate of the 12SA7 tube. If the hum is no longer heard, the trouble is in the 12SA7 mixer or oscillator circuits. Check the tube, the continuity of the mixer control grid return circuit, and the oscillator grid resistor (if this latter has increased markedly in value, it may be causing self-modulation, which could sound like hum). Experiment with the position of the mixer and oscillator grid leads.

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If the hum is still heard with the hot probe on the 12SA7 plate, move it to the plate of the 12SK7 tube. If the hum stops, the trouble is in the 12SK7 circuit; test the parts, tube, and wiring in it. If the hum continues with the hot probe on the 12SK7 plate, the trouble lies between this point and the volume control. Check the parts and the wiring involved. Also, try another 12SQ7 tube.

Localizing Steady Hum. Now suppose the hum is in the power supply or the a.f. section of the receiver shown in Fig. 7. First check the 20-mfd. and 12-mfd. sections of the filter, and test for cathode-to-heater leakage in the 12SQ7 and 35L6 tubes. If this does not locate the hum source, use the *circuit blocking* method of localization. That is, prevent the audio signal from passing some point; if hum is still heard, it is getting in between this point and the speaker. Otherwise it is farther back toward the input.

Begin by shorting the *primary* of the output transformer with a test lead or a .5-mfd. condenser. (Connect the shorting lead or condenser *across the terminals of the primary.*) This prevents any signals from being fed from the 35L6 to the loudspeaker. If the hum is still heard, the humbucking coil (marked B.C.) is probably reversed, or else the power supply is defective. If the hum disappears when the output transformer primary is shorted, remove the shorting lead (or condenser), and short across the 470,000-ohm 35L6 grid resistor. If hum is heard, it is originating in the 35L6 stage.

If you do not hear hum in this test, remove the shorting lead and short the 10-meg. grid resistor of the 12SQ7 tube. If hum is now heard, either it is originating in the 12SQ7 stage, or the control grid of the 35L6 is picking it up.

If you don't get hum with the 10-meg. grid resistor shorted, remove the shorting lead, and turn the volume control to minimum volume. Any hum now heard is being picked up by the grid circuit of the 12SQ7. If turning the volume control up and down varies the strength of the hum signal, the control may be defective, or some of its wiring may be picking up hum from electro-magnetic or electrostatic fields.

This method of circuit blocking can be used on any type of receiver, a.c. or a.c.-d.c. However, in an a.c. set, using a power transformer, it is often simpler to block signals by removing the tubes one at a time while the receiver is turned on. (Of course, this cannot be done with an a.c.-d.c. receiver.)

Thus, if you have an a.c. set, pull out the power output tube. If hum is still heard, investigate the hum-bucking coil and the power supply. If the hum stops, reinsert the tube in its socket and pull out the first audio tube. If you hear hum, it is getting in the power output stage or in the plate supply circuit of the first audio tube. If no hum is heard with the first audio tube removed, the trouble is in this tube or its circuits.

Points to Remember. Any a.c.-operated receiver will have a certain amount of hum that cannot be eliminated. If you listen carefully you can hear this hum from practically any receiver. We suggest you listen to a number of receivers that are in good condition to become familiar with the amount of hum that is considered acceptable to the average radio listener.

Hum is always more pronounced when the loudspeaker is in its cabinet, for the cabinet improves the response to low-frequency notes. Sometimes, when a receiver (and loudspeaker) is on the workbench, it is almost impossible to hear hum that would be objectionable with the chassis and speaker mounted in the cabinet. You can get an idea of the intensity of the hum with the set out of the cabinet by tuning away from a station and barely touching the speaker cone with the end of your finger. If hum is present, you will feel a vibration of the speaker cone. Whenever you service a set for hum, be sure to notice the loudness of the hum with the speaker in and out of the cabinet. This will give you a good idea of how much difference the cabinet makes.

Getting Practical Experience at Home

Hum is readily introduced into a radio receiver. Carry out the following suggestions on the set that you are using for the NRI Practical Training Plan.* This should be a standard a.c. receiver with a power transformer and a full-wave rectifier.

To learn the difference between 60-cycle and 120-cycle hum, locate the output filter condenser, and temporarily unsolder it from the circuit. When you do this, there will be a strong hum from the loudspeaker. If everything else is normal, this hum will have a 120-cycle fundamental frequency plus higher harmonics.

When you think you can recognize this hum, resolder the filter condenser and introduce a 60-cycle hum. There are several ways of doing this; one of the best is to connect a small condenser (.01 to .05 mfd.) from the ungrounded side of a filament to the control grid of the first audio tube. This will introduce a strong hum

*This is explained in Job Sheet 25, which is sent students with the graded answers for Lesson 23FR.

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with a 60-cycle fundamental frequency and higher harmonics.

Much depends on the response characteristics of the receiver as to whether you can at once tell the difference between these two hum frequencies. If the set does not respond very well to low frequencies, you may hear only the higher harmonics of the two, which may sound much alike. Listen to the two hum frequencies carefully, one after the other, until you think you can recognize the difference between them.

Now proceed to introduce various defects. The test we have just described of opening the output filter condenser has the same effect as a loss of capacity would have. Make the same test on the input filter condenser by reconnecting the output condenser and disconnecting the input condenser. The hum level will increase, but the d.c. voltages will all drop radically, and you may have weak reception or even a dead receiver. Try out the set to see how it works with the input filter condenser disconnected.

High power factor in either electrolytic condenser will have virtually the same effect as opening the condenser, so there is no necessity for demonstrating this condition. Leakage is important in the output filter condenser. You can simulate leakage by connecting a 5000-ohm 10-watt resistor in parallel with the output filter condenser so that it draws extra current through the filter choke. This will probably increase the hum, but it will cause a lower-than-normal plate voltage on most of the tubes, and this may prevent the increased hum level from becoming very noticeable.

Cathode-to-heater leakage can be simulated by connecting a .25-mfd. condenser between the cathode terminal of a tube and an ungrounded filament terminal on that tube socket. This will not cause hum in certain stages, but in others there will be a strong hum. Try this on audio stages in which the cathode is not directly grounded—that is, stages that have cathode bias resistors. Try it in r.f. and i.f. stages as well, and see if you can cause modulation hum.

You can take off tube shields and introduce other conditions to see just what effect they cause in your receiver. Try bringing the power cord close to the grid lead of the first audio tube. Finally, create excessive hum in your set while the speaker is in its cabinet, then remove it from the cabinet, and notice the hum level. Compare this level with the first one to learn how different the hum level may be when the set is on the workbench. Lightly touch the cone with your fingers to feel the vibration caused by the hum (no signals should be tuned in)—then cure the hum and feel the cone again. Frequently you can feel the difference as well as hear it.

How To Get Along With Others

By DR. JAMES F. BENDER,
Director The National Institute for Human Relations

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Once upon a time there was a man who owned a farm. And this farm was much in the man's mind, for it was his hobby and chief delight. And he hired an old fellow to look after the farm. Now this hired man was exceedingly tight-lipped. He scarcely ever talked.

The man would drive out to his farm every week-end, regular as sun-set, and he would find much satisfaction in looking over his house and barn, his garden and fields, and his animals—all of which were his pride and joy. And he would go to great length to ask how his possessions were doing, all the while plaguing the old fellow with endless questions. But all the hired man would ever say was, "I sleep well o' nights" and continue to go about his tasks. This always made the man hot under his collar; and he would mumble to himself, "Why, the fellow isn't even civil!", and then he would drive back to the city, planning through the weary miles to hire someone else.

And then one night it came to pass that there was an awful storm. The wind blew in terror, and you heard the lightning strike all around you, and the rain came down in floods. And the man tossed upon his bed the whole night long fearing great harm must surely come unto his farm and all the belongings thereof.

Early next morning he came unto his farm, forgetting his business in the city. But he feared to gaze upon his house and fields for he had seen destruction all along the way. But when he looked with all his eyes, praise the Lord, everything was as it should be. The chimney was not toppled down; the shutters were not blown away; the roof was whole.

And then he hurried to the barn. And his heart beat fast within him, for it was not touched. Even the hay stack was in its place, and there was a covering over it with the ends staked down fast as a tent. And the cows and horses were grazing contented about it, blinking at the dew-diamonds. Not an iota of destruction did he find anywhere on his place.

As the man watched the old fellow feed the chickens, and the ducks and geese and the other fowl that he did like to see increase, a great warmth welled within him and his spirit was quickened to see for the first time the meaning of, "I sleep well o'nights."

"Surely," said the man unto himself, "my friend knows how to deal with man and his God for he keeps faith with his work and himself. I too shall do likewise for it is a good thing to be able to say, 'I sleep well o'nights'."

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So You Want a Radio Position

. . . All too often applicants for a position forget that they are selling a commodity—a very expensive one; namely, labor and—themselves . . . In this highly competitive field there are certain musts, certain rules, which are often overlooked. . . .

By HUGO GERNSBACK

An interesting story with some mighty good tips for the job-seeking man. Reproduced through the courtesy of Mr. Hugo Gernsback, Editor of "Radio Craft" magazine.

A FEW weeks ago, we inserted an advertisement in a local paper to fill a vacancy in our organization. In due time a rather large number of letters was received, through which we plowed with zest.

As we went from letter to letter, we became appalled at the lack of common sense of most applicants, who did not have the most elementary understanding of how to proceed when applying for a more-or-less important position. Eighty percent of the missives immediately went to the waste-paper basket, which we shall identify hereafter with the symbols of WB. Twenty percent of the remaining letters, after a second careful reading, melted down to 3% of all the applications. To these few applicants, letters were dispatched asking the candidates to arrange for an interview.

We are not alone in our contention that most applicants today violate every established rule in looking for a position; other radio officials whom we interviewed speak of it with equal distress. They, too, are appalled at the tremendous waste of energy and time of applicants writing letters, telegrams, postal cards, and other communications when trying to obtain a position.

The greatest violation is found in the careless reading of the prospective employer's advertisement. Many applicants skim heedlessly over the wants ads and answer without seeming to have the remotest idea of what the requirements are all about. The upshot is that when a radio manufacturer recently inserted an advertisement for a radio man who was to prepare technical booklets concerning his products, this is what happened: Over 85% of the answers came from persons who knew nothing whatsoever about technical radio. The majority of the letters referred to scripts for radio broadcast purposes. It would seem that there are literally millions of people, male and female, out to make easy money in writing radio broadcast skits, which have no connection whatsoever with technical writing.

If the applicant had read the advertisement carefully, he or she would never have written a lengthy letter of application, which promptly went into the WB. We shall attempt here to classify what is wrong, and what is correct for applicants seeking radio positions today.

1. *Careless Readers of Want Advertisements* must be placed first on the list. See above.

2. *The Scrawler.* When a man tries to sell a valuable commodity, the presentation should be perfect. In a highly competitive market the better and the more business-like a presentation, the more attention the letter will be given. The scrawler is an individual who takes a piece of scrap paper and scrawls on it a few hieroglyphics, blithely forgetting that no one but he can decipher it. When there are hundreds of letters to be read, no official or employment manager will attempt to decode illegible handwriting. WB for that one.

3. *The Postal Card Applicants.* This is another violation, and while a postal card is small enough to make the message brief, usually not enough information can be given. Furthermore, most postal card writers use handwriting which cannot be read too well either. There may be exceptions to postal card applications, but most employers frown on them.

4. *Lengthy Applications.* When a letter of application is well typed, is clean and paragraphed in such a way that by merely skimming through,

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one can get the highlights of the applicant's past experience, etc., a lengthy three or more page application may be in order. Usually, however, it is best to keep it to a maximum of three pages.

Too lengthy a letter becomes unwieldy and is usually put aside for a second reading, thereby automatically diminishing the chances of a final reading. This may never take place if too many good applicants are being considered.

5. *Writing in General.* If a letter of application is handwritten, the writing clean, and easily legible, perhaps not much fault can be found. (We speak of writing in ink.) It is amazing in these days of progress that in every batch of applications, penciled letters are still to be found. They are in 99 percent of the cases WB material. The busy official prefers a neat, crisp, typewritten letter, preferably on the applicant's own stationery.

That is another point on which we may expand somewhat. If you are looking for a position these days—and by position we mean just that, not a minor job—it will pay you to invest in a letterhead which has your own name neatly printed on top. If you have a telephone, it should be listed too. If you are an ex-serviceman it is an excellent idea to have the discharge emblem with the eagle printed in the upper right-hand corner. This immediately signals to a possible employer that you were in the service without your having to go at length into your military record. It is dignified and flags your letter immediately as that of an ex-serviceman.

Incidentally, the extra dollars that you invest in good printing and good paper, will pay handsome dividends. These are all little but important points to remember. You are selling yourself to a prospective employer who knows nothing about you and who can only judge by one thing, your letter.

Again, many letters, even when they are written on the best bond paper and typed neatly, will be scanned with lifted eyebrows, if the letter contains a number of grammatical or just plain, careless mistakes. If you make an application for a position, the letter MUST be perfect to get real attention. Therefore, re-read it, not once, but three times. If necessary re-type it, or re-write it—this pays dividends too.

6. *Complete Information.* No matter how well a letter is composed, no matter how much thought you gave to its preparation—it will fall flat if you do not give full information about yourself. Every employer, as a matter of routine, wants to know the following:

Your age, whether single or married, your weight, your educational background, and your general experience in the field. Follow this with a list of former employment, and any additional information such as former earnings capacity, etc. It sometimes pays to state what other aptitudes you have. For instance, you might make an application as a technician with an amplifier concern making sound equipment. If by any chance you are a musician, or amateur musician, play the violin, etc., that information is valuable because in sound the prospective employer frequently requires someone who has musical ability or understands music. Similar expressions in other positions might sometimes turn the balance in favor of the candidate who has some aptitude that another might not have.

7. *Processed information.* Many applicants take the easy way in making applications today. They use their visiting card, or write a few words on a small slip of paper and attach it to a processed record of experience, and then mail it to the advertiser. By processed, we mean where the applicant gives a complete list of experience, aptitude, etc., often running anywhere from two to ten pages. If the processing is done neatly and legibly, no fault can be found. But all too often the work is done by hectograph, mimeograph, or otherwise processed in such a manner that it becomes most difficult to read it. Frequently there are illegible fifth or sixth carbon copies on tissue paper. All this is deadly, although many applicants don't realize it.

If the record of the applicant is processed carefully with good workmanship no fault can be found. Indeed, it is a good way to make an application. The best process is multigraphing, or by the Hooven letter method. While the application can be printed, this is more unusual, besides it is expensive and does not serve a purpose. Clean good typewritten copy is still the best method and is preferred by all employers.

8. *High-Pressure Boys.* Very frequently persons with otherwise sound mental equipment think that high-pressuring an advertiser will get the job quicker than anything else. They will send telegrams such as the following, actually received by an advertiser recently.

"Do not look any further, I am the man for the job. Have all the qualifications. Phone or write at once."

In most cases this kind of a high-pressure method will not get the job, simply because not enough information is given. It is also a "blind" application and few employers fall for it. It usually is not even answered.

Other missives in the same category are those that are elaborately prepared in colors and usually mounted on cardboard to get attention. There is nothing wrong with such unusual applications, except that in most of them the applicant does not get down to brass tacks and only

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gives sketchy information about himself. It too goes into the WB.

Other applicants of similar ilk send a letter which arrives by express or parcel post and to which is attached a large scrapbook or other voluminous data setting forth the applicant's performances heretofore. This is not a bad idea because employers are usually impressed by past performance and by actual samples of the candidate's work. But it must again be stressed that such applications fall down if the writer does not give complete information about himself. If such is supplied, the unusual method of presentation, will get many jobs.

9. *The Doughboys.* This class is primarily interested in the money end which is first and uppermost in their mind. When it comes to service and ability, they are not so much interested. Here is a verbatim example:

"If you cannot pay $3,500.00 a year, or over, do not read any further.

"Applicant also would expect a five-day week."

Then follow a few scant lines of vague information about the applicant who no doubt expects quick employment. Whenever an official gets letter of this caliber he appreciates the fact that this type is more interested in cash than in a position. Even an employer who does not have the first rudiments of psychology would probably immediately mark it WB.

10. *The Humorists:* If there is one thing an employer detests, it is a humorous application. Humor has its place and all of us enjoy a good laugh, but when it comes to employment, officials are hardboiled. They do not like facetiousness. Here is an actual letter received only a few days ago. It speaks for itself.

"Twenty-five years of temperate and celibate living have netted me one wife, a three-year-old son, five years of military service (retired a first lieutenant—sound of wind and limb), six months' experience"—

Here the applicant gives a very scant amount of information as to his past work, then goes on:

"As to minor accomplishments, I have lectured brilliantly on subjects about which I knew nothing, written for military radio and sold life insurance to my wealthier friends. Now, one week removed from the comforting arms of our beneficent Uncle, I find myself faced with the unhappy necessity of achieving some manner of regular stipend to keep my wife in mink and my boy's string of polo ponies in blankets."

This man, without question, is a high class applicant, but missed his vocation. He should be a professional humorist or perhaps a columnist.

We could go on in the same vein for many columns, but there is not sufficient space to list all the mistakes made by applicants. A friend of ours, a big official in a large radio plant, has in his office a huge scrapbook on the back of which is printed "Choice Morsels." It is filled with unusual letters of application of all types, funny and otherwise, collected over a space of many years. Some day when he gets old and decrepit, he intends to bring out a book entitled: "How Not to Apply for a Job."

It is hoped that the foregoing has given you some idea what to do and what not to do when seeking a position. Always remember that if you do apply for one, your letter cannot possibly be too good if it is to get maximum attention.

———*n r i*———

F. C. C. Release

In view of the fact that Army surplus walkie-talkies and other radio transmitting equipment are now being offered for sale in some stores over the nation, the Federal Communications Commission warns that the unauthorized use of such transmitters by the general public is illegal and may subject the user to a $10,000 fine or imprisonment or both.

Under the Communications Act no person may operate a radio transmitter without first obtaining a license from the FCC.

No licenses will be issued by the Commission for the walkie talkie and other transmitters to the general public, except in the Amateur Service, until the Citizens Radiocommunication Service, designed to govern such use, is put into effect. This service will not be inaugurated until equipment operating in the Citizens Radiocommunication band, namely 460-470 mc., has reached a satisfactory stage of development, and until the Commission has completed certain technical and legal studies necessary to the formulation of rules and regulations. When this Service is opened to the public, the Commission will make an appropriate public announcement and set forth the conditions under which licenses may be obtained. A simple licensing procedure requiring only a minimum knowledge of the regulations is contemplated.

The Commission also pointed out that none of the Army surplus walkie-talkie equipment which has come to its attention is built to operate in the 460-470 megacycle band allocated for the Citizens Radiocommunication Service.

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NEWS OF THE RADIO WORLD

BY Willard R. Moody

The State of Wisconsin has filed application for the first of two stations in a system of seven which will provide a state wide educational network.

Automatic frequency control may be used in new f.m. receivers to limit the effect of slight mistuning of the receiver. Unless an f.m. receiver is tuned accurately to the frequency of the incoming signal, the audio quality is distorted and there is heavy background noise. Automatic frequency control circuits for a.m. receivers were introduced about 1936.

The General Electric Company has installed an experimental F.M. two way radio system on a bus of the Washington, Virginia and Maryland Coach Company. Using a system of this kind, the driver will be able to report breakdowns, detours, storms, etc., to operating headquarters. Then, immediate aid can be rushed to the scene of disaster. If the tests work out successfully, which seems likely, other buses of the company will be radio equipped.

A recent survey shows the U. S. has approximately 34,000,000 radio families, representing more than 90% of the nation's homes. This huge listening audience makes radio advertising profitable. Today there are four major nation-wide networks and a total of 799 affiliated stations permit efficient distribution of program material. In 1945, the total net time sales of networks and stations were over $310,000,000. In view of the amount of money that has been invested in radio broadcasting and the amount that will be spent in the future, this field offers great opportunities.

Recently the Western Electric Company installed radar on the SS John T. Hutchinson of the Great Lakes fleet. Western Electric has announced that eventually all of the 340 large ships now sailing the Great Lakes probably will be equipped with radar for navigational purposes.

Radio-controlled switches, electronic echo-sounders and recording instruments of many kinds, and television equipment which must operate despite glass, heat and ionizing radiation was used in the Bikini Atoll test to measure the intensity of ocean waves generated by atomic bombs.

An electronic-navigator—a shipboard Radar system for commercial vessels—has been developed by the General Electric Company. This equipment is an outgrowth of war developed apparatus, adapted for civilian and commercial use. The equipment can detect through darkness, fog or storm the position of any above-water obstacles such as light houses, buoys, icebergs, other ships and land, to a distance of 30 miles depending on the size of the object. The device will revolutionize "thick weather" navigation, enabling the mariner to stay on a safe course even though his normal visibility is strongly limited. The equipment is installed in the chart room or pilot house. The electronic navigator develops a Radar map of the area surrounding the ship. The map may be 4, 12 or 60 miles in diameter with the position of the ship itself always at the center. Objects only 200 yards away are shown when the 4-mile map is used. All types of commercial and private boats, yachts, ocean liners, freighters, etc., will eventually find use for such equipment in the future.

Recently, before hundreds of members of the New York Zoological Society gathered at the Waldorf-Astoria in New York City for their fiftieth annual meeting, two electric eels developed voltages which could be seen by means of a special cathode ray oscilloscope and a projecting lens fitted to the scope. The lens permitted projection of the scope pattern on a large screen which was visible to the audience. The electric eels can generate voltages as high as 500 volts and are fully capable of killing a man under certain conditions.

Due to the development of a Television "Eye" by RCA and NBC it is now possible to cover news events by plane, automobile or boat using the revolutionary equipment and to make accurate geographical surveys from planes flown by remote control. This has been, in part, a war time development. Moreover, similar Television equipment may be used in the future to observe hazardous manufacturing processes from a safe distance.

Accurate data on the upper air, in meteorology, can now be obtained by special devices. A balloon sent into the upper atmosphere carries aloft a radio transmitter which sends reports of temperature and humidity. The balloon is tracked with radar to determine its position, providing additional information on wind direction and velocity.

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9,603,000 Families are Considering The Purchase of a Television Set

Survey of consumers made by Sylvania Electric indicates that the majority of these families definitely plan the purchase of a television receiver.

A possible market potential for home television receivers which may reach nearly 10 million sets during the next five or six years providing telecast facilities are made available in all urban areas was revealed by Frank Mansfield, Director of Sales Research for Sylvania Electric Products Inc. He based his report on the answers given by home radio listeners, 28% of which are now located within range of existing television transmitters. "The public," he said, "was asked if it wanted television; what price it thought it would pay for a home receiver; and results it would expect from the set."

"26.6% of the urban families interviewed said they definitely planned to buy a television receiver," he continued, "and 18.5% were considering television but had not definitely made up their minds. In other words, 45.1% or 9,603,000 families are considering the purchase of a home television set. These possible prospects are pretty evenly distributed in different income groups. The only significant drop is in families with normal annual incomes of less than $1,000."

When asked how much they thought they would pay for a television receiver, Mansfield stated that 58.9% said they would pay from $100 to $249 and 31.0% said they would pay from $250 to $500. Only 3.4% said they would pay less than $100 while 5.9% appeared to be willing to pay more than $500. The average price for all families interested in the purchase of a television set was in the $250-$500 range.

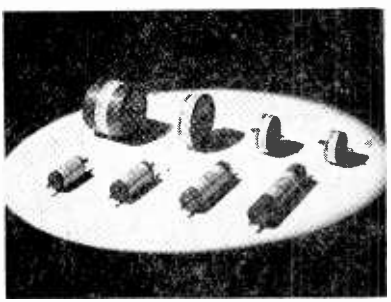
Commenting on what the public expects from a television receiver, Mansfield said that a set designed for four people viewing at one time apparently filled the average need of about 80% of the families. He based this opinion on the finding of the survey which indicated that 78.1% of those interviewed stated that two to four people will want to watch a television show. 12.2% said five persons. Only 1.1% answered one person while 8.6% replied over five persons. The public is evidently anticipating television images larger than 10 x 15 inches and does not realize how screen size affects the cost of a television receiver.

"In spite of the fact that color television exists only in the laboratory state," Mansfield continued, "there appears to be three prospects who want color television to one stating he wants black and white only. Desire for color decreases as income decreases and only one out of five of those who want it say they will pay over $100 extra for it."

In answer to the question: "will television need a new programming structure?" Mansfield said, "There's little evidence that television will supplant movies in the public's mind. People think of television in terms of a new active medium, particularly for sports, spot news and drama by real people. 33.0% of the people said their favorite television program is sports; 20.0% drama by real people; and 19.4%, news. This differs materially from current radio program popularity and obviously from motion pictures."

Only one in six people said they would insist on a home demonstration of television. Of those who said they definitely plan or will buy, the survey indicated market potentials of 773,000 sets in homes with normal annual incomes of $5000 and over; 1,633,000 where normal incomes ranged from $3000 to $5000; 5,069,000 where normal incomes ranged from $1000 to $3000; and 2,128,000 where normal incomes were under $1000.

G. E. Announces New Television Capacitors



A new line of small, light-weight capacitors designed to meet the requirements in size and weight imposed by the compact design of modern television receivers has been announced by the General Electric Company.

Developed especially for use in smoothing out the high-voltage power supply in this and similar applications, these new Lectrofilm units are equipped with prong-type terminals which meet the special mounting requirements of television receiver applications.

Currently available in two designs, a flat cylinder and a tubular construction, these units are rated 0.005 microfarads, 5,000 to 16,000 volts.

Bulletin GEA-4558, available on request to the company at Schenectady, N. Y., contains detailed information on the new capacitors.

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Willard Moody

How to Align Radio Receivers

By WILLARD R. MOODY

NRI Consultant

THE alignment of receivers is an important and necessary job in radio servicing and, for this reason, a knowledge of alignment techniques is essential.

In alignment work, we adjust the trimmers of the receiver according to a definite procedure. This procedure is somewhat different for tuned radio frequency (t.r.f.) sets than it is for superheterodyne receivers (supers). In this article, alignment of both basic types will be discussed.

It is not uncommon to have a set brought in to you for repair which has had the trimmers adjusted by an unskilled person. The result of improper adjustment is a loss of sensitivity and selectivity. In some cases, when a receiver has been badly detuned, it may appear to be "dead."

Of course, such sets are a minority of those requiring service attention and in many cases the receiver will require realignment due to aging of tubes and parts which change the electrical characteristics of the set. Realigning such a receiver, after performing service work such as replacing several tubes or parts, is often regarded as the final touch and attention to the set by a serviceman who does the work of restoring such a set to normal, working condition.

The t.r.f. form of receiver usually has two or more tuned circuits. A typical receiver of this type is shown in Fig. 1. Some older t.r.f. sets using low gain tubes may have three or four r.f. stages. However, the basic principles would remain the same in aligning such sets.

The Emerson BB-208, in Fig. 1, uses a 6D6 r.f. amplifier, 6C6 detector, 25L6 power output tube and 25Z5 rectifier tube. The r.f. tuning condenser is C1 and its shunt trimmer is C4. The detector stage tuning condenser is C2 and its shunt trimmer is C5.

The trimmers are adjusted for maximum output at the high frequency end of the band. This set, the Emerson BB-208, has a tuning range of 540 to 1730 kc. This means that with C1 and C2 at maximum capacity we reach 540 kc. As the dial is adjusted and the set is tuned higher in frequency, less capacity is used. The values of C1 and C2 are varied in step. To compensate for slight differences in capacity between C1 and C2, and different stray capacities across these units, C4 and C5 are used.

It can readily be seen that if C4 and C5 are adjusted at the low frequency end of the band, when C1 and C2 are at maximum capacity, that the change in tuned circuit capacity as trimmers C4 and C5 are adjusted will not be very noticeable. This would make it difficult to observe any change in the output of the receiver during the alignment process. Accordingly, we may make the trimmer adjustments at the high frequency end of the band when C1 and C2 are at minimum capacity. We can judge the sound output by listening to it or by using an output meter. The output meter, however, is used only when we are employing a signal generator for alignment.

The reason for this is simply that the modulation of the generator is constant, a 400 cycle tone, permitting a steady reading on the output meter. The noise and music signals modulating a broadcasting station, to which the set might be tuned, vary from instant to instant, making a constant output meter reading impossible.

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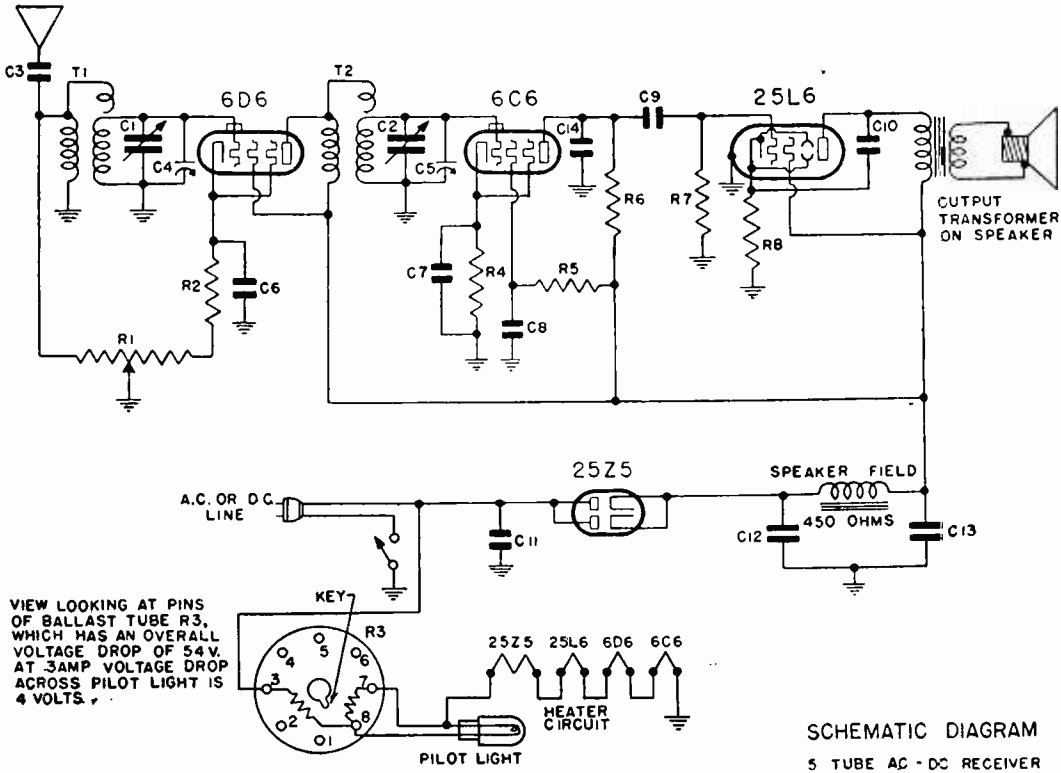

Fig. 1. Emerson Model BB-208

A signal generator is desirable in aligning t.r.f. receivers, but we can use a broadcasting station to align sets without a generator. Both methods will be described.

Aligning TRF Receivers Without A Generator

The receiver shown in Fig. 1 has a range of 540 to 1730 kc. The manufacturer specifies, for this set, a 1400 kc alignment frequency. (Wherever possible, refer to the circuit diagram of the receiver and the manufacturer's service notes.) Therefore, in adjusting the set we should pick a station having a frequency close to 1400 kc. A short antenna should be used on the set to permit getting a sharp response. The r.f. trimmer adjustment is often quite broad while the detector stage trimmer is usually fairly sharp. In adjusting the trimmers, we may use a screwdriver, but this often results in a detuning action. It is better to use a special alignment tool.

The tool may be a screw driver type with a small metal blade fitted into a bakelite rod or other type of insulator material in rod form. The tool may also be one having a hollow center, permitting slipping the end of the rod over a nut on the trimmer. Some trimmers are equipped with slotted head alignment screws while others are fitted with nuts that can be turned and adjusted as required.

With the receiver adjusted to a 1400 kc. station, or one having a frequency close to 1400 kc., adjust C5 for best reception. Then adjust C4. If the 1400 kc. signal is used, the receiver dial is set at 1400 kc. If a 1450 kc. station is used, the receiver dial would be set at 1450 kc. and the trimmers would be adjusted as in the previous example.

One way of identifying the stations is to listen to the program and then refer to a newspaper which will indicate, in the radio section, what is on the air at a given time. This procedure, however, is somewhat slow and inefficient. A better

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method would be to use a calibrated receiver for station identification. If necessary, you could borrow a set from a neighbor, preferably a small table model which is equipped with a loop antenna. The loop would make a special antenna connection unnecessary.

Aligning TRF Receiver Using Signal Generator

The signal generator, in a sense, is a small radio station. However, the r.f. output of this station is controllable at the will of the operator. This means we can get any desired alignment frequency within the tuning range of the generator, and, by adjusting the attenuator knob or output control of the instrument, we can govern the strength of the modulated r.f. signal fed into the receiver.

The steps in the alignment may be stated as follows:

1. After the set has been turned on and allowed to warm up for at least ten or fifteen minutes (and the generator has been warmed up), set the generator and receiver dial at the correct alignment frequency—in this example 1400 kc.

2. Set the receiver volume control at maximum.

3. Adjust the output control of the generator until the signal can be heard, with the generator cable connected to the receiver input circuit. The connections are shown in Fig. 2. In many cases, a direct connection of the generator cable to the set is permissible but to limit any possibility of excessive current flow, blocking condensers C1 and C2 as shown in Fig. 2, may be used.

4. Adjust the trimmers for maximum output as indicated by listening to the radio. As the output is raised, reduce the generator output. This can be done by using your left hand to adjust the generator output control and your right to hold the alignment tool and make alignment adjustments.

The development of skill in alignment will come with practice. Only a few minutes time is required to align such a receiver as this one, when an expert, experienced serviceman does the job. A beginner may require more time at first but he will soon "catch-on" to the relatively simple job of aligning a t.r.f. receiver. The alignment of superheterodynes is somewhat more difficult and here, again, experience and practice, gained gradually, will enable you to learn and master the alignment technique required. You must, however, as a first step learn the fundamentals of such alignment work.

Aligning Supers

The alignment of superheterodynes involves the use of a signal generator and an alignment technique that is somewhat more complicated than t.r.f. work, but can be done in a straightforward manner. A typical superheterodyne receiver is shown in Fig. 3. This receiver uses 5 tubes and is designed for operation on an a.c. line.

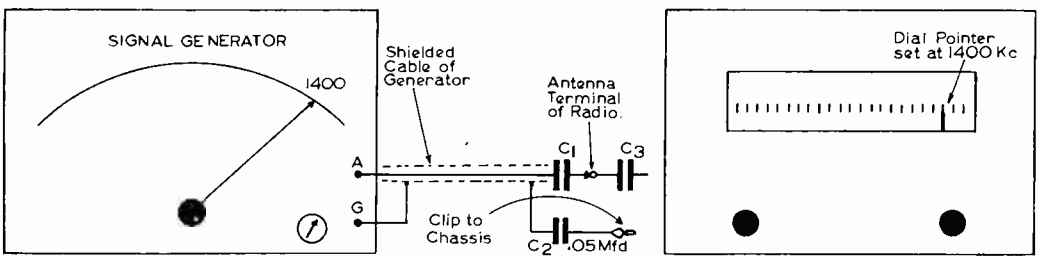

Fig. 2. Signal Generator Connections (RF section alignment)

A 6A7 is used as a mixer, 78 i.f. amplifier, 75 second detector and first audio, 41 power output tube and 84 full-wave rectifier.

The intermediate frequency of the receiver is 470 kilocycles and the tuning range is 540 to 1720 kilocycles. In order to adjust the receiver correctly, the dial must be aligned to track properly with the tuning condenser. To adjust the dial, proceed as follows:

1. Turn the tuning condenser to maximum capacity position (plates fully meshed).

2. Holding the tuning condenser to this position, turn the pointer until it is 1/16th of an inch below the three lines of the scale at the 550 kilocycle end. Refer to Fig. 4. This is the correct

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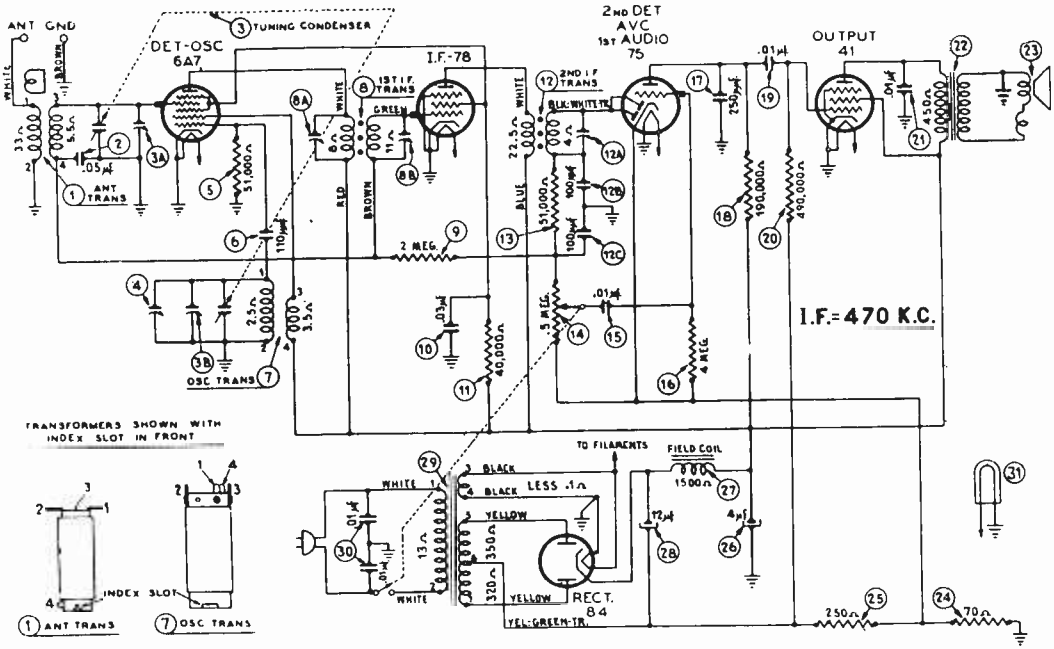

Fig. 3. Philco Model 38-12

position of the dial pointer at maximum capacity. The mechanical adjustment of the dial pointer should be made first. Then, the receiver alignment adjustments may be made.

The procedure is to align the i.f. circuits, then the oscillator and r.f. circuit.

I.F. Alignment

Familiarize yourself with the general layout of the tubes on the chassis and the location of the various trimmers. The drawing in Fig. 5 gives this information for the Philco 38-12. Set the generator dial at the i.f. value of 470 kc. Have the receiver dial set at 550 kc. and short out the receiver's oscillator tuning condenser which would lead to incorrect alignment adjustments.

The generator may now be connected to the 6A7 top cap through a .05 mfd. condenser and the shielded side of the cable may be connected directly to the chassis since this is an a.c. set. The use of a blocking condenser in the ground cir-

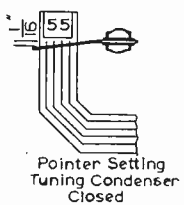

Fig. 4

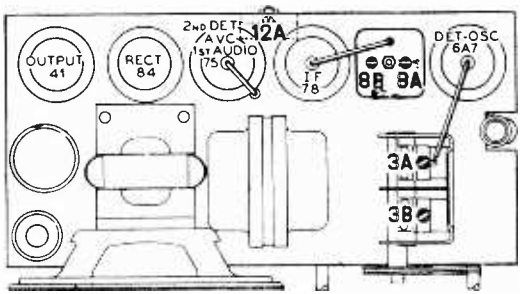

Fig. 5. Philco Model 38-12
(Tube and Trimmer Locations)

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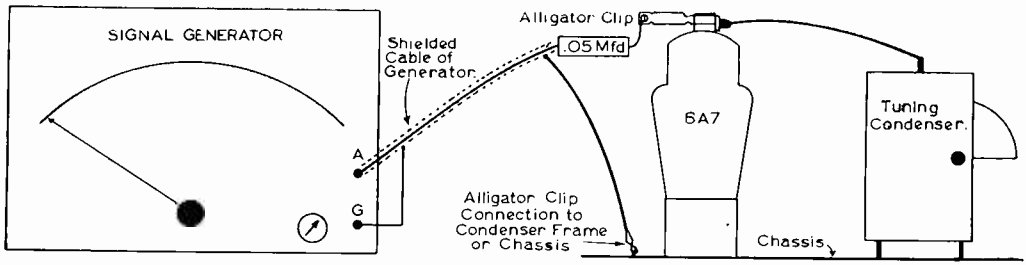

Fig. 6. Signal Generator Connections (Oscillator alignment)

cuit is not necessary since the radio is isolated from the a.c. power line by the power transformer. The generator connections are shown in Fig. 6.

The end of the cable is clipped to the 6A7 top cap, using the series condenser, as shown in the drawing, and the ground connection is made to the chassis. The oscillator tuning condenser of the receiver may be shorted. This will prevent beat notes and whistles due to the local oscillator of the receiver beating with the incoming signal supplied by the signal generator. A simple means of shorting the oscillator is to attach a wire across the oscillator tuning condenser. The wire may be fitted with two alligator or battery clips at each end of the wire. The wire may be about 6 inches in length.

The receiver volume control is set at maximum at all times during the alignment work. This is necessary to obtain maximum gain and to avoid automatic volume control action. A ground connection is made to the ground post of the set, the chassis, at a convenient point, or to the tuning condenser frame. (For the shorting wire.)

At first, the generator output control may be adjusted for maximum output, to force a signal through the mixer and i.f. amplifier. Then, a preliminary adjustment of one of the i.f. trimmers may be made to increase the receiver gain. When this is done, the output of the signal generator is reduced by means of the attenuator knob on the generator panel.

As the adjustments are made, it will be convenient to use your left hand for adjusting the r.f. output of the generator and your right hand to hold the alignment tool and to make alignment adjustments.

Usually, manufacturers specify in their alignment notes that the trimmers are to be adjusted in order as you work back from the second detector towards the generator. Thus, in this example, in Fig. 3 the adjustments would be those of 12A, 8B and 8A in the order named.

As the gain is brought up by resonating the various trimmers, back off on the output control of the generator to maintain a continuously weak input signal to the receiver. This will aid in getting sharp response and proper alignment. Also, it will enable you to judge slight differences in sound intensity at the loudspeaker.

This is important since it is possible to detect more readily slight differences in volume levels when the sound output is relatively low. If a high sound intensity is used at the loudspeaker, it will be difficult to detect slight changes in the sound level during the alignment process.

Many persons find it difficult to judge differences in sound intensity and prefer, for accurate alignment work, to use an electrical output indicator, commonly referred to in the trade as an Output Meter. Shortly, in this article, we shall discuss output meters.

Oscillator Adjustment

Following the adjustment of the i.f. amplifier trimmer condensers, the receiver oscillator circuit may be adjusted. This is the next step in the alignment process rather than an adjustment of the r.f. tuned circuit since it is necessary to tune in the signal first. The generator connection is shifted from the 6A7 top cap to the antenna terminal of the set and the ground connection is made to the ground post of the set, or the ground lead may be attached to a convenient point on the chassis.

The short circuit wire across the oscillator tuning condenser of the receiver, of course, is removed. Then, 3B is adjusted to tune in the 1500 kc. signal supplied by the signal generator. The receiver and generator dials are set at 1500 kc. and the r.f. output control of the generator may be set at maximum at first, reduced as the volume rises. To facilitate matters, the generator may be set close to 1500 kc. at first, then tuned slowly above and below 1500 kc. until the signal is tuned in on the receiver. To make certain the correct frequency is picked up, the receiver trimmer

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may be screwed down to full capacity. The signal is then tuned in by adjusting the general dial.

The generator might be set, then, at 1300 kc. Obviously, the adjustment required is one which will permit tuning to a higher frequency, to 1500 kc.

With the left hand adjusting the generator dial and frequency, and the right hand the trimmer capacity and receiver oscillator tuning, we can keep the generator and oscillator in step as we go higher in frequency. For example, by decreasing the trimmer capacity a slight amount and going to 1310 kc. we can reset the generator to 1310; then, adjust the trimmer again, to go slightly higher. In this way, we can reach 1500 kc. in a number of short steps and not "lose the signal."

Some servicemen merely set the generator at the specified alignment frequency and then adjust the oscillator trimmer back and forth quickly until the characteristic tone signal of the generator is heard.

When the oscillator has been aligned, the r.f. stage may next be tuned to resonance. This is done, for the Philco 38-12, by adjusting trimmer 3A in Fig. 3.

It should be noted, in passing, that this particular receiver does not use a condenser across the primary of i.f. transformer 12. This primary is not tuned. Many sets, however, do use such a trimmer across the primary of the second i.f. transformer and in such cases it is adjusted for maximum output.

Output Meters

In our alignment work, as we have indicated, we may listen to the output of the set to judge the relative intensity of the signal. But under certain conditions it may be very difficult to judge the output by ear. For example, in a service shop or factory there may be considerable noise which will make hearing the signal difficult, and in some service shops two or more men may be working on different receivers at the same time, making hearing conditions difficult for alignment work.

In view of this, output meters are often used. There is the further fact that many people prefer a visual indication of change, rather than being dependent on hearing.

The output meter usually takes the form of a simple copper-oxide rectifier type a.c. voltmeter but an a.c. vacuum tube voltmeter could be used, if desired.

The output meter may be connected across the voice coil of the loudspeaker to indicate the signal level, or between an output tube plate and B- -. The plate circuit connection is preferred since the output meter will then be fed a greater amount of signal voltage. Thus, easier alignment will be possible, as you will find by actually setting up the equipment and using it.

The plate circuit meter connection for the output meter is shown in Fig. 7. Condenser C may be a .25 or .1 mfd. unit. Although many output meters have a blocking condenser built into the circuit, to keep d.c. out and pass a.c. to the meter

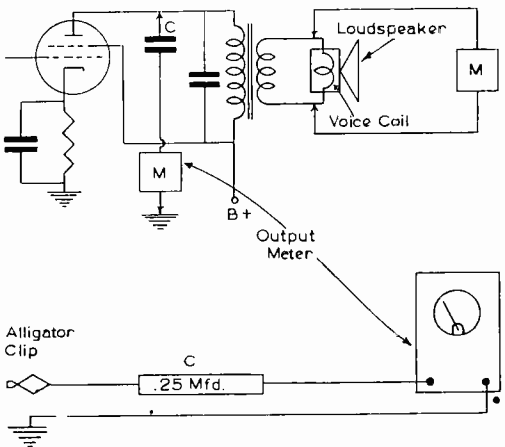

Fig. 7. Output Meter Connected in Plate Circuit

(the signal is a.c.) it is nevertheless desirable to use a series condenser as shown in the sketch. This will prevent shorting the plate circuit of the tube and getting a shock if the plate lead is touched. The condenser may be fitted with a small alligator clip as shown in the lower part of the drawing. In a.c. receivers where the d.c. plate voltage on the output tube plate may be 250 volts or higher, the blocking condenser is desirable as a protection.

When the vacuum tube voltmeter is used, it merely replaces the output meter shown in the sketch. Using the voice coil connection, no blocking condenser is necessary since there is only a.c. in the circuit.

In either case, the alignment adjustment is for maximum output as indicated by maximum swing of the meter pointer. The signal voltage in the plate circuit may be as high as 50 volts under certain conditions, so start with a high range first and then, if an adequate deflection is not obtained, go to a lower range. Usually, 5 to 30 volts will be encountered. Further, the higher the effective resistance of the a.c. voltmeter used as an output meter, the greater will be the indi-

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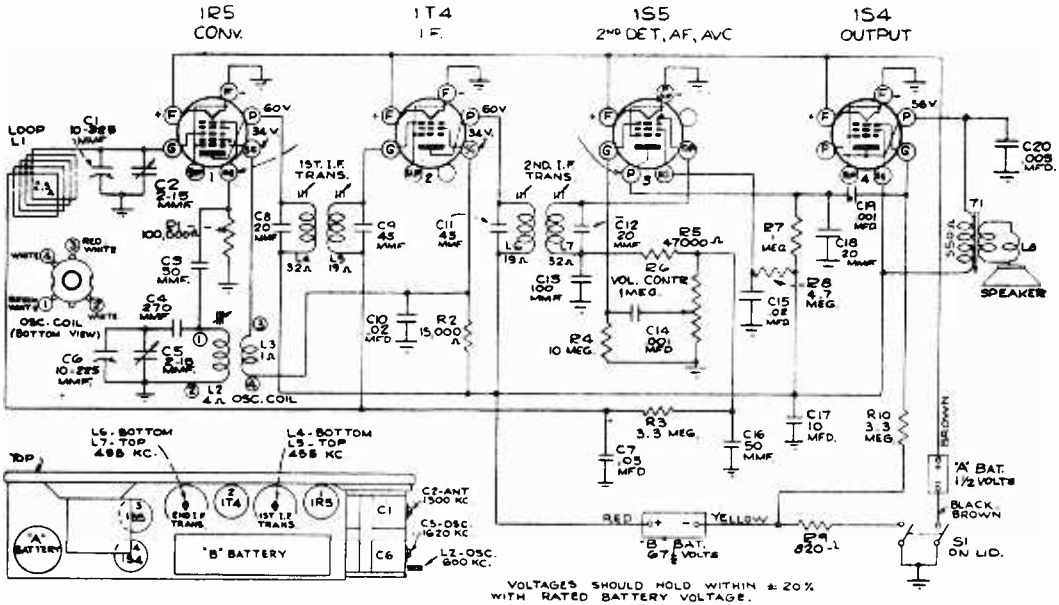

Fig. 8. RCA Model BP-10

cated voltage. A vacuum tube voltmeter puts relatively little load on the output plate, a 1,000 ohm per volt instrument introduces some loading and therefore a lower voltage will be indicated.

In the voice coil circuit, voltages of ¼ to 5 volts may be observed, so that a low range a.c. voltmeter must be used in this circuit position.

We have considered standard alignment techniques. Now, we can turn our attention to a few special cases.

Loop Antennas

A typical receiver circuit using a loop antenna is shown in Fig. 8. The loop is marked L1 and is connected to the 1R5 mixer tube. The step-by-step alignment procedure of the manufacturer is shown in Fig. 9.

This receiver has some unusual features but in general is of standard design. Let's take the alignment steps in order. Step 1 shows the generator is to be connected to the stator of the receiver tuning condenser through a .01 mfd. unit. The manufacturer advises putting the receiver dial at 1600 kc., near the high frequency end, to prevent the oscillator action from interfering with i.f. alignment. If desired, however, this instruction may be disregarded and the tuning condenser can be set at 550 kc. Then, the receiver's oscillator is stopped by shorting out C6.

Steps	Connect the high side of test-osc. to—	Tune test-osc. to—	Turn radio dial to—	Adjust the following for max. peak output—
1	Tuning condenser stator (ant.) in series with .01 mfd.	455 kc	Quiet point at 1,600 kc end of dial	L7, L6, L5, L4 (2nd and 1st I-F transformers)
2	Radiated signal 1,620 kc	1,620 kc	Full clockwise (out of mesh)	C5 (oscillator)
3	Radiated signal 1,300 kc	1,300 kc	1,300 kc	C2 (antenna)
4	Radiated signal 600 kc	600 kc	600 kc	L2 (osc.)
5	Repeat steps 2, 3 and 4.			

Fig. 9. RCA Model BP-10, Alignment Procedure

Some leeway is permissible in following the alignment instructions. Instead of trimmers, the i.f. transformers are tuned by means of adjustable inductances. These inductances are L7, L6; L5 and L4. The condensers used in the i.f. transformers are fixed types.

L7, L6, L5 and L4 are adjusted for maximum output at the i.f. value of 455 kc. The next step after i.f. alignment is the adjustment of the oscillator circuit of the receiver. The receiver dial is set at the extreme high frequency end, with the tuning condenser plates all of the way out. A test signal of 1620 kilocycles is used. C5 is adjusted to

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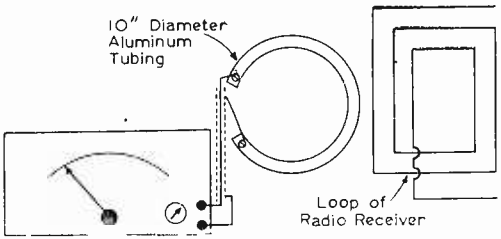

Fig. 10. Special Radiating Loop

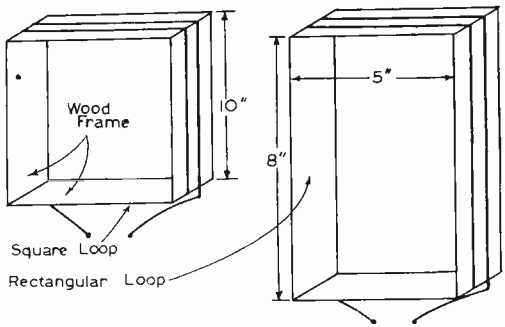

Fig. 11

tune in the signal. The generator is not connected directly to the receiver but a "radiated" signal is used. This radiation may be accomplished by simply putting a 3 ft. piece of wire near the loop antenna of the set, connecting one end of the wire to the "hot" terminal of the signal generator cable. The ground of the generator is connected to the receiver chassis.

The use of a special radiating loop for this type of work is also possible. The loop arrangement is shown in Fig. 10.

The loop may be purchased commercially and is mounted on a convenient floor height stand or on a bench type stand. The signal is then radiated from the test loop into the receiver loop without a direct connection.

If desired, a loop could be made up, using ordinary #18 bell wire employed three or four turns on a 10 inch diameter form. If such a large form is not available, a square or rectangular loop as shown in Fig. 11 may be used.

In some cases, the loop antenna used for signal injection may be eliminated. Referring to Fig. 12.

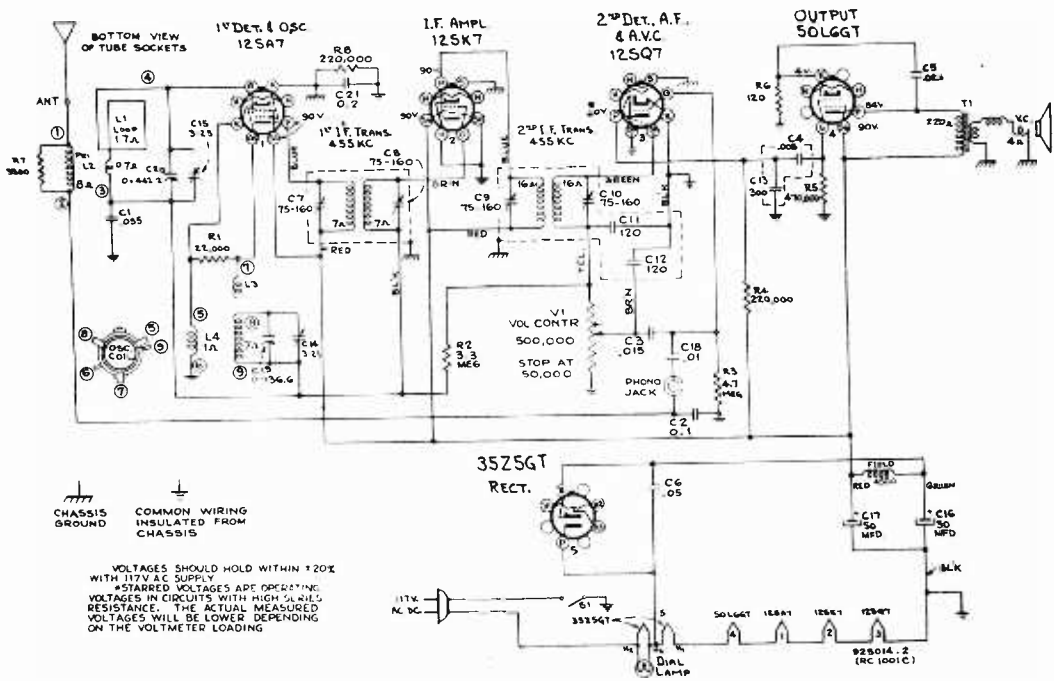

Fig. 12. Westinghouse Model WR-12X3

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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	I-F grid, in series with .01 mfd.	455 kc	Quiet point 1,600 kc end of dial	C10, C9 2nd I-F Transformer
2	1st Det. grid in series with .01 mfd.			C8, C7 1st I-F Transformer
3	Ant. terminal in series with 100 mmfd.	1,720 kc	Gang at minimum	C14 (osc.)
4	Radiated signal 1,300 kc		Signal frequency	C15 (ant.)
5	Repeat steps 3 and 4.			

Fig. 13. Westinghouse Model WR-12X3, Alignment Procedure

a Westinghouse WR-12X3 is shown. The i.f. transformers would be tuned in the usual way, as described previously for the other sets. The manufacturer recommends radiation of the signal into the loop of the set. However, by using loose coupling to the antenna terminal of the set a direct connection can be made.

The generator's hot lead may be connected through a .0001 or .0005 mfd. condenser to the receiver's antenna terminal. The generator ground may be connected through a .05 mfd. condenser to the chassis of the receiver. Then, Step 4 of the alignment procedure, in Fig. 13, may be carried out.

Regenerative Supers

Some midget superheterodynes use regenerative second detectors to make up the loss of gain and selectivity occasioned by the omission of a conventional i.f. amplifier stage. Such a receiver is shown in Fig. 14, the Philco 84. This receiver uses a 77 detector-oscillator, 77 second detector, 42 power detector, 42 power output tube and 80 rectifier.

In aligning the receiver, first tune up the i.f. transformer which is marked 14 on the circuit diagram. Set the receiver dial at 550 kc. and the generator dial at the intermediate frequency of the set which is 460 kc.

The regeneration condenser, 17, should be set at minimum capacity. I.F. trimmers 11 and 15 are now adjusted for maximum output. The tuning condenser may be set at full mesh (dial at 550) when the i.f. signal is fed into the 77 det.-osc. grid circuit. A connection may be made to the top cap of this tube.

Following the adjustment of i.f. trimmers 11 and 15, adjust the receiver's regeneration control, 17. Screw the trimmer clockwise to increase capacity

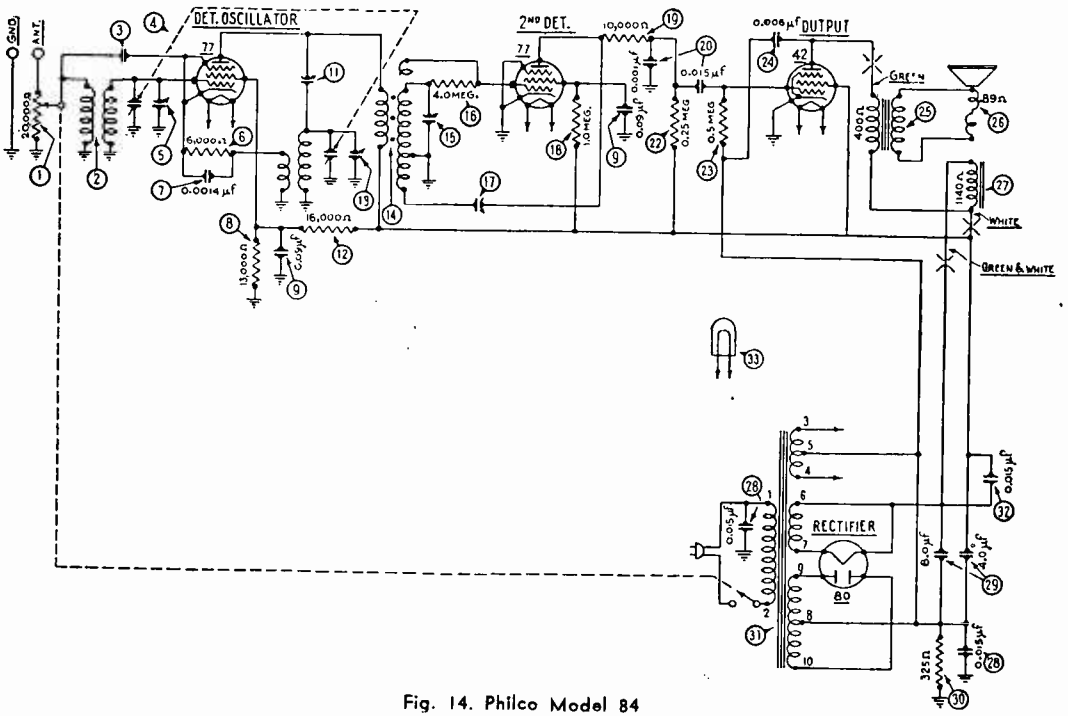

Fig. 14. Philco Model 84

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until the feedback is sufficient to cause a squealing or oscillation sound. Then, rotate the trimmers counter-clockwise about ¼ turn so that the set is on the threshold of oscillation. This will be the point of maximum sensitivity and selectivity.

Upon completion of the i.f. transformer adjustments, align the r.f. and oscillator circuits. First, adjust 13 to tune in the signal. Have the receiver and oscillator dials set for 1400 kc. Next, adjust 5 for maximum output. When 13 and 5 are adjusted, the "hot" generator connection, is to the antenna terminal and the generator ground connection goes to the ground terminal of the radio.

This completes the discussion on alignment. While signal generators are essential and alignment is important, you should bear in mind, before alignment is attempted, the necessity of giving the receiver a preliminary test with a volt-ohmmeter to check suspected parts or circuits.

Also, as a general rule in servicing any set it is desirable that you have the tubes carefully tested in a tube tester as the first step in servicing the radio. Bearing these points in mind, developed through experience, you should find your work is made easier and more efficient.

———————*n r i*———————

Our Cover Photograph

This interesting picture, made by Larry Colwell of New York, was supplied to us through the courtesy of Television Station WABD, which is operated by Allen B. DuMont Labs., Inc. It shows an announcer, who is conducting an advertising program featuring a shaving product. An attractive girl dresses up the picture.

DuMont has found in experimental tests that the advertising possibilities of Television are great. The future of Television looks promising indeed.

———————*n r i*———————

Studying Hints

To get the most from your lessons, you must study. But how you study is more important than the mere fact that you do study. First, learn to concentrate. When you are studying your lessons, put everything that you have into it—free your mind of all things except the lesson material. Be alert and alive to the meaning of each and every word. Learning is easier when you have an interest in the subject and since radio itself is very interesting, learning its technical principles seems more like fun than work. But never forget that what you are learning will mean value to you in real dollars and cents. Your studies have a purpose; you are not wasting your time in studying—continue it to your benefit!

New Midget Size Selenium Rectifier

A midget size Selenium Rectifier, which can be put to a variety of uses heretofore not considered as applicable for rectifiers of the metal plate type has been developed by the Federal Telephone and Radio Corporation, Newark, N. J., manufacturing associate of the International Telephone and Telegraph Corporation.

Manufacturers of electrical equipment who incorporate the midget rectifier into the design of their product will find that its small size, durability and cooler operation will make possible a more compact, less fragile, and more efficient unit.

Federal's Selenium Rectifier can replace as many as 29 different rectifier-type tubes now used in various radio receivers. By installing the rectifier in pairs as voltage doublers, with condenser values up to 40 MFD, the use of a transformer, rectifier tubes and sockets is eliminated.

It offers greater efficiency to vibrator power supplies using rectifier circuits of the half wave and full wave type, and in highly specialized equipment where long life of the vibrator is essential. Because the midget rectifier becomes operative practically instantaneously, the efficiency of an intercommunication box is greatly enhanced by using the Federal Selenium Rectifier power supply.

The broad use to which the midget rectifier can be put is even more startlingly revealed by its ability to charge a 2-volt battery in a battery portable set and to charge deformed electrolytic condensers.

Known as type 4031D-2625, the rectifier consists of five square selenium plates made on aluminum base plates, connected in series, with Center Contact, and measures only 1¼" x 1¼" x 11/16". Its small size makes it possible to install the unit in spaces where the ordinary tube will not fit. Because only two soldering operations are necessary and a minimum of mounting hardware is needed, installation is made quickly and assembly work is substantially reduced.

Life of the Selenium Rectifier is many times that of the tubes it replaces. The unit has a rated current carrying capacity of 100 milliamperes DC and a peak inverse voltage of 330 volts. The amount of heat dissipated by the rectifier stack is only a fraction of that normally generated. *Radio receivers using Federal's rectifier become operative practically instantaneously; no warm-up period is necessary.*

The same rigid pattern of advanced engineering and precision manufacturing methods that is inherent in all Federal rectifiers has gone into the development of the square stack Selenium Rectifier.

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N.R.I. ALUMNI NEWS

Harry R. Stephens ..... President
Ernest W. Gosnell ..... Vice-Pres.
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Harry Andresen ..... Vice-Pres.
F. Earl Oliver ..... Vice-Pres.
Earl Merryman ..... Secretary
Louis L. Menne ..... Executive Secretary

IT IS HIGH TIME TO RESCUE CUSTOMER GOOD WILL

DO you remember the days before the war when customers had to be attracted to a business establishment through advertising, good display, and, above all else, customer appreciation? The days when the clerk stepped up to you and said, "May I help you, please?" Of course you remember, because it is only during the past five years that business men threw all Good Will principles to the wind. In most cases this was due to inefficient and indifferent help. It was also due to shortage of supplies and tremendous demand. Anything went —and still does, in all too many stores.

When customers fight one another to get a bit of this and a bit of that, what difference does it make whether the clerk smiles or scowls? Even the owner of the place walks around like a "big shot," stern of face, overly independent, just because he sees, day in and day out, people almost pleading with him for scarce items. He feels important. He just leans back of the counter and says "Haven't got it!" "Can't get it!" "When you find out who has got them let me know." Wise-cracks! Abuse! The customer takes them all.

But this condition will change. There is still a scarcity of many of the things we all need. And too many business men are still curtly saying "No" and turning their backs. On the other hand, the business man, who has an eye on the future—not just today—is saying "No" with a smile—"Sorry, I'm out, but I'll try to get it." "Will keep you in mind." "Will be glad to have you drop in again." "I appreciate your business and am sorry I can't do something for you now."

Customer Good Will has been dragged through the gutter. It is high time to rescue it. Now is the time to get the jump on your competitor. It is just as easy to be polite as indifferent, and politeness pays off in good customer relations.

Begin today—right now—to smile when you talk to your customer —to say "Thank you," no matter how small the sale. Build Good Will. It is your greatest asset.

L. L. MENNE, *Executive Secretary*

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Detroit Chapter

At each meeting we set aside a portion of our time for a discussion of the lessons of the NRI Course. Our members lead us in these discussions. Mr. Fitzgerald, Mr. Oliver, Mr. Rich, Mr. Jeris, and Mr. Patterson have given some fine reports.

At one of our meetings Chairman Quinn conducted a quiz program after the fashion of the New York Chapter. Two teams, one headed by Earl Oliver and the other by Harry Stephens participated. The contest ended in a tie, thus saving the Chapter the cost of a prize for the winning team. (chiselers)

Our old favorite, Mr. Henry Rissi, took over one of our meetings. He asked questions and then proceeded to answer them, always allowing those present to volunteer any information if they felt inclined to do so. This was a very interesting and instructive program.

Among those who have joined our Chapter recently are, Charles Shutock, 2073 Grant St.; Clarence Wright, 22049 Willmarth; E. C. Baumgarth, 12341 Wilfred; S. S. Grajek, 884 Connor's Ave.; Ernest Domenico, 4400 Beniteau; Thomas Patterson, 18927 Westmoreland; Floyd Buehler, 665 W. Warren Ave.; Wilfred Rice, 4137 Holcomb; Constantine Kravez, 5983 Marseilles; A. S. Ciesla, 1197 McKinstry Ave. Some of these men have re-joined the chapter after returning from military service.

We closed our season with our annual dinner party which was attended by the following: Mr. and Mrs. Harry Stephens, Mr. John Stanish, Mr. and Mrs. Thos. Patterson, Mr. and Mrs. F. Earl Oliver, Mr. and Mrs. Geo. Patz, Mr. and Mrs. Clifton Bakewell, Mr. and Mrs. Larry Upham, Mr. and Mrs. Bernard Hiller, Mr. and Mrs. Ray Fouke, Mr. and Mrs. Harold Chase, Mr. Val Guyton, Mr. and Mrs. J. A. Quinn, Mr. and Mrs. Charles Mills, Mr. and Mrs. George Novak and Mr. Charles Shutock. Our guests of the evening were Mr. and Mrs. Henry Rissi, Mr. and Mrs. W. L. Wayman, and our own Executive Secretary of NRI Alumni Association, Mr. Lou Menne. Mr. Menne made a very appropriate talk which was enjoyed by all—a lot of wit and humor which certainly helped to make our party a success.

Very attractive and valuable door prizes were awarded. A beautiful table lamp jointly donated by Detroit Chapter and our Vice Chairman Bernard Hiller, was won by Mrs. Henry Rissi. Two other prizes were donated, one by Radio Supply and Engineering Co.—a voltmeter which was won by Thomas Patterson. The other, donated by Radio Specialties Co., a pick-up arm, was won by none other than Chairman Quinn. (To allay any suspicions, it should be stated here that Jim Quinn did not draw his own ticket.)

Following is a schedule for meetings for the 1946-1947 season:

Sept. 20—Picture—The Magic of Fluorescence.
Oct. 4—Picture—The Story of FM—Curves of Color.
Oct. 18—Speaker—Floyd Buehler.
Nov. 1—Pictures—Sightseeing at home—Principles of Electricity.
Nov. 15—Speaker—Henry Rissi.
Dec. 6—Picture—Exploring with X-Rays.
Dec. 20—No Meeting.
Jan. 3—No Meeting.
Jan. 17—Picture—The World's Largest Electrical Workshop.
Feb. 7—Speaker—Ted Steinmetz.
Feb. 21—Pictures—Life of Thos. Edison—Excursions in Science #1 and #2.
March 7—Pictures—Excursions in Science #3, 4, and 5.
March 21—Speaker—Henry Rissi.
April 4—Pictures—Excursions in Science #6, 7, and 8.
April 18—Pictures—West Lynn.
May 2—Speaker—Dick Hendricks.
May 16—Picture—When You Can Measure.
June 6—Speaker—Robert Mains.
June 18—Annual Dinner Party (Wednesday).

No meetings are scheduled for the month of August. Our next regular meeting will be September 20.

VAL GUYTON, *Secretary*

Phila-Camden Chapter

We have had some wonderful meetings recently. John Biaselli, one of our Marine veterans now back with us, gave a demonstration, showing the cause and effects of different defects in the loud speaker. He made good use of our RCA Demonstrator. Mr. Biaselli also answered all questions put to him. He does an excellent job as a leader of a Radio discussion.

Chairman Ed Rood brought in his RCA "scope" and Signal Generator and with the aid of our new Voltomyst gave us a splendid picture of just what takes place in a Radio circuit. There was only one criticism at this meeting—our time was too short.

At another one of our meetings we spent most of our time doing actual Radio work. We repaired six sets, presenting interesting problems.

At still another meeting John Biaselli again presided and the topic was centered around the failure of sets to operate on low frequencies while they seem to operate O.K. on the higher frequencies.

New members to join the Chapter are: Robert Oliver, 2228 Cumberland; J. G. Evans, 1853 N.

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Lambert; Daniel Pressede, 817 Penn St., Bryn Mawr; Owen Markey, 3627 Calumet St.; Fred H. Grant, 18 W. Chester Pike, Lenarch; Milton DeVac, 39 Wistar St.; Sumach Simpson, 706 Pennypack Circle, Hatboro; Elmer Miller, 440 Heaton Rd., Hatboro; Joseph Rooney, 6214 Erdrick St.; H. C. Schonewolf, 2112 N. Melvin St.; Roy Rebbie, 620 E. Allegheny Ave.; Christopher Doukas, 3023 N. Frankford Ave.; Paul Moyer, 20 Wood St., Landsdalle; John L. Jackson, 706 E. Alden St.

Meetings are held on the first and third Thursday of each month at 8:15 P.M. at 4706 Comly St. in the Post Office building in Philadelphia. All NRI men in this locality are urged to attend these meetings. You are assured a cordial greeting.

F. Armstrong, Secretary.

Baltimore Chapter

Like Old Man River, this Chapter just runs along smoothly, without fuss or feathers, but we do have some bang-up meetings.

Chairman Rathbun is taking an extended vacation, motoring to the West Coast. During his absence the chair is being occupied by Vice Chairman Larry Arthur, who is doing his usual swell job.

Most of our time is given to actual Radio work under the leadership of our Chairman, but the program is varied quite frequently, with a talk by our Chairman or some one of our members. One of the most interesting of these talks was on AVC control.

At another meeting Chairman Rathbun discussed the use of a "Condenser Analyser." Still another subject discussed by our Chairman was "Automobile Radios and their Troubles."

We also have a number of outside speakers on schedule.

Those who live in this area should attend these meetings. They are sure to derive much benefit.

We meet on the second and fourth Tuesday of each month at Redman's Hall, 745 West Baltimore St., at 8:15 P.M.

P. E. Marsh, Secretary.

New York Chapter

Our Executive Secretary Lou Menne paid us a surprise visit which all the boys enjoyed. The visit was a good morale builder.

The quiz program conducted by Alex Remer continues to prove very popular and we understand other chapters have taken the idea from us. We are very glad to supply these chapters with the questions. Mr. Remer says that he has received some very constructive suggestions from some of our members which will help him iron out the wrinkles in this new feature. Mr. Remer deserves a lot of credit for his hard work in the interest of our Chapter.

The following discussions were part of our recent programs — James Newbeck, "Cathode Ray Tubes," Philip Spampinato, "Receiver Design" and "Army Radar," Eugene L. Williams, "Alignment." Morris Friedman also spoke to us on his Radio experiences, and at all meetings, of course, Pete Peterson takes over with the "Questions and Answers."

Chairman Bert Wappler spoke to our Chapter about purchasing a RCA Demonstrator Board. After thoroughly considering the matter, the members decided to purchase such a demonstrator. Our members therefore, now have the advantages and benefits of this excellent additional equipment.

Those who joined our Chapter recently are Mayer Steihurst, Charles Aliberto, Damiano Brucato, Henry Blatt, Edward Karpf, Raymond Hackel, Leon Rosenfeld, John Harrison, Vincent Nobile, Joseph Kujawski, Peter Sales, R. B. Macready, Theodore Durante, Joseph Fromer, Vincent Echevarria, Michael V. LaRossa, John Krebs, George Gannon, Theodore Piotrowski.

Our Chapters meetings are held on the first and third Thursday of each month at 8:30 P.M., at St. Mark's Community Center, St. Mark's Place, between 2nd and 3rd Aves., New York City.

Louis J. Kunert, Secretary.

"I understand, sir, that you are seeking an aggressive type salesmen!"

Chicago Chapter

We held this issue right up to the last minute awaiting the usual complete report from Chicago Chapter but it did not reach us. That may mean big news is in the making. No doubt a long newsy report from Chairman Andresen and Secretary Coltun will reach us shortly. We are looking for word about that annual picnic.

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Annual Dinner Party of Detroit Chapter

On June 19 Detroit Chapter held its annual dinner party for wives and members. The party took place at Huck's Redford Inn. After dinner the group posed for the above picture. Reading from left to right (front row) Clifton Bakewell, Larry Upham, Secretary Val Guyton, Thomas Paterson, George Novak, Henry Rissi, Charles Shutock. (second row) Ray Fouke, Charles Mills, Mrs. Clifton Bakewell, National Vice President F. Earl Oliver, Mrs. Harry Stephens, National President Harry Stephens, Chairman James A. Quinn, Executive Secretary L. L. Menne, Mrs. F. Earl Oliver, Vice Chairman Bernard Hiller, Mrs. Charles Mills, Harold Chase. (third row) Mrs. Henry Rissi, Mrs. Bernard Hiller, Mrs. George Patz, Mrs. Ray Fouke, W. L. Wayman, George Patz, John Standish, Mrs. James A. Quinn, Mrs. Larry Upham, Mrs. Harold Chase, Mrs. Thomas Paterson, Mrs. W. L. Wayman.

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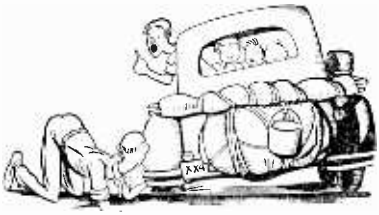
Here And There Among Alumni Members



H. J. Rathbun, Chairman of Baltimore Chapter, took a well earned vacation visiting Denver, Yellowstone National Park, Brices Cavern, San Francisco and many other interesting places. Traveled by automobile.

———n r i———

Charles Jackowski of Chicago has a mighty fine store and shop alongside the largest motion picture theater in his community. We very much appreciate a fine photo of Mr. Jackowski at work at his bench. That man is really making strides in the Radio Servicing business.

———n r i———

Sebastian Hauser of Winnipeg, Man., Canada, is now operating his own Radio business and, from all reports, is doing very nicely. He sent us a nice photograph.

———n r i———

R. C. Gregg of Indianapolis, Indiana, has a full time business in which he is doing from $300 to $350 a week. Has two men working for him now —one a veteran, who is an NRI student.

———n r i———

Gerald A. Miller, Newington, Conn., operates under the name Sound Equipment Service Company. Jerry owns the company outright. Has twelve industrial accounts which they maintain 24 hours a day. Has five men all of whom are kept busy because, in addition to the above mentioned concerns, Jerry also has several other important contacts for sound equipment and service.

———n r i———

Pete Peterson, that stick of dynamite in New York Chapter, is another NRI graduate who deserves a lot of credit. He started with nothing but plenty of ambition and determination. Right after graduating Pete took a bit of space in a second hand furniture shop. There he acquired 700 customers in 13 months. He now has a new store, beautifully decorated, neon window framing, fluorescent lights, a 16 x 20 laboratory and two work benches. Some boy, that Peterson.

———n r i———

Olin T. Jaynes is Radio supervisor for the local Police department at Anderson, S. C. They operate on 37.5 mcs with several mobile units having two-way Radio. In addition, their motorcycles are equipped with receivers. Mr. Jaynes is a war veteran and is getting a big kick out of this interesting civilian connection.

———n r i———

U. M. Westbrook of Hialeah, Florida, who recently reported that he had received a Restricted Radio Operator's permit, now reports that he has obtained a Radio Telephone, Second Class license.

———n r i———

Paul W. White of Newport, Tenn., sent us several newspaper clippings announcing the purchase of an established Radio and Electrical business. The firm will handle a complete line of Radios and appliances. Mr. White has been a resident of Kingsport for the past 29 years and is well known in his community.

———n r i———

Michael Hordisky of West Babylon, New York, has a grand job with Press-Wireless. Doing very well financially. Mr. Hordisky was a Major in the Signal Corps during the war. He says, without reservation, "NRI gave me my Radio education."

———n r i———

The Manchester Radio Service of Manchester, Conn., is conducted by John F. Gruber who is modernizing his shop and really dolling things up. Sent us several of his forms for records and billing. Says he used NRI reference text to set up his bookkeeping system and it works to perfection. It should.

———n r i———

J. W. Willoughby of Gainesville, Texas, has a full time Radio business. Started on a small scale in spare time. Business grew rapidly. Now is sitting pretty, so to speak.

———n r i———

Joel Robinson of Brooklyn is working as a Junior Engineer for Pilot Radio Corp. He is a member of New York Chapter.

———n r i———

We missed Jack Hasen at the annual meeting of Detroit Chapter. Upon inquiry we learned that Jack was quite occupied at home assisting with a brand new baby. The Hasens live in Windsor. Congratulations.

———n r i———

Elhart Nelsen, 16 N. Kildare Ave., Chicago, Ill., just passed the exam for 2nd class Radio telephone license. He is now aiming toward a telephone 1st. Good luck!

———n r i———

How about some news from you good members who read this page but seldom write. Let's hear from you.

———n r i———

Millard Burris of Verona, N. J., is quite a fellow in his community. He specializes in Sound work and covers track meets, political campaigns, bond drives and all sorts of outdoor advertising. He is a Rotarian and is popularly known as Skippy. His wife, also very active in the Radio business, is often referred as Mrs. Skippy. These fine people are known by all in Verona from the Mayor down. We were pleased to have a picture of one of their sound trucks.

———n r i———

Vice President F. Earl Oliver, a prime mover in Detroit Chapter, wants to personally thank those good people who donated prizes for the Detroit Chapter Annual dinner. For names of donors please see Detroit Chapter News, this issue.

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Joe Clark Finds He Made $612.78 In Spare Time, During Past 12 Months

An NRI Graduate Turns In a Fine Record of His Wide Radio Experience

"I BECAME interested in Radio back in 1927 or 1928, when The Diamond of The Air was popular and the Browning Drake sets could be bought in kit form at the local store. C. C. Coddington had built a station with call letters WBT. He was the Buick distributor and the call letters were to mean "Watch Buicks Travel In The World's Best Town."

After my graduation from the Charlotte Tech High School in 1929, I went to work for the Armature Winding Company in Charlotte, N. C. I got a good bit of training in practical electricity, which was of great help in my future radio work. I next went to work for the Bosch Radio dealer as aid to the regular radio service men.

Then I went to work for the RCA Victor Radio distributor. While there, a friend advised me to enroll with the National Radio Institute for training. Today I can say, "It was the greatest financial investment I ever made." I want to add my name to the list of those who owe so much to our school. I never miss an opportunity to talk up the NRI.

Joseph W. Clark

The experimental kits were the most interesting part of the course. The Vacuum Tube Tester Kit was among the first in this neighborhood and drew much interest. It was responsible for a good many of my friends enrolling with NRI. The lessons were in good sequence.

It was soon after I finished my experimental kits lessons that I tackled my first Radio service job. I found the neighbors were very cooperative in this respect. I soon had all the repair jobs I could handle in my spare time. Most of the money from my first jobs went to purchase test equipment. Then came my first real radio service job. It was with a company that specialized in auto Radio repairs. I did most of the installations, and therefore had to get out all the motor noise interference possible—that being a big headache at that time. I was surprised to learn that I had become known as an expert in this line. After that, I worked for other shops about town. I went on the road and solicited auto Radio work from the shops. I learned they were having trouble with motor interference in their auto Radio installations. In some instances they had to remove the set and thus lose the sale altogether. I would agree to remove the noise for a certain fee, depending on the make of car and set. I made good at this and later traveled through states from Virginia to Texas.

I returned to Charlotte, N. C. and worked for various plants as maintenance electrician, during which time I finished my course with NRI.

I have been working here in the shipyard as maintenance electrician. I have been doing Radio repair work in my spare time. By referring to my books, I find I have made $612.78 in the past twelve months, in my spare time. I wish to thank all those at the school for the cooperation I received during my studies and after my graduation. Wishing the school continued success, I remain"

Yours truly,

JOSEPH W. CLARK
810 Market Street
Wilmington, N. C.

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Minutes That Pay

Ever notice how time skips by? It's every minute that counts, and yet we waste minutes, all of us, every day, and there's no turning back the clock . . . so as a post-war resolution you might well resolve never, never again to waste another minute if you can possibly help it.

No, I can tell what you're thinking—we can't work all the time. There are minutes that may be used for healthful relaxation and entertainment . . . in fact a good laugh now and then helps you to do better work during working hours. But there are minutes, too, that may be used for careful thinking and charting of your future. How many of those precious minutes are wasted in plain loafing, instead of doing the things that could be done if you were only conscious of Old Man Time and the minutes in which he deals?

The number of men who have snatched a few minutes from a noon lunch-hour, while at work on some dull, prosaic job, to study lessons that would mean, eventually, getting into much more pleasant work at better pay is virtually a legion. Thousands of men have learned to turn their minutes into happiness and better living. Who am I? I'm one of those Minute Men—and it pays!

———*n r i*———

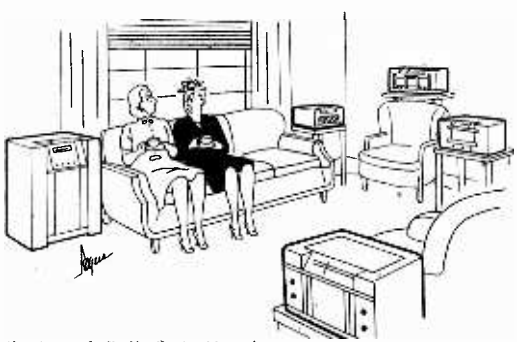
"Where is Johnny this afternoon?"

"If he knows as much about canoes as he thinks he does, he is out canoeing, but if he doesn't know any more about it than I think he does, he's swimming."

———*n r i*———

Bookkeeper: I'll have to have a raise, sir. There are three companies after me.
Manager: That so? What companies?
Bookkeeper: Light, telephone and water!

———*n r i*———



Courtesy of Radio-Craft Magazine

"By the way my dear, have you seen that handsome new salesman at the radio store yet?"

NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

Vol. 12 August-September No. 4

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

NATIONAL RADIO INSTITUTE
Washington 9, D. C.

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

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J. B. STRAUGHN, TECHNICAL EDITOR

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