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Give a Little More Than is Expected

"He profits most who serves best."

That old adage is as true today as ever. No one can gain promotion or build a successful business unless he constantly tries to give *a little more* than his employer or his customers expect.

The fellow who grabs an extra dollar here and there without giving full value for the charge can never be a success. Why! Because a man who cheats on petty things is tearing down his moral fibre. He may fool his employer for a while, or a few customers now and then, but he can't fool himself. He eventually loses that spark, that vitality possessed by men who have nothing to hide—nothing to fear.

When scales are balanced evenly, a little bit of extra weight on one side will over-balance the scale in that direction just as effectively as would a ton of extra weight.

In the same way, a little better value, a little extra effort, makes a man or a business stand out above the average. It pays to give a little more value than seems necessary—to work a bit harder than is expected.

We are proud of the reputation of N.R.I. students and graduates. For twenty-seven years we have been advocating truth and honesty in all radio business dealings. Our records are definite proof that a great many of our graduates have profited by this counsel. Let every N.R.I. man uphold these standards and, by so doing, bring genuine rewards to himself.

E. R. HAAS,
Executive Vice President.

Circuit Analysis of a Universal Receiver

By J. B. Straughn

N.R.I. Service Consultant

Emerson Radio & Phonograph Corp.—Model BA-199

THIS Emerson model BA-199 receiver consists of one r.f. amplifier stage using two tuned circuits, a detector and an output audio stage, all receiving d.c. operating voltages from a half-wave rectifier.

Signal Circuits. This receiver is referred to in the diagram as a 5-tube A.C.-D.C. receiver, on the basis that the ballast tube R_8 is a tube. Calling a ballast a tube was once considered proper, but today only tubes in the signal and supply circuits, operating by virtue of electron emission, may be considered as tubes. Actually, then, this is a 4-tube radio receiver.

This receiver is a midget table model of the portable type; that is, it can be taken from room to room or to any location where 115-volt a.c. or d.c. power is available. A highly flexible insulated wire, permanently connected to the receiver, serves as the antenna. This wire can easily be tossed out of a window or hung around the room. Quite often, this wire is connected to a heating radiator or some metal object in the room. This is information not given in the diagram, but worth knowing when you run across these receivers.

This antenna connects to primary winding L_1 of antenna transformer T_1 through condenser C_3. The other end of L_1 is grounded to the receiver chassis, which in turn connects to one end of the power line. The power line is used as the ground. As a rule, one of the power lines is grounded somewhere in the house wiring; even if it were not, its long length and its proximity to the earth would make it highly suitable for a ground.

We now realize that the chassis is connected to the power line. This means that to avoid a possible serious shock, you must keep your hands off the chassis whenever the receiver is in operation.

Condenser C_3 prevents winding L_1 from burning out if the antenna wire touches some grounded metal object in the house. Without this condenser, a condition might arise wherein L_1 is directly across the power line.

The r.f. current in L_1 induces an r.f. voltage in L_2; this voltage is stepped up due to resonance when C_1 is tuned. (Condensers C4 and C5 are trimmer condensers.) Capacitive link *l* helps equalize gain over the tuning range. The type 6D6 tube amplifies the r.f. signal, so that the r.f. current in the plate circuit is substantially greater than the r.f. current in L_2-C_2. This r.f. current is stepped up still more by the second r.f. transformer, so that the r.f. voltage across C_2 is greater than that which exists across C_1.

As a detector, the type 6C6 tube demodulates the modulated r.f. signal, producing an audio voltage across R_6. Radio frequency signals resulting from detection are kept out of R_6 by by-pass condenser C_{10}.

Observe that the end of R_6 farther away from the plate of the 6C6 tube goes to the chassis through condenser C_{12}, a 16-mfd. electrolytic condenser. Resistor R_7 also terminates at the chassis, with its other end going to the grid of the 25L6 pentode output tube and to the plate of the 6C6 tube through condenser C_9. Thus, at normal audio frequencies R_7 is in shunt with R_6.

The audio voltage across R_7 is fed to the 25L6 output tube. The cathode of the 25L6 tube goes to the chassis through R_8, thus completing the grid circuit. (Note the semi-circular symbols inside the symbol for the 25L6 tube; these indicate that the tube is a beam power tube.)

Audio current flowing in the plate circuit of the output tube passes through the primary of output transformer T_2, flows to the chassis through C_{13}, and returns to the cathode through R_8. Transformer T_2 couples the loudspeaker to the output tube, and is designed to furnish the loudspeaker with maximum possible undistorted power.

Both beam power and pentode output tubes have high plate resistance, which makes them unstable when the load (the loudspeaker) is subject to a great range in load conditions. Leakage inductance, which is especially high in an inexpensive

output transformer, will cause feed-back and produce undesirable oscillation, often inaudible.

This loads the output stage and ruins the normal fidelity of operation. Beam power tubes therefore have a higher degree of amplitude distortion than triode power tubes.

Condenser C_{10} is used between the plate and cathode of the 25L6 beam power output tube to by-pass higher audio frequencies. This suppresses oscillation and thereby prevents unstable operation. Undesired signals getting into the plate circuit produce across R_8 a voltage which, because it is out of phase with the desired grid signal voltage, cuts down the undesired signals by degeneration. The desired signal is also partially reduced by degeneration, but its original strength is sufficient to allow for this degeneration. Distortion is also greatly reduced by degeneration, for undesired harmonics of the signal are attenuated.

Condenser C_{11} is included to place both power leads at ground r.f. potential. With this condenser in the circuit, normal reception is obtained in either position of the power cord plug in an a.c. outlet. Noise signals coming over the line will be by-passed by C_{11}, and thus prevented from getting into the power supply and the receiver output.

Power Supply Circuit. All items in the lower part of the diagram are parts of the power pack. In this power supply, terminals *1* and *2* are the output of the power pack, and serve as the high-voltage d.c. source for all positive tube electrodes in the main receiver circuit.

The 25Z5 tube is a twin rectifier tube used as a single diode by connecting corresponding electrodes together. Electrons will flow only from the cathode to the plate through this tube. Hence, for a d.c. outlet the power plug must be inserted in a wall outlet in such a way that the plug prong marked + is in the + terminal of the wall outlet. The other prong is then —, as indicated.

Note that the chassis is connected through switch SW to the negative terminal of the source during d.c. operation, and the plate of the rectifier tube is connected to the + terminal. All circuit terminals will thus be positive with respect to the chassis.

Some voltage is dropped in the rectifier tube and some in choke CH, but most of the power pack output voltage is dropped in the receiver circuit itself, which may be considered as a load connected to points *1* and *2*. Terminal *1*, being nearer the + terminal of the source, is the + terminal of the power pack output. As you trace from point *1* through the receiver (for example, through R_{10}, through the plate-cathode of the 6C6 tube, and through R_1 to the chassis) the positive potential with respect to the chassis diminishes. Point *3* is therefore positive with respect to point *4*, a condition essential for the operation of the 6C6 tube.

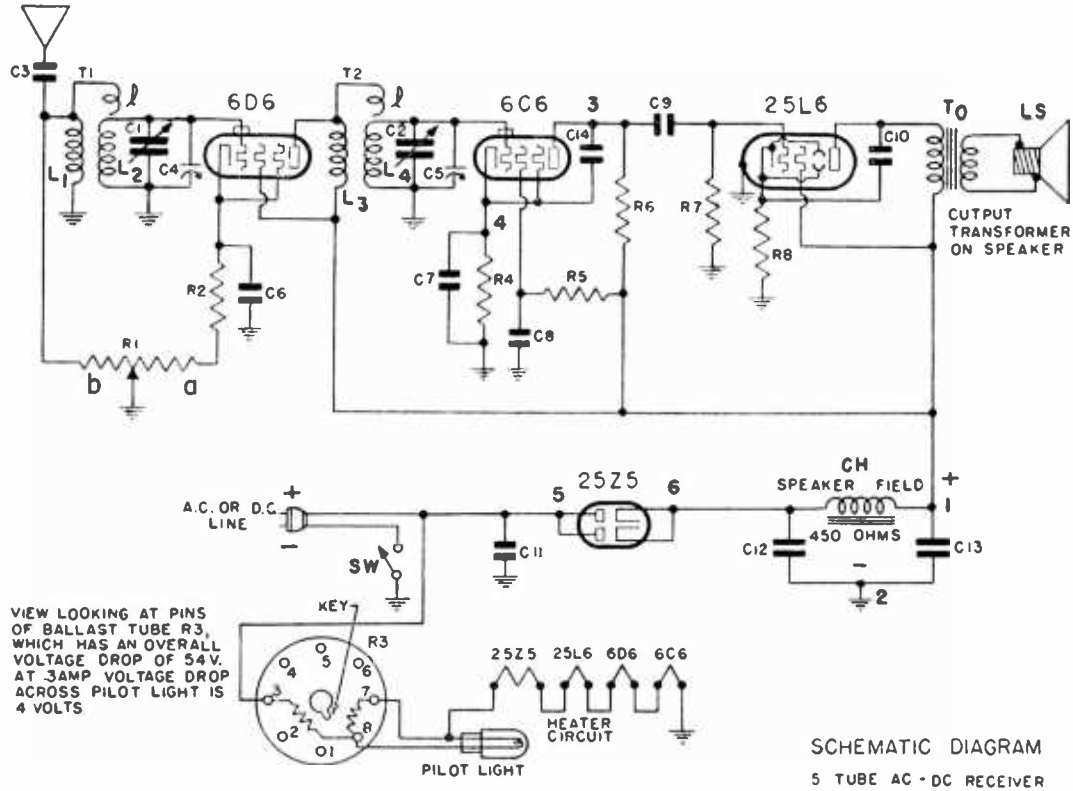
Should you insert the plug incorrectly into the outlet of a d.c. source, point *5* will be negative with respect to chassis, hence point *5* will be negative with respect to point *6* and electrons will not flow through the rectifier tube. Under this condition, the rectifier tube acts as a very high resistance, and the tubes do not get the required operating voltages. In practice, you will see the pilot light go on and the tubes glow, but the receiver will act "dead"; reversing the power plug will remedy the condition.

With an a.c. power source, point *5* is alternately positive and negative with respect to the chassis. During the half cycle that *5* is positive, the 25Z5 tube is conductive, and is furnishing the receiver with a high d.c. voltage. During the other half-cycle, the tube is not conductive. Most of the ripple in the resulting rectified current is eliminated by filter choke CH and filter condensers C_{12} and C_{13}. Note that the filter choke is also the field coil of the dynamic loudspeaker.

Starting with the first tube, let us trace the d.c. supply circuit through the tubes. Imagine, of course, that the tubes are operating, hence conducting. Assuming that the negative prod of a d.c. voltmeter is on the chassis, you can place the positive prod on the cathode of the 6D6 tube, then on its plate, on the junction of coil L_3 and the screen grid, on point *1* and on point *6* in rotation, and get a voltmeter reading each time. As you progress in this order the voltage reading will be higher. When you place the d.c. voltmeter between the cathode of the 6D6 tube and the chassis, you will find that the voltage varies as you adjust R_1; in fact, as the receiver volume decreases, this voltage increases. Here we have a volume control using variable C bias as the means of control. The grid gets this C bias from a chassis connection through coil L_2.

Note, too, that L_1 is shunted by R_1, since one end of L_1 connects directly to R_1; the other end of L_1 is grounded, hence connects to the movable contact of R_1. Section *b* of R_1 shunts L_1, and thus provides a shunt path for part of the signal current which would otherwise flow through coil L_1. As R_1 is turned so the resistance in section *a* increases, the resistance in section *b* decreases. Both sections thus contribute to a reduction in volume, for increasing the resistance in section *a* increases the C bias voltage, and decreasing the resistance in section *b* increases the shunting effect across L_1. Condenser C_6 always shunts R_2 and section *a* in R_1, and thus prevents degeneration in this r.f. stage.

In the 6C6 tube stage, point *7*, the plate and the junction point of R_5 and R_6 are increasingly more



SCHEMATIC DIAGRAM

5 TUBE AC - DC RECEIVER

T1	Broadcast antenna coil
T2	Broadcast detector coil
R1	Volume control—75000 ohms, with line switch
R2	240 ohm, 1/2 watt wire-wound resistor
R3	Plug-in ballast tube
R4	25000 ohm, 1/4 watt carbon resistor
R5	2 megohm, 1/4 watt carbon resistor
R6, R7	500,000 ohm, 1/4 watt carbon resistor
R8	110 ohm, 1/2 watt wire-wound resistor
C1, C2	Two-gang variable condenser
C3	.001 mf, 600 volt tubular condenser
C4, C5	Trimmers, part of variable condenser
C6, C8	.1 mf, 200 volt tubular condenser
C7	.25 mf, 200 volt tubular condenser
C9	.02 mf, 400 volt tubular condenser
C10	.05 mf, 400 volt tubular condenser
C11	.1 mf, 400 volt tubular condenser
C12, C13	Dual 16 mf, 100 volt dry electrolytic condenser
C14	.0002 mf, 600 volt tubular condenser

positive with respect to the chassis. The plate-cathode voltage of this stage is equal to the main supply voltage (between points *1* and *2*) less the drop in R_6 and R_4. The drop in R_4 serves as the C bias voltage; note that the chassis end of R_4 goes to the grid through L_4. The screen grid voltage is obtained from the main d.c. supply but is reduced by the drop in R_5; only the screen grid current flows through R_5 to produce this drop. R.F. screen grid current returns to the cathode through C_8 and cathode by pass condenser C_7.

A technician would recognize the 6C6 as a detector by the R_6-C_9-R_7 coupler in the plate circuit and by resonant circuit L_4-C_2 in the input; this is a typical r.f. to a.f. coupling arrangement. Furthermore, R_6 is 500,000 ohms, R_5 is 2 megohms and R_4 is 25,000 ohms, indicating low plate and screen grid voltages and a high C bias voltage, all of which are essential for operation as a detector.

The output stage was previously considered, and needs little further discussion. The plate circuit starts with the chassis, continues through R_8, then goes from cathode to plate, through the primary of T_0 and from point *1* to point 2 back to chassis.

The filaments are connected in series to the 115 volt supply, and will function with either a.c. or d.c. power. Let us trace this filament circuit by starting with point 5 (the rectifier plate). From here we go back to prong 3 of the ballast tube, then through the ballast resistor to prong 8 and eventually to prong 7. From prong 7 the filament current finds a path through the filaments of the 25Z5, 25L6, 6D6 and 6C6 tubes in series. One filament lead of the 6C6 tube is grounded to the chassis, and switch SW completes the filament circuit from the chassis to the other side of the power line.

The total voltage required for the filaments is 25+25+6+6, or 62 volts. The ballast must drop the difference between 115 and 62, or 53 volts. Since the tube filaments and the ballast are self-regulating to a reasonable degree, increases and decreases in line voltage have very little effect on the emission characteristics of the tubes.

The pilot lamp shunts that portion of the ballast resistor between prongs 7 and 8. The resistance of this portion is so chosen that the lamp normally gets 4 volts; a 6.3 volt Mazda lamp is used, hence it will burn dimly. When the power is first turned on, however, the tube filaments have low resistance until they heat up; this causes a large current to flow, but it is partially "cushioned" by the ballast. During the heating-up period, the voltage across the pilot lamp will be high, and the lamp will burn brightly; a 6.3 lamp normally operating at 4 volts thus provides a degree of safety from burn-out. In receivers which use this arrangement, you can expect the pilot lamp to glow brightly initially, and then dim down to a subnormal glow.

Checking Continuity in Universal Receivers. Bear in mind that continuity tests are made with an ohmmeter while the receiver is turned off. In fact, with a universal a.c.-d.c. receiver be sure to pull the power plug out of the wall socket. Ohmmeter tests can then be made from tube terminals or socket prong clips, for the tubes are not conductive when power is off.

In checking this receiver, you will find that all positive tube electrodes, such as the screen grid and the plate, trace to the *cathode* of the rectifier. This rule applies to a.c.-d.c. as well as a.c. receivers. Prove this basic service fact by selecting one tube, the 6C6 detector; trace from the plate through R_6 and CH to the cathode of the 25Z5.

Theoretically, all negative tube electrodes, such as the control grid and suppressor grid, should eventually trace to the *plate* of the rectifier tube. In an a.c.-d.c. receiver that is inactive, this path is opened by pulling the power plug out of the wall outlet. You can, however, short the plug prongs, or better still, test with respect to power switch SW, after turning this switch ON so as not to be concerned with finding the receiver side of the switch.

Another equally important test for the negative electrode continuity test is to check with respect to cathode. Thus, you can place one prod of the ohmmeter on the cathode of the 6D6, the other prod on the control grid, and expect continuity. You should find continuity between other points in the grid circuit and the cathode; for example, from the movable contact of R_1 or from the junction of R_1 and R_2.

To check for continuity in the filament supply circuit, connect the ohmmeter to the two power plug prongs and turn the switch to the ON position. A resistance much lower than 300 ohms (approximately the hot resistance of this circuit) will usually be measured.

Common A.C.-D.C. Receiver Service Problems. Quite often electrolytic condensers C_{12} and C_{13} dry out, lose their normal capacitance and acquire a higher power factor; that is, they act as if a large resistance is in series with the capacity. When this occurs, the filter loses its ability to remove ripple, and hum is quite evident. Reduction of input capacity lowers the over-all output d.c. voltage, and low volume may exist along with hum. It's a good idea, when hum and low volume exist, to try a new dual electrolytic condenser. A short or excessive leakage in an electrolytic condenser gives the same effect, hum and low volume, but in addition it may force the rectifier tube to lose emission. Try a new rectifier tube, but before inserting it into the receiver, test the electrolytic condensers for resistance (they should be substantially above 50,000 ohms without any other part such as the field of a dynamic loudspeaker in shunt).

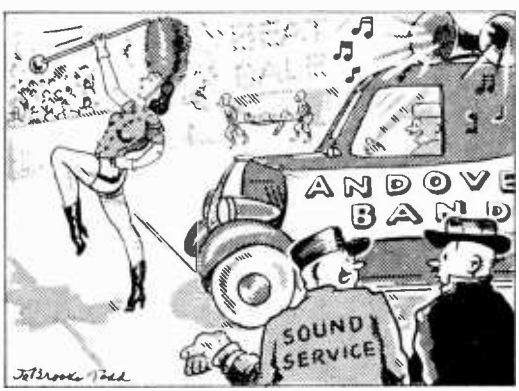
When servicemen encounter distortion in an a.c.-d.c. receiver, they check the filter condensers, particularly the output filter condenser, then look for gas in the output amplifier tube and for a leaky coupling condenser just ahead of the output tube (C_9 in this circuit). In either case, current will flow through the grid return resistor (R_7) and place a positive bias voltage on the grid of the output tube so that linear (distortionless) operation no longer exists.

The test for gas or a leaky coupling condenser is easily made with a vacuum tube voltmeter or a high-resistance voltmeter. Connect the meter across the grid resistor, with the positive prod on the grid end. There should be no reading. If a reading is obtained, unsolder the coupling condenser—a reading now indicates a gassy output tube, and no reading now indicates a leaky coupling condenser. (In an a.c.-d.c. receiver it is necessary to unsolder the coupling condenser as pulling the output will cause the receiver to become inactive.)

When a tube is operated with an a.c. potential between filament and cathode, leakage resistance between the cathode and filament in a tube can give rise to serious hum. All tubes in this receiver circuit will have an a.c. voltage between cathode and filament (normally the capacity between these two electrodes introduces negligible ripple current). Imagine, however, the cathode of the 6C6 tube leaking to the filament. One side of the filament will be grounded, so if it leaks, little hum results; should the other side of the filament leak to the cathode, then the 6 volts across the 6C6 filament will be across R_4, and an a.c. voltage gets into the grid and plate circuits.

Note that one end of the filament circuit is grounded, hence those tubes which are connected in the circuit farthest away from the ground end will introduce a greater a.c. voltage. A cathode-filament leak in those tubes will have greater effect, unless the tubes are farther along in the signal circuit. The detector tube is most affected by cathode leakage, hence its filament is connected nearest to ground; the output stage will give the least amplification of a.c. voltage due to leakage, hence its filament is placed third from the ground (it will have either 12 or 35 volts of a.c. leaking into cathode resistor R_8). Tubes used in an a.c.-d.c. receiver should be checked in a tube tester for cathode-filament leakage should you encounter hum troubles.

Should squeals or oscillations exist, shunt C_{12} with a condenser of similar value to see if this cures the trouble. If it does, the original C_{12} is open and should be replaced. Be sure the full length of the antenna is used because a short pick-up will not sufficiently load the input circuit and the least amount of feed back will cause oscillation.



"They couldn't afford to send the whole band with the team, so they had some recordings made, shipped them here with the gal, and rented my sound truck for the afternoon."

Cover Photo Shows New 1942 "Magic Brain" Phonograph

The "Magic Brain," RCA Victor's new automatic record playing mechanism illustrated on the front cover of this issue, is magical in its uncanny, almost human operation. The mechanism, by use of a radical new Tandem Tone Arm, plays both sides of records without turning them over.

The turntable automatically moves aside to discard a record which has been played on both sides, and returns to position and finds the center hole of the next record to be played. This feature is unique in automatic record changing devices and is made possible by the use of two motors, one to drive the turntable and the other to operate the automatic mechanism. This also makes it possible to increase the capacity of the mechanism to fifteen 10-inch records or twelve 12-inch records.

As soon as the Tandem Tone Arm has played both sides of a record, it swings free to permit the turntable assembly to tip over to the left, gently carrying the record into the padded pocket below the mechanism. While the turntable is in this position, the next record in the stack drops silently to the heavily felted motor board. The turntable then returns to its original position, raising the record from the motorboard enroute. While the record is held in position by the record support posts, the turntable spindle seeks out the center hole of the record to be played and finds it, positioning the record for playing. The turntable is no larger than the size of the record label, in order to permit the lower section of the Tandem Tone Arm to play the under side.

The Tandem Tone Arm is actually two complete Magic Tone Cell pick-ups set, one above the other, into a tone arm shaped somewhat like a tuning fork. Its action is completely automatic from the time it leaves the rest position at the touch of the starting button, until it returns to rest after the last record has been played. Since the vibrating parts of the unit weigh less than a postage stamp, no undesirable mechanical noise or needle chatter is created.

Among the many other features which are attracting much interest as the "Magic Brain" is demonstrated are the Magic Tone Cell (or pick-up cartridge), the Flexible Tone Bridge and the Jewel-Lite Scanner. The Tone Bridge connects the sapphire Jewel-Lite Scanner (replacing the standard needle) to the Magic Tone Cell.

The new "Magic Brain" with its Tandem Tone Arm is incorporated in the 1942 RCA Victrola model V-225 combination three-band receiver and automatic phonograph, which is the receiver pictured on the front cover.

Puzzling Radio Questions From Students

F. M. Antennas

QUESTION: *I understand frequency modulation (F.M.) receivers will work on television antennas and that some have obtained operation on just ordinary aerials. Therefore, are special aerials really necessary for F.M. reception?*

ANSWER: For best results, the proper type of F.M. antenna system should always be installed. It is possible to pick up such signals if the signal level is high enough, using an ordinary aerial or even just a short piece of wire. However, are the proper results being obtained?

One of the important advantages of a frequency modulation system is the ability to suppress static and other noises. This is obtained by a limiter stage so designed that amplitude variations above a certain level are wiped out, providing the desired signal is above this level in strength. This immediately means that the desired signal voltage must be considerably larger than the saturation point of this limiter, so that these variations will be wiped out. It may be possible to pick up F.M. signals with an ordinary aerial in a quiet location and on a quiet evening satisfactorily, and then have the owner complain that at times he hears noises. This is an immediate indication that insufficient signal energy is picked up. Therefore in such a case, it is definitely necessary to install an antenna better able to pick up these signals.

In regard to using television aerials, remember that television stations are operating on frequencies which are very close to those of the frequency modulation transmitters. Therefore, these antennas will be practically the same in design as the standard frequency modulation aerial and should work satisfactorily, providing the proper match is obtained at the receiver. Usually it is best to use the recommended type of aerial, carefully reading the instructions furnished with the receiver.

AC-DC Operation

QUESTION: *Is it possible to operate an A.C.-D.C. receiver from three 45 volt B batteries?*

ANSWER: It is impractical to operate an A.C.-D.C. receiver from batteries alone. That is, although the receiver is designed to operate from 110 volts, and you have this amount of voltage with the batteries, the batteries are not able to furnish the required current.

The filament current in a standard A.C.-D.C. receiver is somewhere between .15 and .3 ampere. An ordinary B battery is seldom designed to deliver more than .03 ampere, which means that it is being overloaded by a factor of ten times. It would operate the receiver for a few minutes, but then the batteries would be exhausted.

Of course, there are available modern sets which are designed to operate from batteries and also from A.C.-D.C. lines. Such sets are quite different in design, however, being primarily battery sets with an A.C.-D.C. power pack attached and a changeover switch to make the proper connection. They use A batteries in addition to B batteries, so the required current will be furnished.

Ordering Radio Parts

QUESTION: *I need a volume control for my radio. I do not find it listed in the catalog of a wholesale supply house. Where can I obtain it?*

ANSWER: An important rule to remember is that it is possible to obtain any standard radio parts from any of the larger mail order supply houses. Even if the item is not carried in their catalog, they will be able to obtain it. Therefore, in your case, just order the volume control for the receiver, giving its make and model number. I am sure that your favorite supply house can furnish you with a replacement.

Similarly, you can order any other parts. Of course if the receiver is not a well known make, then it is best to give all the information you can about the item. This will help the supply house in identifying the part.

Philco Diagrams

QUESTION: *On examining several recent Philco radios, I find that there is a wire run from the secondary of the output transformer to a terminal on the antenna terminal strip. What is the purpose of this wire?*

ANSWER: A close examination of the diagram of these same receivers will show that the other side of the secondary of the output transformer is connected to the set chassis. The wire is run out to the antenna terminal strip to provide a convenient means of connecting an output meter. In other words, connecting an A.C. voltmeter between this terminal and set chassis provides a simple means of getting output readings when aligning the receiver.

Are Answered By N. R. I. Experts

AC-DC Intermittent

QUESTION: *I have an A.C.-D.C. receiver which has an intermittent open circuit in the filament supply circuit. How can I find out just which part it is?*

ANSWER: It is possible to make use of an A.C. voltmeter with a range above 110 volts, to determine just where the open circuit happens to be in this case.

Notice that the filament circuit is a series circuit. If the circuit opens at any point, then the full line voltage will appear at that point. Therefore by using the voltmeter with a range greater than 110 volts A.C., and connecting this voltmeter across various parts or sections of the circuit, you will find that the reading will jump up to the line voltage value (approximately 110 volts) whenever the circuit opens up.

When you are testing across a section of the filament circuit and find this condition to exist, eliminate one part at a time by moving the voltmeter terminals. You will soon be connected across the offending part, as shown by the variation in the voltmeter reading from some low value to 110 volts.

Inverse Feed-back

QUESTION: *On several recent radio receivers I have noticed a condenser connected from the secondary of the output transformer to the cathode of the first A.F. tube. What is the purpose of this connection?*

ANSWER: This particular connection is one form of inverse feed-back. Examine the circuit and you will find that the usual by-pass condenser which you would expect across this cathode resistor is omitted. Also, the other terminal of the output secondary winding is grounded. Now, notice what occurs when a signal comes through. A voltage will be developed across the secondary of the output transformer and this voltage is effectively across the bias resistor for the first audio frequency stage through the condenser. By adjusting the polarity of the output transformer in the proper manner, we can make this voltage from the output either aid or oppose the incoming signal. In practical cases, it is made to oppose the signal.

In other words, consider a condition where a certain signal voltage is coming through. The voltage coming back from the output winding appears between the cathode and ground, and thus is between the grid and cathode of this first audio stage. If this voltage has a polarity opposite to that of the signal voltage at that particular instant, it will oppose it.

The result of this is that gain of the amplifier is decreased, but even more important, the amount of distortion will be decreased. In other words, when conditions in the output stage become such that distortion would occur, the feed-back voltage tends to cancel out such high peak values and thus acts as a regulator on the output stage. You will of course usually find this connection where the output tube is a pentode, because it is more liable to cause distortion.

A triode tube has a low plate impedance and requires a low load resistance. This tends to stabilize the circuit. On the other hand, a pentode has an extremely high plate resistance. Variations in the load throw the matching off considerably more with pentode tubes. This feed back voltage, however, has the effect of lowering the plate resistance, so the ratio of plate resistance to load resistance is lower. This makes variations in the load have less effect thus tending to smooth out variations and giving a less distorted output.

Loop Aerial Set

QUESTION: *I have a small set using a loop aerial, which does not bring in one of the local stations. How can this be cleared up?*

ANSWER: Be sure the loop aerial is turned in the proper direction. A loop aerial is highly directional and should be turned so that it points toward the desired station. On midget receivers, the receiver itself can be picked up and rotated for best results. On some larger sets there are provisions made for rotating the loop alone.

If this does not clear up the trouble and reception should be obtained in that district from the particular station, try a regular aerial connected to the set.

This directional quality of a loop aerial should be remembered, as it is possible in some cases to cut down on the amount of local interference by proper positioning of the aerial.

In other words, where man-made interference is bad, sometimes the loop can be rotated to pick up a minimum amount of noise while still giving good results in regard to station pick-up.

RINGING THE BELL

BY SAMUEL C. MILBOURNE

The Editor is very grateful to Radio News for permission to reprint this interesting article which originally appeared in Radio News, June, 1941.

Credit is the most precious asset any radio service business can possess.

As explained by Mr. Ben Gruber, Credit Manager for McGregor's, Inc., of Memphis, Tennessee, credit extension is based on three principles — *character*, *capacity* and *capital*.

Character refers to the personal character of the man who operates the business.

Capacity refers to the ability of the operator to run a successful business, and to keep his Accounts Payable in good shape.

Capital refers to the net worth of the business which is arrived at by comparing the assets to the liabilities.

Current assets produce the income necessary to take care of *current* liabilities and, while many other assets are considered in analyzing a financial statement and extending a line of credit, more consideration is given to such current assets as *cash on hand*, *cash in bank*, *accounts receivable*, and *merchandise*, for they furnish the means for paying current liabilities such as *accounts payable*, *notes payable* and any other obligations due in connection with the operation of a business.

Hence, it is important that when credit is desired, the serviceman can furnish a financial statement which will reflect favorably upon his business and himself.

It has been our experience that no business including the radio service business—can continue long without some form of credit extension. All business is based on an easy flow of credit and our whole business structure would crash without it.

Yet, many servicemen continually abuse their credit standing with jobbers and manufacturers without giving any thought to the future consequences.

How can you establish a satisfactory credit rating? It's not too easy, because it requires the *capacity* to be successful and the *character* to meet your obligations as promised, as well as sufficient *capital* (in this case, "quick" assets such as cash and good accounts receivable) to keep your business operating normally.

Before you can obtain credit, in most instances, you must show an ability to pay cash for your goods. Let us suppose that you are in the plight of many servicemen—practically no cash, some accounts receivable and quite a few debts. Here again we must emphasize the need for an adequate bookkeeping system for every service shop, and its value in keeping the serviceman "posted" on the condition of his business.

Your first step in gaining a credit footing is to analyze your business worth. List all your assests (such as cash in the bank and on hand, accounts receivable, notes receivable, merchandise, equipment, etc.). Then list all your liabilities such as accounts payable, notes payable and any other business obligations. The difference between the two totals is your "business worth."

Now, make a determined effort to collect all accounts receivable (money that people owe you) and use it to pay all your accounts payable (money you owe other people). If necessary, buy as little as possible and reduce your stock inventory up to the point where you are clear of old accounts payable.

Next, for several months try to pay cash for all stock and other business expenses, building up your bank account by "cutting every corner" of business expense.

Then, when your business is "liquid," apply for a small credit extension from your jobber and others with whom you deal. Don't expect too much of a line of credit at first, even a $5 or

$10 limit is a start. Talk with your local bank representative, explain what you are attempting to do and ask for a business loan of enough to tide you over each month so that you can pay your accounts payable promptly and not press your accounts receivable unduly. Assuming a $100 loan, and a rate of interest at 6% per year, this means that you will have to pay $6 per year interest. However, most jobbers allow a cash discount of 2% and, on their open accounts, extend this so that if the account is paid by the 10th of the following month, the 2% discount still applies. Therefore, by using bank credit, you can enjoy the advantages of cash purchasing power without pinching yourself each 1st of the month. In the above case, you could get your $6 interest paid for you when you discounted $300 worth of accounts payable (2% of $300 is $6). After that, for the balance of the year you actually make a profit on your loan when further discounts are taken up. Another saving you make is the amount of C.O.D. charges you will not have to pay when you deal on an open account basis.

One word of caution at this point. To make this work successfully, you *must* collect *your* accounts receivable during the month so that on the 1st of each month you will have an amount of cash on hand or in the bank *at least* equal to the amount of the loan. This does not include any amount you might want to draw for your salary or salaries of your employees.

By careful "nursing" of your credit and by prompt discounting of all bills, you can establish a small but very solid credit rating in as short a time as a year.

Now, of what value is a good credit rating other than the above reason?

Let us take a concrete case. You find it advisable to purchase $100 worth of new test equipment. Under ordinary circumstances, you would apply for credit from the test instrument manufacturer. If he would allow you a year to pay, the carrying charges would (in most cases) equal about 15% of the net price of the item. You think not? Let us explain.

If you will check the difference in cost between the *cash* price and the *time* price of almost any line of test equipment, you will find that the time price runs about 10% higher. If the test instrument costs more than $50, a year is usually allowed for full payment. If it costs less than $50, the usual thing is to clean up the payments in some time less than a year.

Now, assuming that the manufacturer allows you one year in which to pay for your $100 worth of test equipment, and assuming the usual carrying charge of 10% of the total, let's see what happens.

The total cost is $110 which is divided into 13 equal payments (a down payment and 12 monthly payments) of about $8.46 each. As you pay for your tester, you owe the manufacturer progressively less and less so that, if figured each month on the *unpaid balance*, you are actually paying about 15% for the loan of this money!

This is not meant as any discredit to the test instrument manufacturer because it is necessary for him to make this carrying charge to take care of bookkeeping, mailing costs, bad debts (which are quite high) and other expenses, not to mention the normal rate of interest he could receive on his money if he used it for other purposes.

It can be safely said that *no* test instrument manufacturer would be unhappy if *all* his sales were on a cash basis. He is forced into the time payment plan because of necessity and he has no intention of doing other than breaking even on it.

Now, let's see what would happen if your credit were established. You could go to your local bank and borrow $100 for one year at 6% which would cost you only $6, or no doubt you could make out 4 notes for $25 each, maturing at 90-day intervals. At 6%, this would cost you $3.76. Each month you could lay aside about $9 and this would give you additional working capital, even though only a small amount. Compare this with the $10 you would have to pay under a condition of poor local bank credit. Another way to look at it is that, assuming the borrowing of $100 at 6% for one year and further assuming a 2% cash discount on the test equipment, *you actually pay only 4% or $4 for this money*, against $10 as paid under a time payment plan. And further, *you* have the use of the accumulating monthly payments to bolster *your* bank balance, although you show a Notes Payable for the full amount.

It is from just such savings in expense that successful businesses are built. Carrying the story one step further, if you used that $6.25 you saved in interest for a small advertising campaign, you could easily profit many times more than the original.

Are you taking your cash discounts? Many servicemen are not aware of the usual cash discount of 2% and, thus, pass the opportunity of saving $2 on every $100 purchased. Some jobbers' catalogs show the price of items *after* the 2% has been deducted, so that an item which has a price of $50 in one catalog will show a price of $49 in another catalog.

Don't be afraid to ask for your cash discount and see that you get it. This in another way to Ring the Bell for greater profits.

Watching the Pennies

We want to point out several ways to *watch the pennies* without cheapening the *quality* of the parts or tubes used in repairing radios.

First, do you check every item on jobbers' invoices, check the extensions and re-add the invoice? We doubt whether many servicemen take the trouble to do so, yet you will be surprised how often you will find an error, an error which you were slated to pay for. Don't for one moment think that we wish to imply that the errors are intentional, because they aren't, but human nature is human nature and we all make honest mistakes. Check and double check every bill you pay. It will be profitable to you.

Do you count your change? If you do not, you are the loser. Once more, there is no attempt to imply dishonesty among those with whom you deal, but it's merely good, sensible business to count your change whether it is received from the cashier at your jobber's or the cashier at your bank.

Do you follow the market trends and stock accordingly? That is, when there is a possible rise in the tube prices do you stock up, and when there is a possible lowering in tube prices do you cut down your tube inventory? This is important because every dollar rise in the cost of tubes or parts means a dollar you could have saved if you had bought earlier.

Do you investigate the discounts offered in various brands of tubes and take this into consideration when you establish the line you wish to handle? We do not mean that the tube deal with the longest discount is necessarily the best tube deal, but discounts *do* vary and it can be one way you can save money.

If you buy on a cash basis, do you send the money with the order or do you order the item C.O.D.? C.O.D. fees mount up to a sizeable item over a period of a year and it is much the wiser business policy to send the money with the order (include enough for transportation costs).

These are but a few of the ways to *Watch the Pennies* and increase the monthly net profits without additional sales or advertising expense.

How Many $5 Commissions Have YOU Earned?

During the past few months, many N.R.I. men have earned $5 commissions for sending in the names of friends who later enrolled with N.R.I.

Have YOU earned some of these Commissions? DO you want to earn *more* of them? O.K. then --start the ball rolling NOW by sending *one specially* good name on the coupon below.

Send the name of some man you are reasonably sure is interested in Radio—a fellow who is mechanically inclined, and who is willing to use some of his spare time to learn more about the fascinating, progressive Radio business.

Send the name at once—and N.R.I. will do the rest. A copy of "Rich Rewards in Radio" will immediately be sent your friend, along with other information about N.R.I. and the N.R.I. Course.

Then, as soon as this man enrolls you will be notified and awarded your commission of $5. The only rules are: (1) You must send the name *before* I get it from some other student or from advertising. (2) Your Commission will be paid as soon as the new student has sent a total of $6 on his account.

Don't you agree that this is an easy way to earn $5? But remember—just *any* name won't do! To stand a good chance of getting your $5 commission, send the name of a man who, from all you know about him, should be a really good prospect for the N.R.I. Course.

Fill in and mail this coupon now, while you are thinking about it. And I promise you that I'll do my part in trying to get this man to enroll with N.R.I.

.....

Dear Mr. Smith: Here is the name of a man I believe is a good prospective student for N.R.I. When he enrolls, be sure to notify me and award my $5 Commission when it is due.

Name .....

Address .....

City ..... State .....

Submitted by .....

Student No. .....

Address .....

RADIO-TRICIAN
REG. U.S. PAT. OFF.
Service Sheet
Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

Philco Model 42-323

Alignment Procedure

When adjusting I.F. padders, high side of the signal generator is connected through a .1 mfd. condenser to antenna section of tuning condenser. Connect ground or low side of generator to chassis.

When aligning R.F. padders a loop is made from a few turns of wire and connected to signal generator output terminals; signal generator is then placed close to loop of radio.

The receiver can be adjusted in the cabinet or removed from the cabinet.

in order to adjust radio outside of cabinet the dial scale should be removed from cabinet and placed on dial background plate. Dial scale can be held in position by clips or rubber bands. The loop aerial should also be placed in approximately same position around or near chassis as when assembled.

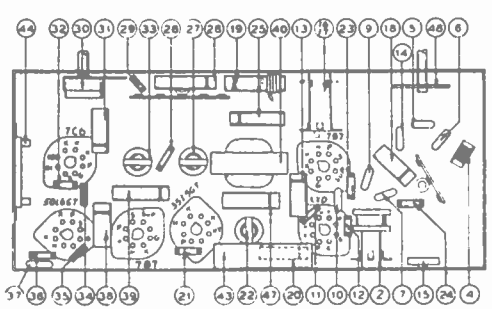
After connecting aligning instruments adjust compensators as shown in tabulation below. Locations of compensators are shown in schematic diagram.

Note A.—Adjusting Dial Pointer: In order to adjust receiver correctly, dial must be aligned to track properly with tuning condenser. To do this, proceed as follows: Turn tuning condenser to maximum capacity (plates fully meshed), then set pointer on first mark below 540 KC.

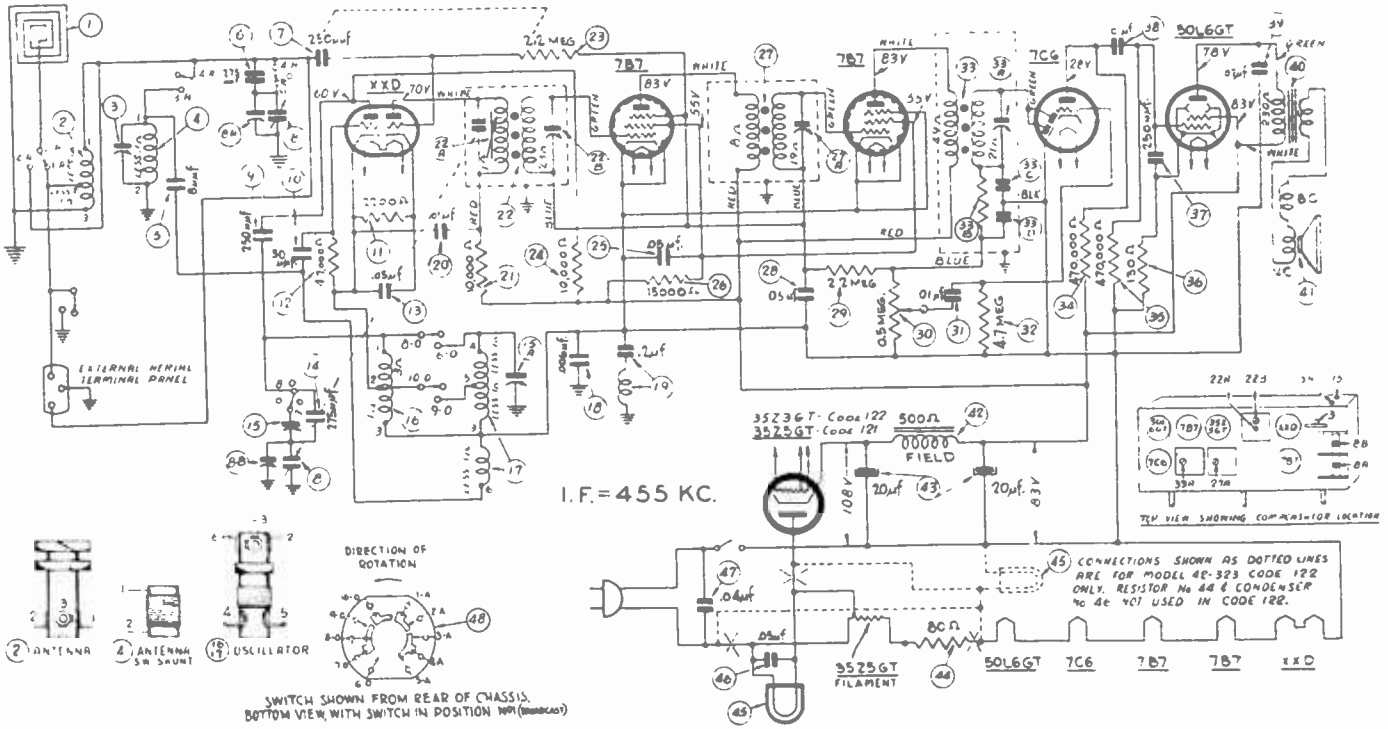
Note B.—When adjusting low frequency compensator (Broadcast) or aerial padders of high frequency tuning range, receiver tuning condenser must be adjusted (rolled) as follows: First, tune compensator for maximum output, then vary tuning condenser of receiver for maximum output. Now turn compensator slightly to right or left and again vary tuning condenser for maximum output. Repeat this procedure for maximum output.

Note C.—Tune receiver to 15.5 MC. Adjust oscillator compensator to maximum on 2nd signal peak from tight position (compensator closed). The Short Wave Aerial padder should then be "rolled" to maximum on 15 MC signal. See Note B.

Operations in Order	SIGNAL GENERATOR: Output Connections to Radio	SIGNAL GENERATOR: Dial Setting	RECEIVER: Dial Setting	RECEIVER: Control Setting	RECEIVER: Adjust Compensators in Order — Models 42-323	42-327	42-340	42-360	Special Instructions
1	Aerial Section Tuning Condenser	455 KC	540 KC	Vol. Max. Band Switch Brdcst	22A 22B 22A 33A	24A 24B 29A 35A	15A 15B 18A 32A	25A 25B 29A 37A	
2	Loop (See above instructions)	1720 KC	1720 KC	"	8B	8B	7	14A	Note A
3	"	1500 KC	1500 KC	"	8A	8A	23	4	
4	"	580 KC	580 KC	"	15	15	23B	4A	Roll Tuning Condenser Note B
5	Repeat Operation 2								
6	"	15.5 MC	15.5 MC	Band Switch S.W.	15A 3	15A 3	7A 23A	14 12	Note C



Courtesy, Philco Radio & Television Corp.



SCHEMATIC DIAGRAM MODEL 42-323

The D. C. voltages indicated at the tube elements in the above diagram were measured with a 1000 ohms per volt voltmeter. Philco Model 027. Line voltage, 117 volts A. C. No signal being received—range switch broadcast.

Novel Radio Items

—BY L. J. MARKUS—

All motion picture film used on television broadcast must be identified as such either at the beginning of the program in which such film is used, or immediately before the film is televised, according to a recent ruling of the Federal Communications Commission.

———————n r i———————

Rare, highly-prized green diamonds are now being produced by exposing ordinary white diamonds to the stream of invisible high-speed atomic particles produced by a cyclotron or "atom-smasher."

———————n r i———————

Until recent years it was thought that the main cause of power transformer hum was a magnetic pull at the joints of the laminations. Experiments with transformers whose cores had no joints gave the same hum, however. It is now believed that the iron itself alternately swells and contracts during each reversal of the magnetic flux; this action, known as the phenomenon of magnetostriction, is supposed to be the cause of the hum.

———————n r i———————

A new record for remote broadcasts is claimed by station WINX in Washington. Between May 23 and June 23, 300 broadcasts were made from remote points, including special events, man-in-the-street shows, and broadcasts from local traffic courts.

———————n r i———————

Televised time signals under the sponsorship of Bulova Watch Co. started on July 1 at station WNBT in New York, when commercial television got under way at this NBC television station. The television camera is focused on a large clock having a moving second hand, with the Bulova name prominently displayed on the clock face. Test patterns, also on the face, serve as guides for focusing television receivers.

———————n r i———————

A recording of every word spoken during the marriage ceremony may soon become as essential as the traditional marriage certificate and wedding photograph. One recent ceremony was recorded without the knowledge of the chief actors, by planting a microphone in one of the bridal bouquets and carefully concealing its cable leading to a Philco Home Recorder in an adjacent room. The resulting records served as a gift to the bride and groom.

Possible tie-ups of streetcar and bus traffic in New York City are prevented by a fleet of ten patrol automobiles equipped with short-wave transmitters and receivers. When a fire or accident threatens to block traffic, the dispatcher at the central headquarters immediately orders patrol cars to the scene so as to intercept approaching trolley cars or buses and reroute them on parallel lines. The dispatcher broadcasts on 31,460 kc., and all cars broadcast on 39,340 kc. Ten additional cruising automobiles, as well as five emergency trucks and several other service cars, are equipped with receiving sets. F. C. C. regulations permit only emergency calls over this unique street car-bus radio system, but between fifty and one hundred calls of this type are issued each day to keep New York City's 1,200,000 passengers moving. If this work had to be done by telephone, hundreds of passengers would be delayed for as long as an hour at certain points.

———————n r i———————

Night baseball games in New York City are being televised and broadcast successfully by the National Broadcasting Company.

———————n r i———————

A phonograph pick-up which delivers a frequency-modulated r.f. signal instead of the customary audio signal has recently been invented by Leslie A. Gould, a Bridgeport, Connecticut, radio man. This pick-up will radiate its signal through space to the input of an f.m. receiver over distances up to 50 feet. It is claimed that the fidelity possibilities of this new pick-up are much better than those of conventional crystal or dynamic pick-ups. The pick-up contains a type 6C5 tube connected into an ultra-high-frequency oscillator circuit. The phonograph stylus is attached to a light metal ring placed near the oscillator coil. Movement of the stylus moves the ring towards and away from the oscillator coil, thus changing the frequency of the oscillating circuit.

———————n r i———————

A "cough button" for microphones has been devised by the technical staff of station WOR, to permit a speaker to disconnect his microphone temporarily just before coughing. This eliminates frantic waving to the monitor operator in the control room to turn down gain, and prevents putting the transmitter off the air due to overloading of transmitting tubes by the strong audio signal associated with a cough.

Auto Radio Trouble-Shooting

National Radio News is indebted to the Cadillac Motor Car Division of General Motors Sales Corp. for permission to reprint this up-to-date and detailed outline of modern auto radio servicing techniques.

Non-Technical Trouble-Shooting

That phase of trouble shooting that can be performed with the radio in the car, without the use of special radio test equipment other than a tube tester, is classed "Non-Technical."

Practically all auto radio complaints registered by owners will come under one or more of the following classes:

1. Dead
2. Inoperative
3. Intermittent
4. Weak
5. Noisy

In the following pages, a section will be devoted to each type of complaint, the proper procedure for diagnosis and the proper correction.

1. Dead

A dead set is one where the dial or indicator lights do not light, the tubes are not heating and the vibrator does not function or hum. This failure is always due to a break in the "A" or power supply line from the ammeter to the set, or to an open "A" circuit within the set. Proceed as follows:

A. Check fuse. If blown, replace vibrator with known good vibrator and replace fuse. If set operates normally and fuse does not blow again, failure was due to sticking vibrator points. If fuse blows again, failure is undoubtedly due to a short in "A" circuit, either in switch or leads and set must be removed for bench repair. Replace original vibrator in set.

If fuse is not blown, the failure is due either to an inoperative On-Off switch or an open circuit in the "A" leads. Check push button operation of On-Off switch to make sure no interference at that point is preventing switch from turning on. If okay, then it will be necessary to remove set for bench repair.

2. Inoperative

An inoperative set is one where the dial lights light, the tubes heat, the vibrator may or may not hum, but no signal is reproduced. This failure will be due to a shorted or open antenna connection to the set, defective vibrator or tubes, or an open or shorted connection within set. Proceed as follows:

A. If vibrator is not functioning (humming) replace vibrator. If known good vibrator does not function, replace original vibrator and remove set for bench repair.

B. Check to make sure signals are getting to receiver by inserting a wire, long enough to reach outside of the car (equipped with a Deleo male connector), into the antenna socket of the set. If signals are received, look for:

1. Damaged insulator bushings in the antenna socket or lead.

2. Shorted or broken lead in wire, due to kinking or a sharp bend in the lead.

3. Loose or broken connections at lead to antenna.

4. Check for water in the Vacuum Aerial cylinder by pulling up the antenna rod rapidly by hand. Presence of water will be indicated by small drops forming on the rod just above the insulator. This will cause fading and weak reception.

C. Check tubes to see if they are lighted or warm. Check rectifying tube first; if cold, replace. If all tubes are warm, remove tubes and replace with a set of known good ones or test in a tube tester, replacing those that are defective.

If the trouble is not located, the receiver must be removed from the car for bench repairs.

3. Intermittent

Intermittent operation is the most difficult trouble to locate unless the car is brought in when the set is not functioning. In cases of intermittent complaint, the owner should be contacted and as accurate a history of the failure as possible be obtained to guide in diagnosis. Intermittent operation is caused by:

A. Intermittent short or open connection in antenna lead-in or lead-in connectors.

B. Intermittent tube failure.

C. Intermittent vibrator failure.

D. Intermittent open or short in wiring or component part within the radio set.

The first step is to analyze and check to try to duplicate the intermittent operation of the set while still on the car. Proceed as follows:

A. Check antenna lead-in for possible open or short circuit of lead to ground by twisting or moving the lead about in the car with the set operating.

B. Check antenna for intermittent contact by tuning to a weak station and raising and lowering the antenna by vacuum. If the station cuts out intermittently either in the process of raising or lowering, in the fully extended position or fully collapsed position, it is evidence of dirty contact springs or water or both in the aerial tube. Check further by fully extending the aerial, both manual and vacuum, and oscillate the aerial rod by flipping. If the set is scratchy or cuts out as the antenna comes to rest, the contact springs are weak and/or dirty. Disassemble the antenna, clean out the water, clean off contacts and bend slightly to increase contact pressure (replace if necessary).

When reassembling the antenna, care should be exercised when inserting the antenna rod and piston so that the leather piston washer is not damaged by the threads on the cylinder.

C. Check vibrator for intermittent failure by turning set on and off 15 to 20 times about 5 seconds apart. If vibrator fails to function at any time, replace.

D. Check tubes for intermittent failure by tapping with the butt end of an insulated screwdriver while set is operating. If under tapping any tube shows up as noisy, scratchy, or cuts out, replace.

If these tests fail to reveal any intermittent operation of the set, remove the set from the car for further diagnosis.

4. Weak

A weak radio operates normally in all respects except its volume is below standard. This type of failure is due to incorrect adjustment of antenna trimmer, an open connection in the antenna lead-in, defective vibrator, defective tubes, misalignment, or a failure within the set proper. Check as follows:

A. Check antenna trimmer adjustment and make sure it is properly set, referring to instructions for the particular model radio.

B. Check antenna lead-in and antenna proper for open connection, as described under "Intermittent," paragraphs A and B above.

C. Check vibrator by replacing with known good one.

D. Check tubes by tapping with butt end of insulated screwdriver. If a tube shows up as noisy, or if while tapping the volume increases to normal, replace that tube. If this test fails to reveal bad tube, replace all tubes with known good set or test in the tube tester.

If set is still weak, remove for further diagnosis and repair.

5. Noisy

Most complaints of noise are caused by ignition radiation due to faulty installation. The first step is to determine the kind of noise and to trace the source. This can be discovered by making a road test. Try the radio tuned on and off station, with the engine of the car running and off, and with the car in motion and standing still.

If the noise is constant with the engine running, standing still or in motion, but absent with the engine off, whether standing still or in motion, it is IGNITION or HIGH TENSION RADIATION.

If the noise is present when the car is in motion, engine off or on, but absent when the car is standing still, whether the engine is off or on, it is WHEEL or TIRE STATIC.

If the noise is present with the engine off or on and the car in motion or standing still, it

is ELECTRICAL, or within the radio receiver or its connection.

After the kind of noise is determined, the next step is to correct it, using the following procedures as a guide. For simplicity, this section on noise has been divided into three parts: A. Ignition Radiation; B. Wheel or Tire Static; C. Electrical Noise.

A. Ignition Radiation. Ignition radiation is electrical interference generated by the ignition system of the automobile engine, and can get into the radio in two ways:

1. Through the battery circuit via the power connection or "A" lead to the receiver, known as Primary or Backway Radiation, or

2. Through the antenna system, known as Secondary Radiation.

To determine presence of "Backway" interference remove the antenna plug, insert a shielded dummy antenna of proper capacity (see Service Bulletin on model radio involved) into the antenna socket and check for noise with volume control fully on, local-long distance switch (if so equipped) on distance side, tone control at maximum treble position, and with the engine running.

Secondary Radiation into the antenna system is a broad problem and is the common cause of ignition noise complaints for all series. Proceed as follows to correct:

1. Make certain ignition suppression has been installed as directed in the manual and instruction sheet for the model involved.

2. Inspect the engine ground straps to see that they are bolted tightly in place and contact surfaces are free from paint and dirt.

3. Check antenna lead-in shield and make sure the clip is making good contact to ground. (Make sure hood is closed when making antenna tests, to prevent radiation from ignition system.)

4. Check the points at which the radio is attached to the dash and instrument panel to make sure good ground contacts are obtained at each point. It is unnecessary to scrape paint from metal if shakeproof washers are next to metal surface, as their sharp edges will cut throught paint and establish a good bond contact.

5. On some cars the hood, side panels, and fenders may not be grounded sufficiently to shield the ignition system from the vacuum antenna. This is due to variations of paint thickness between points of metal to metal contact in the hood, side panel and fender assembly. This permits the hood and side panels to become a radiator instead of a shield. This may be determined by inserting a shielded dummy antenna of 35 mmf. capacity in the radio set. If the noise has disappeared, the interference is undoubtedly radiated into the antenna. To correct, remove the various parts to which the side panel and hood are attached, scrape away the paint from the points at which they contact the body or install an external lock washer between these points. This will result in a uniform ground potential throughout the hood and side panels, thereby acting as a shield. The most important points of good ground contact are—hood to body through hinges, side panel to body through rear mounting bracket and side panel to radiator shell through front mounting bracket.

6. If noise is still present, bond the motor block to the dash or fire wall, and bond the transmission housing to the floor pan. Make the bond leads as short as possible, using heavy ground straps and attach to sheet metal by using self-tapping screws and flat washers. Make sure the paint and dirt is removed from points of contact.

In case some ignition radiation is still present, go over the procedures taken so far, to make sure no error has been made.

B. Wheel or Tire Static. Wheel or tire static is reproduced in the radio speaker as an almost continuous roaring sound, resembling somewhat heavy atmospheric static. The intensity of the static does not vary appreciably with car speed, and increasing the car speed has but slight effect on the loudness of the interference. Generally, the noise is greater on a dry, sunshiny day and is oftentimes hardly noticeable on a humid or rainy day. The noise varies considerably according to the construction of the road. It is usually greatest on an asphalt highway, less on a concrete surface and practically unnoticeable on either gravel or dirt roads. This noise will also vary as the wheels of the car pass from dry spots to damp or wet spots, such as found after showers on the streets.

Wheel static is due to an electrostatic charge being built up in the wheels of the car and accumulated until the leakage to the car body or to the ground from the tires is sufficiently high to be radiated into the car antenna where it is audible above the level of the signal being reproduced. It is caused by the flexing of the tires in contact with the road and also by the air friction of the wheels, tires and body.

Another form of wheel static is caused by irregular wearing of the brake lining. This form of wheel static, however, is different in sound as it "clicks" or "pops" whenever the high spot of the brake lining contacts the drum.

Occasionally brake static is confused with a popping sound noticeable in some cars when the brake pedal is depressed. This is invariably due to the electrical contact of the stop light when the brakes are applied. This should not be objectionable, but if the owner complains it can be corrected by putting a condenser across the stop light terminal.

If wheel static, either tire or brake or both types, is present first check the static eliminators in both front and rear wheels. Static collectors are provided in the radio kit for installation in the front wheels of Cadillac cars. Rear wheel static collectors are standard equipment on all late model cars.

Make sure the static collectors are properly installed, making good contact, and free from grease. If the noise is due to brake static only, the correction is proper adjustment of the brakes. If static collectors are all functioning correctly and wheel static (not brake static) noise is still present, it may be one of the rare cases where the tires are extremely susceptible to the formation and accumulation of static.

First, try cross-interchanging the tires. Move the left front to the right rear and the right front to the left rear, etc.

If still unsatisfactory, dismount all tires and tubes, clean inside of tires and tire sidewalls with naptha or high test gasoline, and paint tire sidewalls and beads with a conducting paint mixed from 1 pint naptha, 8 ounces powdered graphite and 1½ ounces patching cement. Do *not* permit paint to get on tubes or inside of casings.

Also, clean inside of rim flanges and rim ledges, removing all paint, dirt and rust with a wire brush and gasoline and apply the conducting paint. Do not remount the tires until the paint is dry.

C. Electrical Noise. Electrical noise in radios can usually be classified as one of the following types:

1. Intermittent frying or crackling
2. Constant frying or crackling
3. Constant hum or buzz
4. Intermittent squeals or howls
5. Rattling or buzzing on sounds of certain pitch.

For simplicity in diagnosing point of failure, each type of noise is covered separately.

1. *Intermittent frying or crackling* is caused by a loose connection in the antenna circuit, loose elements in tubes, or a loose connection in the radio receiver. Check the antenna lead-in by moving the lead-in while the set is tuned to a station. Check tubes by tapping with the butt end of a screwdriver. If noise is intensified or stopped, replace the tube. If noise is still present, remove radio and take to workbench.

2. *Constant frying or crackling* is caused by bad vibrator, tube or open or shorted condensers. Replace vibrator. Check tubes by tapping with butt end of screwdriver. If tapping reveals no failure, replace complete set of tubes. If noise is still present, remove radio and take to workbench.

3. *Constant hum or buzz* is usually caused by a noisy vibrator, but oftentimes by tubes or open or shorted condensers. Replace vibrator. Check tubes by tapping with butt end of screwdriver. If tapping reveals no failure, replace complete set of tubes. If noise is still present, remove radio and take to bench.

4. *Intermittent squeals or howls* are sometimes caused by tubes, but are usually open or short circuits within the receiver. Check tubes by tapping; if no failure revealed, remove receiver and take to bench.

5. *Rattling or buzzing* on sounds of certain pitch is caused by a loose part either on the instrument panel or in the radio case, vibrating with the frequency of the note. Check instrument panel for loose parts. Check case cover to make sure it is tight. Remove case cover and make sure tubes and vibrator are tight in sockets. If noise is still present, inspect speaker screen. If screen is pushed in or too close to speaker, pull away carefully with a hooked piece of wire. If these steps do not correct rattle, take set to bench.

Technical Trouble-Shooting

In the foregoing sections, that portion of radio servicing which can be performed by the non-technician has been covered as thoroughly as possible. In the following section, technical radio servicing is covered, beginning at the point where the set is taken to the bench after tests in the car fail to reveal the trouble.

The following information offers the basic procedure to guide and direct the trained Radio Technician in diagnosing and correcting troubles that occur within the radio chassis proper. These procedures deal with bench testing and repair of the radio off the car. The same five classifications of failure are followed as in the non-technical section, namely: 1. Dead; 2. Inoperative; 3. Intermittent; 4. Weak; 5. Noisy.

1. Dead

A. Check "A" line lead from connector to On-Off switch in radio set.

B. Check switch.

C. Check connection from switch to vibrator transformer.

2. Inoperative

A. Check tubes.

B. Check audio system with speaker connected by introducing a low frequency signal into the first grid of the audio stage. This may be done by touching the grid of the tube with a test prod or metal screwdriver, or if an audio oscillator is available, introduce a signal from the audio oscillator.

C. Check the I.F. system by applying a signal of the proper frequency to the grid of the first detector. Refer to Service Bulletin on the specific model on which the failure occurred.

D. Check the R.F. system by applying a signal of broadcast frequency to the grid of the R.F. tube and then to the antenna terminal. By this method the point of failure may be located, and with reference to the Service Bulletin on the particular model receiver, the trouble can easily be corrected.

3. Intermittent

Intermittent operation is caused by intermittent tube failure, intermittently open or shorted connection, intermittently open condenser or resistor, or sticking vibrator. When checking for intermittent operation it is desireable to use an 8-volt storage battery, as the condition will show up more quickly. Use a heavy lead from set to battery, so that the voltage drop will be negligible.

A. Check tubes.

B. Check all wiring connections carefully, using procedure detailed under "Inoperative" in preceding paragraph.

4. Weak

A. Check tubes.

B. Check vibrator.

C. Check I.F. and R.F. alignment, referring to alignment procedure in Service Bulletin for specific model radio being tested.

5. Noisy

Noisy operation due to defects within the radio chassis will fall within one of the following classifications:

A. Vibrator hash.

B. Vibrator hum—electrical.

C. Vibrator hum—mechanical.

D. Oscillation (squeals, howls, motorboating).

E. Distortion (tone distortion, scratchiness, etc.)

F. Case and speaker rattles.

The following procedures should be followed to determine point of failure and correction.

A. Vibrator hash. Check vibrator. Check tubes for heater to cathode short. Check primary filter circuit condensers for open or loose grounds. Check ground connection for loose or open connections. Check buffer condenser. Check rectifier tube.

B. Vibrator hum—electrical. Check tubes for shorted elements. Check electrolytic filter condensers for open or intermittent circuit. Check buffer condenser for intermittent open circuit.

C. Vibrator hum—mechanical. This trouble is due to excessive mechanical vibration of the vibrator unit proper which resonates at case frequencies, or loose vibrator mounting, causing parts to vibrate excessively. Correct by replacing vibrator or tightening vibrator mounting if loose.

D. Oscillation. High frequency oscillations are high pitched whistles and are usually heard when tuning across signal and vary in pitch as the station is tuned to resonance. They are caused by the R.F. tubes oscillating. Check tubes. Check for open or shorted condensers in the R.F. circuit. Check for loose connections (causing intermittent oscillation).

Low frequency oscillations are medium and low pitched howls constantly heard, not affected by tuning through a signal and not greatly affected by volume control. This is caused by an open condenser, usually electrolytic, in the cathode circuit of the first audio stage. Check audio driver and output tubes. Check electrolytic condenser across cathode circuit of first audio stage. Check resistor or condenser in screen circuit of first audio stage if equipped with pentode tube.

NOTE: Even though replacement of tube eliminates howl, always check electrolytic condensers for possible open circuit, as new tube may draw more current, thereby causing higher voltage across electrolytic condenser. TEMPORARILY correcting open circuit in condenser.

Very low frequency oscillations, or motorboating, are constant and are almost always caused by an open grid return circuit. Trace complete grid return circuit until open is found, referring to schematic wiring diagram of the particular radio model.

E. Distortion. Tone distortion includes scratchiness as well as definite tone distortion. Scratchiness is usually caused by a defective tube, loose connection, dirt in tuning condenser, or loose parts. If set is scratchy momentarily when jarred, check tubes for loose elements, then check for loose connection of component parts by jarring individually with set operating.

If tone is definitely distorted, check for defective tube, check for loose voice coil in speaker, check for voice coil leads rattling against cone, check for voice coil rubbing pole pieces, and check for short or open condenser or resistor.

An Adventure With Electrons

BY L. J. MARKUS

Technical Editor

SUPPOSE a friend told you that the whole world and everything in it is made from only two different extremely small particles called *electrons* and *protons*, and that these two tiny particles are responsible for all the wonders of electricity and magnetism. Suppose further that you have an inquisitive nature, and decide to investigate for yourself.

You take a small piece of rock and pound on it again and again with a good heavy hammer. Your rock breaks into smaller and smaller pieces – into pebbles, grains of sand, and finally into powder. You secure a powerful microscope, and pound with a smaller hammer while watching the particles of rock powder split up under the microscope. The powder becomes so fine that you can't even see individual particles with the microscope, but still you are not satisfied.

Recalling that a nearby university has a huge atom-smashing machine called a *cyclotron*, you go there, and ask the atom-smashing scientists to break up a particle of your rock powder into electrons and protons.

Let us suppose that you arrive just before the start of a network broadcast which is to describe to radio listeners the smashing of atoms with this cyclotron. You quickly tell your story, and the scientists agree to use your rock as their subject.

They place the speck of rock on the target of the atom smasher. The head scientist announces that he is ready to start the bombardment, the radio operator at the controls gives the signal that they are on the air, and the announcer begins:

"Today, in this great university laboratory, we are going to watch a group of scientists bombard a piece of ordinary rock. They'll be using projectiles which are too small to be seen, but travel 35,000 times faster than a rifle bullet! We're ready to start! Everybody has moved back a safe distance, because tremendously high voltages will be used. There's the signal! Hear those big automatic switches clang shut! The bombardment is on!

"All we can see from here is a bluish-lavender stream of light coming through a mica window, but it's not ordinary light. If you were to hold your hands in that light, they'd be burned as badly as by a blow-torch.

"Dozens of sensitive instruments are telling these men what's going on inside the cyclotron—telling things which no human eyes could see. And they've made a hit—a direct hit!—It has shattered that particle of rock into a million pieces! They've broken it up into *molecules* of rock, all alike and so small you could string a million of them in a straight line across the dot of the letter *i*. These scientists now have the smallest particles of that original rock *which are still rock*. We're not through yet, though. The machine is still running, and now those invisible projectiles are being concentrated on a molecule of that rock.

"It's another direct hit, right on the molecule! They've smashed it into *atoms*—yes, into several different kinds of atoms!

"The men are making adjustments rapidly, and watching their instruments even more closely. Now they're gunning for an atom. It's a pretty small target to hit, and so tough that nothing but a direct hit will smash it up. Mr. Scientist,

won't you come over here for a few minutes while we're waiting, and tell our audience about atoms?"

"Gladly, Mr. Announcer. That molecule we had a few minutes ago was made up of a half dozen or so atoms, some alike and some different. You know, there are only ninety-two different kinds of atoms in this world of ours. Each belongs to one of the ninety-two different pure materials which we scientists call ELEMENTS. The atoms for any one element are all alike, but atoms for different elements are unlike.

"Things like iron, copper, mercury, silver, aluminum, hydrogen, and oxygen are elements. Rocks, table salt, brass, solder, and water are mixtures of pure elements called COMPOUNDS or ALLOYS. For instance, table salt is a compound made from atoms of sodium and chlorine in equal numbers. Water is a compound containing two atoms of hydrogen for each atom of oxygen. Brass is an alloy of copper and zinc.

"Here's an interesting fact which few people realize. If we took particles of every different material in the world and split them up just as we're done for this piece of rock, we'd have left only a collection of those ninety-two different atoms. But we can go still further, and smash up these ninety-two different atoms so that we have ONLY TWO different kinds of particles left, ELECTRONS and PROTONS. That's what we're trying to do now with one of the atoms from that rock."

"Thank you for this interesting information, Mr. Scientist. But what's that the men are saying?—Yes, it's a perfect hit on that atom! Today must be our lucky day, because with one shot they're knocked out both of those particles about which you've just learned. They have succeded in getting electrons and protons by themselves!

"Ladies and gentlemen of the radio audience, we have witnessed today a remarkable demonstration of modern science. We have taken a piece of matter—a particle of rock which an inquisitive radio student has brought in. We have divided it into smaller and smaller particles, until finally we arrived at those two different particles, the *electron* and the *proton*, from which everything on this earth is made.

"Here's our scientist again. I'm sure he has something interesting to tell you about these electrons and protons."

"I certainly do, Mr. Announcer. My first believe-it-or-not fact is this: Every atom normally has the same number of electrons as it has protons. Some atoms have only one electron and one proton. Many of you know that I'm speaking now of the hydrogen atom. The proton is the bigger of the two, and is always in the center of this hydrogen atom. The much smaller electron is revolving continually around the proton at terrific speed.

"Atoms of other elements are more complicated than the hydrogen atom, but in every single one the protons are grouped with some of the electrons in the center to give what we call the NUCLEUS. The rest of these electrons revolve around this nucleus at great speed.

"Electrons are strongly attracted to protons. We scientists know that the electron is the smallest negatively charged particle in the world, and the proton is the corresponding smallest positively charged particle. Frankly, some of us think electrons attract protons for the same reason that girls attract boys—because they are different and exactly opposite.

*"In our work, we don't care so much about what's in the nucleus; it is the electrons which are outside it, whirling around and at the same time spinning like tops, which give us electricity, give us magnetism, give us radio.**

"Yes, the electrons which we can knock out of atoms with this machine are exactly like the electrons which are dancing back and forth through the copper wires of this radio system. It is electrons which make it possible for radio men to bring my words to you and millions of other listeners today."

This story about the student who went hunting for electrons didn't actually happen, of course—nor are atom-smashers being used in exactly the way just described, but the story does serve to bring out some facts which will help you to understand the fascinating actions of electrons at work in radio circuits. Let us review these facts so as to fix them clearly in mind.

Everything on this earth can be broken up into tiny particles called *molecules*, and these are the smallest particles which still retain the characteristics of the original material. When we break up the molecules of any material, we get *atoms* of one or more of the ninety-two different kinds of pure *elements*. Each of these ninety-two elements has its own kind of atom. Finally, when we break up an atom, we get *electrons* and *protons*, the two kinds of particles which make up the entire world. The electron is the smaller of the two, but is so full of life and activity that it gives the electricity and magnetism which make radio possible.

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*Scientists now believe that each proton in the nucleus of an atom can be divided into two smaller particles: 1. The *positron*, which is like the electron but has a positive charge; 2. The *neutron*, which is an uncharged particle almost as large as the proton. Since the positron and neutron have no practical importance in radio, we can neglect them.

The Service Forum

Conducted by

J. B. Straughn, N. R. I. Service Consultant

Send in your service notes. We will re-word them for publication. To qualify your note for the NEWS *you must have observed the same trouble on two or more identical receivers.*

ARVIN MODELS 19, 29 AND 39 — **MOTOR NOISE**

If motor noise is heard with the antenna disconnected, remove the radio chassis front cover and sandpaper the rim of the cover. This will remove any grease which may be present and any paint which is sometimes found on the inside rim of the top covers or speaker front. Due to the lack of a good ground on this unit, it will pick up motor noise and this in turn will get directly into the receiver circuits.

—n r i—

ARVIN MODELS 19, 29 AND 39 — **NOISY WHEN TUNING**

This is due to dust and dirt collecting in the bearings of the tuning condenser with a resultant rasping noise when tuning between stations. To eliminate the trouble, install two additional ground wiper springs in each condenser. These are to be inserted in the extra slots provided by the manufacturer in the condenser rotor shaft. The method to use is: First loosen the serial number plate mounting screws and remove the number plate bracket. Then remove the 6K7G and 6A8G tubes alongside of the tuning condenser. Disconnect the three ground clips off the edge of the case and lay the tuning condenser back in a position so that additional springs may be inserted. Slip the two springs into the slots and place the receiver back in operation.

—n r i—

ARVIN MODEL 17 — **DEAD AT LOW FREQUENCY**

Try another 40,000 ohm resistor in series with the oscillator screen as the resistor sometimes increases in value.

—n r i—

ARVIN MODEL 6 — **OSCILLATION**

In those chassis bearing a serial number between 85001 and 88001 oscillation between 1100 kc. and 1500 kc. is sometimes encountered. The condition may be corrected by placing a 20,000 ohm ¼ watt resistor in the B+ lead to the oscillator. Also, connect a .002 mfd. condenser from the B+ lug of the oscillator coil to ground. This will eliminate parasitic oscillation.

AIRLINE MODEL 1955 — **INTERMITTENT**

This is often due to opening up of the .01 mfd. feed-back condenser connected from the plate of the oscillator tube to the oscillator coil. Even if wiggling the condenser will not make the action occur, try another condenser. The condenser should be rated at 600 volts.

—n r i—

AIRLINE MODEL 62-451 — **NOISY**

If noisy reception and lack of tuning indicator action is observed, check the shielded lead from the condenser gang to see if it is touching the aluminum shield on the underside of the chassis. You may tape this lead so that it no longer shorts.

—n r i—

AIRLINE MODEL 62-207 — **NOISY AND DISTORTED**

Check for leakage in the three .05 mfd. 180 volt condensers. Two of these condensers associated with the R.F. choke used in the filament circuit of the R.F. tubes are the ones most likely to cause the trouble. For replacement purposes you may use a condenser with a higher working voltage to avoid any possibility of repetition of this difficulty.

—n r i—

AIRLINE MODEL 62-203 — **NOISY WHEN TUNING**

This is generally due to a lose shaft bearing in the manual tuning control. To correct the trouble loop one end of a small coil spring over the control shaft on the outside of the chassis pan and pass the spring through the nearby hole which is already stamped in the chassis. Then loop the other end of the coil spring over the shaft on the inside of the chassis pan. This holds the shaft tight against one side of its bearing surface and in this way eliminates the noise.

—n r i—

FERGUSON MIDGET — **DISTORTION**

In Ferguson midget receivers utilizing a 25A6 output tube, distortion after a few minutes of operation frequently may be traced to the grid leak in the 25A6 stage. Sometimes measures as much as 2 megs. Replace with a ½ megohm resistor.

(Page 26, please)

N.R.I. ALUMNI NEWS

NOMINATIONS FOR 1942

MEMBERS of the N.R.I. Alumni Association, we are again called upon to select candidates for offices in our organization. This is in accordance with our Constitution which provides that two months prior to January 1 of each ensuing year, nominations for the various offices shall be called for from the membership through the columns of NATIONAL RADIO NEWS.

The two candidates receiving the highest number of votes for each office shall be declared nominated and their names shall be submitted to the membership in the next issue of the News, for the election of one to take office on January 1.

Our Constitution provides that all present officers may be candidates to succeed themselves, except the President. In order that the honor of holding office in our organization may come to a greater number of our members the term of office for the President is limited to one year.

This means that Dr. George B. Thompson of Los Angeles will retire as President on December 31. Dr. Thompson served as Vice President for several terms before being elevated to the office of President. A busy physician, with the degrees of B.Sc., M.S. and M.D., he nevertheless has found time to complete twenty-three home study courses. Many of these courses were along the lines of his profession; others were of a scientific nature, such as Radio.

Dr. Thompson was ideally fitted for the office of President of our organization. It will be difficult to find a man who as nearly typifies the friend of the home study student. An outstanding citizen in his community, a great American, Dr. Thompson has honored us as our President during the current year.

You are now called upon to choose the man you would like to have for President in 1942. Vote for anyone you please. The only qualification is that he be a member of our Alumni Association. You may wish to vote for some officer of a Local Chapter or you may decide to vote for some one of the many fine members whose names appear on the opposite page. These names are given to you merely so that you may have a wider choice. Unfortunately, we can give you only a few names in order to include each state and province. Do not hesitate to vote for some one whose name does not appear here, if you wish to do so.

You may wish to choose your candidate for President from among our Vice Presidents. Ed Sorg was formerly Chairman of Chicago Chapter and would make an ideal President. F. Earl Oliver for many years has been Secretary of our Local in Detroit and is worthy of the honor. Al Stock is former Chairman of New York Chapter where he is very popular with the members. Pete Dunn is a pillar in Baltimore Chapter, a past President of our Alumni Association and again eligible for the office.

Secretary Lou Kunert, of New York Chapter, also will get plenty of votes. Kunert has been doing his job in a manner which has won great admiration at Headquarters. His reports are prompt, his every act indicates efficiency and he shows real executive ability.

John Stanish, Chairman of Detroit Chapter, ran for President against Dr. Thompson last year. He is a capable man worthy of your confidence. Irving Gordy, Chairman of New York Chapter,

E. W. Gosnell, Chairman of Baltimore Chapter, Norman Kraft, Chairman of Philadelphia-Camden Chapter and Stanley Lukes, Chairman of Chicago Chapter also will receive strong support.

Eight candidates for Vice Presidents will be placed in nomination, four to be elected. All present Vice Presidents may be re-nominated.

Charley Fehn, for several terms Chairman and now Treasurer of Philadelphia-Camden Chapter was nosed out for Vice President last year. He has been loyal to our organization through thick and thin and is due for a National Office.

Earl Merryman is a candidate for re-election as Secretary and L. L. Menne is a candidate for re-election as Executive Secretary. Merryman has been Secretary since the Alumni Association was organized in 1929, and is a favorite with our members. Menne takes care of the executive duties of the Alumni Association at Headquarters and also serves as Editor of National Radio News.

In order that our members may have a wide list of candidates to choose from we are submitting a list of names of members located in various parts of the country. These are submitted merely to be of assistance to you. Any member of the Alumni Association may be a candidate for office. Use ballot on pages 29 and 30.

Allen McCluskey, Birmingham, Ala.
Carl E. Slater, Coolidge, Ariz.
Roy Bryan, Ft. Smith, Ark.
C. F. West, San Francisco, Calif.
R. H. Rood, Los Angeles, Calif.
William Sawyer, San Francisco, Calif.
John Jerry, Aurora, Colo.
A. H. Wilson, Leadville, Colo.
M. E. Perkins, Bristol, Conn.
George W. Howell, Wilmington, Del.
J. J. Jenkins, Washington, D. C.
Clyde D. Kiebach, Washington, D. C.
Henry H. Heflin, Washington, D. C.
W. A. Bunch, Miami, Fla.
W. P. Collins, Pensacola, Fla.
M. J. Sires, Jr., Atlanta, Ga.
Oliver B. Hill, Moscow, Idaho
Justus R. McKendrick, Rupert, Idaho
Edward Sorg, Chicago, Ill.
Harold B. Bailey, Peoria, Ill.
Earl Bennett, Evanston, Ill.
Lowell Long, Geneva, Ind.
Henry A. Knoop, Hobart, Ind.
Leonard E. Close, Mt. Pleasant, Iowa
Harry Laborde, Perry, Iowa
William B. Martin, Kansas City, Kans.
Elmer Dyer, Salina, Kans.
Thomas J. Holian, Covington, Ky.
O. M. Davidson, Jr., Ged, La.
Calvin Authement, Houma, La.
Robert Beaule, Lewiston, Maine
John S. Grasser, Baltimore, Md.
J. B. Gough, Baltimore, Md.
I. A. Willett, Govans, Md.
Omer Lapointe, Salem, Mass.
Robert F. Kirkcaldy, Springfield, Mass.
F. E. Oliver, Detroit, Mich.
J. Stanish, Detroit, Mich.
Frederick Gaul, Freeland, Mich.
Lloyd R. Olson, Minneapolis, Minn.
William Radke, Linesboro, Minn.
Al. Fisher, Clarksdale, Miss.
Raymond F. Knoepfler, St. Louis, Mo.
Sidney E. McArthur, Great Falls, Mont.
R. H. Cordes, Omaha, Nebr.
C. D. Parker, Lovelock, Nev.
E. Everett Darby, Woodsville, N. H.
John Stein, Union City, N. J.
Wm. Prescott, Rochelle, N. J.
James E. Graham, Carlsbad, N. M.
T. J. Telaak, Buffalo, N. Y.
A. E. Stock, Brooklyn, N. Y.
Howard D. Leitten, Buffalo, N. Y.
Allen J. Learned, Syracuse, N. Y.
L. J. Kunert, Middle Village, L. I., N. Y.
Charles W. Dussing, Syracuse, N. Y.
C. C. Cobb, Winston Salem, N. C.
L. E. Bruce, Jr., Raleigh, N. C.
Arvid Bye, Spring Brook, N. Dak.
Frank Moore, Portsmouth, Ohio
Jacob J. Knaak, Cleveland, Ohio
Guy M. Long, Tulsa, Okla.
Henry W. Freeman, Portland, Oreg.
Verl G. Walker, Medford, Oreg.
Charles J. Fehn, Philadelphia, Penna.
Alfred McConnell, Pittsburgh, Penna.
Harry Coleman Reed, Steelton, Penna.
Karl R. Smalley, Cranston, R. I.
James F. Barton, Greer, S. C.
Noel J. Lawson, Aberdeen, S. Dak
W. P. Brownlow, Johnson City, Tenn.
J. E. Collins, Paris, Tenn.
John E. Elsik, Temple, Texas
R. L. Southworth, Wichita Falls, Texas
L. H. Watkins, Ogden, Utah
Arthur N. Olson, Bennington, Vt.
Mahlon C. Atwood, Fredericksburg, Va.
T. E. Ellis, Richmond, Va.
Woodley C. Blackwell, Jr., Warsaw, Va.
R. F. Keil, Seattle, Wash.
M. C. McMillan, Tacoma, Wash.
R. A. Heise, Wheeling, W. Va.
William Wiesmann, Ft. Atkinson, Wis.
M. L. Githens, Casper, Wyo.
Robert Kirkham, Calgary, Alta., Canada
Alvin L. Campbell, Innisfail, Alta., Canada
John J. Cain, Vancouver, B. C., Canada
Henry H. Sutton, Flin Flon, Man., Canada
James T. Redstone, Winnipeg, Man., Canada
John T. Dixon, St. John, N. B., Canada
J. Perrin, Belleview, Man., Canada
H. V. Baxter, St. John, N. B., Canada
Aubrey W. Isenor, Lants Siding, N. S., Canada
G. C. Gumming, Smiths Falls, Ont., Canada
John R. McVity, Toronto, Ont., Canada
George A. Griffiths, Montreal, Que., Canada
E. Bergeron, Sherbrooke, P. Q., Canada
J. W. Meadwell, Saskatoon, Sask., Canada
Roy Kozak, Outlook, Sask., Canada

The Service Forum (Continued from page 23)

FIRESTONE MODEL 363-S-7402-6 — **DEAD ON BATTERIES**

This set would play perfectly on 110 volt line but when switched to battery operation refuse to operate. During the process of checking tubes, switch, batteries, etc., I noticed the pilot light was burned out. I installed a new pilot light and the set played perfectly.

n r i

FARNSWORTH ATL-50, AT-51 — **HUM**

A bad hum which is not filterable can be traced to the 6SQ7 grid lead in spring shielding. This lead is too close and parallel to the 15 mfd., 150 volt condenser (part No. 252-1). Lengthen lead on condenser and move two inches away from original position.

n r i

FARNSWORTH MODEL AT-50 — **MODULATION HUM**

Connect a .25 mfd. condenser from rectifier cathode to chassis. Low volume in audio amplifier circuit—check shielded wire connecting grid of 6SQ7 to arm of volume control for leakage between enclosed wire and shield.

n r i

FARNSWORTH MODEL AKL59 — **HUM**

Loud on phono, less on radio—line cord running parallel to radio-phono leads and switch. Dress leads further away.

n r i

FARNSWORTH MODEL AT21 — **CRACKLES**

Electrolytic action between filter condensers and clamps securing them. Remove clamps. Condensers are self supporting.

n r i

FARNSWORTH MODEL AK-76 — **FADES**

Check the .01 mfd. condenser connected from the arm of volume control to grid of first audio 6SQ7.

n r i

FADA MODEL 61-69 — **HUM**

A.C. leads from ballast to rectifier (blue-brown) too close to grid of 6SQ7GT. Lift and rearrange on opposite side of chassis.

n r i

ARVIN CHASSIS 518 — **CHECKING THE DIAL CALIBRATION**

To correct the calibration of the dial proceed in the following manner: Rotate the dial pointer to 550 kc. Then press with the thumb on the dial face above its center. Rotate the tuning knob while preventing the dial pointer from moving. This will enable the position of the dial pointer to be changed with respect to the tuning condenser and this makes it possible to readjust the calibration without removing the chassis from the cabinet.

EMERSON MODEL 338 — **WEAK**

Check for volume control ground through shaft. Replacement necessary.

n r i

EMERSON BW MODEL 231 — **HUM AT INTERVALS**

After operating for a while this set often begins to hum at intervals becoming very annoying at times. The trouble is found in the terminal strip mounted on the back underside flap of the chassis which appears to be perfectly soldered but will often have a poor electrical connection. Resoldering will remedy the hum.

n r i

EMERSON AC-DC PHONOCOMBS — **HASH IN SPEAKER WHEN OPERATED ON DC**

This is due to audio pickup from brushes, reverse motor leads to set.

n r i

EMERSON MICKEY MOUSE — **MOTORBOATING AND OSCILLATION**

A frequent complaint of this set is "motorboating" and "oscillation" when the volume control is turned upward toward maximum. To correct this trouble, replace the screen grid by-pass condenser. This is one section of the filter condenser block. The best thing is to replace the entire filter block as it will pay in the long run.

n r i

EMERSON MODEL T — **OSCILLATION**

A common complaint of this set is "oscillation" when the tuning condenser is rotated and when the set is jarred. The tuning condenser in this set then is usually not making a good mechanical connection to the chassis. Simply bonding the tuning condenser to the chassis will eliminate this trouble. Also check the filter and cathode condensers for possible defects.

n r i

EMERSON MODEL U6-D, J106 — **HUM AND OSCILLATION**

Open filter condenser. Weak reception: open speaker field. Slight distortion: 15M cathode resistor of 75 may have changed to 30M or plate resistor is 2 meg instead of 500M.

n r i

EMERSON CHASSIS DL, DB, DW, FM, EC — **DIAL CORD REPLACEMENT**

For chassis using the narrow "V" shaped notch in the drive pulley, use a half turn of cord part number 6RZ-870. For chassis using the drive pulley with a broad "U" shaped groove, use a turn and a half of cord, part number 7BZ-867A. Draw the cord snugly around the condenser pulley and knot it, with no slack, near the notch in the pulley, after which the spring may be hooked to the cord and pulley. The dial face should bear against the fibre washer when finally assembled.

A Timely Message

By Geo. B. Thompson, M.D.

President, N.R.I. Alumni Association

THE fall season of the year once again is here. Millions of young men and women are returning to school. Thousands upon thousands of adults, are planning their time to continue their education through home study courses.

In the month of June of this year the public schools, private schools, colleges and universities and other schools of "degreed" standing, conferred degrees, granted graduation diplomas (I have one of these myself), merit certificates and awards and many other educational recognitions, on nearly 1,200,000 graduates. Many thousands of these will now continue to study through various plans of special instruction, practical training and self-discipline under the skilled guidance of the staff of such worth while extension schools as The National Radio Institute and many other reputable home study schools. These extension schools are training their students to do highly skilled work, and are doing much to aid the emergency program of National Defense. We salute these efficient schools as worthy nephews of Uncle Sam.

Dr. Geo. B. Thompson

The country has never been so urgently in need of the services of highly trained technicians as now. Thousands of them have patriotically answered the call to service, and have been inducted into the classifications where their skill, special training and experience have equipped them to render the best service. They have responded unselfishly and without complaining that they are leaving a comfortable home and a good job; and without clamoring for higher wages, or preferred assignments, shorter hours or better quarters for the duration of the emergency. Their answer was to their country's call. They responded without demands, reservations, negotiations, grumbles and grouches.

I am strongly in favor of high or higher wages to any workmen who are able to prove by their skill and productive ability that they are worthy of their hire. No wage is too high; no working hours are too short; and no working conditions are too good if they are commensurate with sound economics and principles of good business. But this is no time to incite discontent or drive sharp hard bargains, or obstruct and delay production, because of some disputed point, thus giving aid and comfort to our depredating enemies. Neither is this the time for charges and counter charges and squabbles between employers and employees. The great need of the hour is national unity.

If we could eliminate dumb greed and egotistical selfishness from every agreement and contract between employers and employees, we could see a cheerful rainbow of hope of peace and unity between quarreling factions, and in that rainbow of hope we could see the blending of our national colors as we listen to the Symphony Under the Stars, and hear The Star Spangled Banner as the opening and closing number on every program at every gathering; we could shout in a patriotic chorus "Peace on earth, good will toward men, with Liberty and Justice for all."

Members of the Alumni Association of N.R.I., as your president I greet you, and congratulate you as loyal patriotic American citizens. You know that you will not be able to transmute all the impure and imperfect into purity and perfection, but your inspiring efforts in the right direction will earn you the gratitude of the generation you serve. That is the spirit it takes to form the background, the backbone, blood and sinew of any Democracy that is to survive. Long after dictators and lustful destroyers of human lives are themselves destroyed, civilization will still survive—will still insure liberty, justice, peace and happiness for all, without oppression or discrimination. Our sterling type of citizenship is a legacy to be enjoyed long after the struggles and sacrifices to secure it have been forgotten. Greetings to you, men of N. R. I. May you bask in the sunshine of liberty and the full enjoyment of your own chosen, unrestricted way of life.

Here and There Among Alumni Members

We understand there is some doubt as to whether our efficient bookkeeper, Charles Alexander, will be in shape to count the ballots this year. He made a serious mistake in figures the other day when he stopped his car to pick up an old friend who wasn't an old friend after all. Boy, what a gorgeous black eye he was sporting!

———n r i———

D. E. Faulkner of El Dorado, Arkansas, sent us three new pictures of his shop. Has that fellow got a nice Radio business! He now has eleven employees several of which are N. R. I. men.

———n r i———

John Meadwell of Saskatoon, Sask., Canada also sent in some splendid photographs. A swell store, attractive window displays and at the curb—a nifty delivery truck. Mrs. Meadwell, also an N. R. I. graduate, is mighty active in the business. Perhaps that is why everything is so neatly placed.

———n r i———

Pete Dunn is back in Baltimore after a vacation at Atlantic City with the political big shots of the Monumental City. Peter is a strong booster for Mayor Jackson. The Mayor, by the way, is an honorary member of our Baltimore Chapter. He has addressed the fellows on a number of occasions.

———n r i———

H. T. Hungerpiller is now employed by the C. C. C. as Radio Instructor in Jacksonboro, South Carolina. He holds a second class telephone and a second class telegraph license.

———n r i———

W. C. Hill was made Service Manager after six weeks of employment by Todd, Hyatt and Company, St. Petersburg, Florida.

———n r i———

Peter Van Bendegom is interested in starting a local chapter in Grand Rapids, Michigan. He is in charge of maintenance of the Police Radio equipment in his city.

———n r i———

Raymond H. Ives of Norfolk, Virginia is employed by Central Radio Company, agents for Mackay Radio and Telegraph Communications equipment, Radio receivers and home appliances, Radio servicing and Intercommunication and P. A. Systems. Just about a complete line-up.

———n r i———

Alton H. Philbrick writes from an Army post that he is now a staff sergeant and is soon to be made a technical sergeant. Radio, in charge of communication in a searchlight battery.

Gabe Newell of Richton, Mississippi, was formerly a dredge operator. He is doing much better in Radio work now and his business is growing right along.

———n r i———

J. O. Starr, informs us he now holds a second class Radio telegraph and also amateur license, W3JFW. He is being transferred to New York where he will open a "listening post" for the Associated Press. Starr studied Radio as a hobby—now it is his vocation—and a good paying one too.

———n r i———

A. Beauchamp has a swell full time Radio business in Owatonna, Minnesota. He carries eleven contracts with stores and garages for all their Radio work. He does practically all the P. A. work in his county including City Band concerts, baseball games, football games, and the County Fair. He uses three P. A. systems.

———n r i———

Griffith Sechler is now Chief Radio operator at the U. S. Naval Air Station, Pensacola, Florida.

———n r i———

The spare time Radio business of E. J. Manosh of Whitinsville, Massachusetts has increased to such an extent he now is giving all of his time to the operation of his new shop. He also has one of his brothers working for him.

———n r i———

Edward E. Gurvey, formerly Chief Engineer for the Yankton, South Dakota Police Department is now transmitter engineer at Radio Station, KSCJ, Sioux City, Iowa.

———n r i———

Neil M. Hepburn has been made operator-in-charge at the T. C. A. station in North Bay, Ont., Canada.

———n r i———

Kenneth L. Kreider is the new control operator at WGAL, Lancaster, Pennsylvania. He also does considerable announcing.

———n r i———

Frank J. Flynn is doing Radio and Electrical installation work at the San Antonio, Texas Aircraft Depot, with Civil Service status.

———n r i———

William Kline of Cincinnati called at the Institute. He brought with him his bride of two weeks. A happy pair of youngsters who have our very best wishes.

———n r i———

Bert Salisbury, who is in the Radio business in Vallejo, California, sent us one of those dainty little cards announcing the arrival of baby Roy Dale. Congratulations Mr. and Mrs. Salisbury.

———n r i———

Charles D. Tinley is on active duty in the Signal Corps, U. S. Army, stationed in the Philippine Islands with rank of Captain.

Directory of Officers

(To Serve Until January, 1942)

President—Dr. Geo. B. Thompson, Los Angeles, Calif.

Vice-Presidents—
Edward Sorg, Chicago, Ill.
F. E. Oliver, Detroit, Mich.
Alfred E. Stock, Brooklyn, N. Y.
Peter J. Dunn, Baltimore, Md.

Secretary—Earl Merryman, Washington, D. C.

Executive Secretary—L. L. Menne, National Headquarters, Washington, D. C.

Chairmen of Chapters

Stanley Lukes, Chicago Chapter, 4364 W. 25th Pl., Chicago, Ill.

E. W. Gosnell, Baltimore Chapter, 5222 St. Charles Ave., Baltimore, Md.

Irving Gordy, New York Chapter, 1746 Bathgate Ave., Bronx, N. Y.

John Stanish, Detroit Chapter, 12551 Camden Ave., Detroit, Mich.

Norman Kraft, Philadelphia-Camden Chapter, 6 S. 8th St., Perkasie, Penna.

Philadelphia-Camden Chapter

The laurel wreath goes to our Harvey Morris who has contributed so much by way of information to our meetings. Harvey has been in the Radio servicing business for nine or ten years and we are fortunate to have the benefit of his experiences. He sure has the knack of diagnosing and locating trouble quickly. His practical demonstrations have been of special interest to all of us. Our Librarian, John McCaffrey, also has been taking a leading part in our practical work.

The Four Musketeers from Perkasie, N. J. take the blue ribbon for regular attendance in spite of the distance they must cover to and from our meetings. They are Chairman Kraft, Harold Strawn, Charley Kuhns and Norman Hafler. Bert Champ, our Financial Secretary, is another who seldom misses a meeting.

Our annual picnic was held at Willow Grove, through the kindness of Marcel Coulon, our Vice Chairman, who turned his place over to us. We had a great time.

Now that summer is over we are buckling down to bigger and better meetings. Our headquarters are still at 3622 Frankford Avenue, Philadelphia and the meeting nights, as usual, the first and third Thursday of each month.

Many of the fellows bring their radio jobs to the meetings so that we can all learn something by working out a tough one. Come and join us. You will receive a royal welcome here.

CHAS. J. FEHN, *Treasurer.*

Tear carefully along this line

Nomination Ballot

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

After the ballots are returned to National Headquarters they will be checked carefully and *the two men having the highest number of votes* for each office will be nominated as candidates for the 1942 election. This election will be conducted in the next issue of NATIONAL RADIO NEWS.

The President cannot be a candidate to succeed himself but you may nominate him for any other office, if you wish. You may, however, nominate all other officers who are now serving, for President or any office, or select entirely new ones. It's up to you—select any men you wish as long as they are MEMBERS IN GOOD STANDING OF THE N. R. I. ALUMNI ASSOCIATION. Be sure to give the city and state of your selections to prevent any misunderstanding. A list of the 1941 officers are to be found in the opposite column.

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

Your signature .....

City ..... *State* .....

(Over)

The 1942 *nomination is a very important one. Choose carefully the men you desire to handle the reins of the Alumni Association for the coming year. Let's all do our part to help the staff handling the elections, by submitting ballots on or before October* 15, 1941.

Nomination Ballot

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

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected as officers for the year 1942.

MY CHOICE FOR PRESIDENT IS

.....

City..... State..... .....

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. .....

City..... State.....

2. .....

City..... State.....

3. .....

City..... State.....

4. .....

City..... State.....

MY CHOICE FOR SECRETARY IS

....

City..... State.....

MY CHOICE FOR EXECUTIVE SECRETARY IS

.....

City..... State..... .....

Baltimore Chapter

The Baltimore Chapter has been continuing its meetings throughout the summer. We decided to forego our usual summer lay-off in order to continue our work with the experiments. Apparently the fellows don't mind the heat when they become all steamed up about Ohm's and Kirchoff's laws and the experimental proofs of each.

The new form for announcing our meetings has gone over with a bang, and to it, too, we must attribute much of the success of our summer sessions. Our hats are off to our new Publicity Editor, Mr. L. J. Arthur, who cooked the form up on his portable typewriter.

Our Chairman, Mr. Gosnell, keeps the business portion of our meetings rolling in fine order, keeps it boiled down to reports of committees, and on new business immediately assigns a committee to iron out all the wrinkles before presenting the matter to the members for a more complete discussion. Consequently, most of the plans submitted by the committees in their tentative form are accepted with a minimum of discussion so that we have a large portion of the evening for lectures and experiments.

Mr. Rathbun and Mr. Snyder are continuing with the experimental kits in fine form, conducting approximately three experiments per meeting night. A short lecture is delivered upon the theory being presented and then the theoretical data is verified experimentally. In this way the information is put across so that it sticks and becomes an integral part of our useful radio knowledge. Mr. Gosnell, our Chairman, Mr. Rathbun and Mr. Snyder have given us the type of meetings which are truly beneficial to all of us. We see evidence of this in our steady attendance.

If you can meet with us once you will want to do it again, so come on you fellows whom we haven't met, grab your hat and get down to Redman's Hall, 745 W. Baltimore Street, every second and fourth Tuesday of the month.

JOHN W. GRASSER, *Secretary.*

All Chapters Have Resumed Meetings

Some of our chapters suspended meetings during July and August. Although Chicago chapter did not hold regular meetings during those two months they did have their annual picnic. Some snapshots are reproduced on pages 31 and 32. Detroit chapter has resumed meetings scheduled for the second and fourth Friday of each month at John Stanish's place, 2500 Jos. Campau.

New York Chapter also has big things lined up for this fall. They meet on the first and third Thursday of each month at Damanzeks Manor, 12 St. Marks Place, New York City.

THE MAILBAG

Active is the Right Word

I would like to make a suggestion regarding contacts with new students. This is the method that sold me, six weeks after I had signed up. It is the method that will sell Joe, the prospect I am referring you to.

It is the N. R. News, published every two months. I was satisfied that N.R.I. provided good training in radio, but it was after I received the two issues of N. R. News that I really became sold on the school.

The same with my friend. When he actually saw Detroit has such an active Alumni Chapter, he was really convinced. So Joe says, "What the heck! I never heard of a correspondence school with an active Alumni Association. That school must be all right." You see, Chief, Joe and I are typical of many fellows. We are skeptical of advertisements, but when we witness something in action, something tangible, like the N.R.I. News, we are convinced.

WILLIAM J. PASMAN,
Detroit, Michigan.

Likes Editorials

I just received my August-September copy of NATIONAL RADIO NEWS. I think it is the best copy I have received yet. It sure "hits the nail on the head" when it comes to Radio news and helpful suggestions. Keep it up and we Alumni will greatly appreciate it. The articles of encouragement from President Smith and Vice President Haas are the best I ever read anywhere.

ERNEST H. WELLS,
Crossville, Tennessee.

Thank You, Mr. Wilcox

With the new F M sets coming in strong, and the renewed possibilities for television along with it, we should see quite a boom in the Radio business during the next few years, and we who are in now should be among the first to profit by it. You fellows down there are doing a swell job on the NEWS. Those Novel Radio Items are always very interesting, and educational, and of course the service helps and the set checking aids are the best part of all. Say, what happened to Jay and Ozzie? I thought that you promised us another of those stories.

LYNDON E. WILCOX,
Cherry Valley, New York.

Rewarded for Honest Service

I am field service manager for the Associated Radio Company of Orlando, Florida, advertised as the largest exclusive radio store in the world. We have approximately one thousand new sets on display in our store at present and are constantly increasing our stock.

Incidentally we have just received a free subscription to the "Readers Digest" as a reward for being one of the firms who did not "gyp" them as per article in their August issue.

ROBERT E. FORD,
Orlando, Florida.

How to Keep From Slipping

Quite often strange sounds would be heard coming from my shop. It was usually my cussing a slipping dial belt or cable. I found that by mixing powdered rosin with carbon tetrachloride, a coating of rosin could be applied to the belt very easily. The tetrachloride evaporates, leaving the thin coating of rosin on the belt. Maybe this suggestion will be of some use to other servicemen.

JOHN FOOTLIT,
Billings, Montana.

Let's Have More Pictures

C. B. Morehead and Clarence Schultz of Chicago Chapter sent us much appreciated letters with which they enclosed pictures taken at their recent picnic. The letters are too long to be included here but our readers will be interested in some of the photographs. Two of these are reproduced below—others are on the following page.

Roy Shine, Chief "Standing Bull"

Leo Lewandowski makes a giant sandwich

Chicago Chapter Holds Picnic

Above is a camera shot taken at lunch time.

Leo Lewandowski, waving to the camera man, Chairman Stanley Lukes, National Vice President Ed Sorg and Tom Lackner pause to drink spring water.

What! You forgot the potato salad? Bennett, the Earl of Evanston, at the extreme left, Frank Pesek in dark glasses, Leo Lewandowski, Mrs. Tom Lackner, Mrs. Leo Lewandowski and Mrs. C. B. Morehead. Mrs. Earl Bennett, Mrs. J. A. Cordero and Mrs. Carl Damphofer are in the background.

NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

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L. L. MENNE, EDITOR
L. J. MARKUS, TECHNICAL EDITOR

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