SEPT. 17
1932

BATTERY SUPER

15c
Per Copy

RADIO
REG. U.S. PAT. OFF.
WORLD
The First and Only National Radio Weekly
Eleventh Year—547th Issue

Wattage Computation

110-v or 220-v D-C SUPER

2-Tube Converter

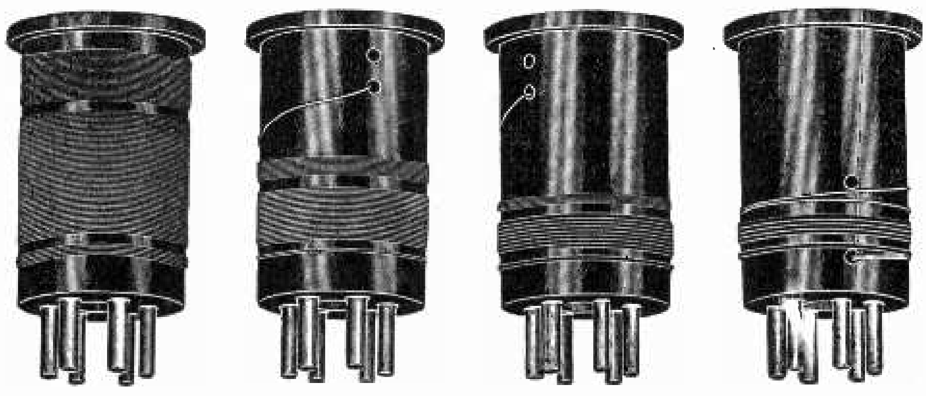
PICTURE DIAGRAM OF 4-TUBE DIAMOND

Full Scale. See Pages 12 and 13

6-Pin Plug-In Coils

200 to 15 Meters with 0.00014 mfd.

SHORT - WAVE plug - in coils with three separate windings for detector circuit produce best results as they avoid the broadness of plate-circuit tuning or the losses of r-f choke load on plate circuit due to damping. The lower winding is for r-f plate circuit, if t-r-f is used, or for aerial otherwise, the center winding is the tuned secondary, while the top winding is for feedback. The coils are accurately **wound on 1.25** inch diameter Bakelite and have a 1/16-inch flange for gripping. Thus the actual **winding need** never **be touched** when you're handling the coils, and they are suitable for calibration.



Cat. SWB—Four plug-in coils, 6-pin base; primary, secondary, fixed tickler....................$1.70
Cat. SZ—Six-spring wafer socket for use as coil receptacle for six-pin coils....................11c
Cat. SWA—Four plug-in coils, UX base, primary and secondary; primary may be used for feedback if condenser connects serial to grid....................$1.35
Cat. SX—Four-spring (UX) wafer socket for use as coil receptacle for four-pin coils....................10c
Cat. H-14—Hammarlund junior midline 0.00014 mfd. condenser with Isolantite insulation....................$1.20
Cat. H-20—Hammarlund junior midline 0.0002 mfd. condenser with Isolantite insulation. Used as feedback control....................$1.35

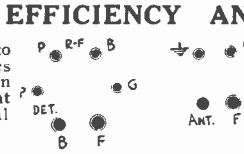
THE secondary is to be tuned with 0.00014 mfd. capacity. Using four coils. there will be sufficient overlapping of bands, also assured coverage to above 200 and below 15 meters. Also, 0.00015 mfd. may be used instead for tuning, with slightly greater overlap. Regeneration may be controlled by a 0.0002 mfd. variable condenser from detector plate to ground, or by a plate voltage rheostat or other means.

The standard six-pin tube socket may be used for coil receptacle.

For antenna stage tuning only two windings are needed, where no stage of t-r-f is included, when use SWA.

HOW TO USE THE COILS FOR HIGHEST EFFICIENCY AND SMOOTHEST OPERATION

In building short-wave receivers using our plug-in coils be careful to locate the coils so that the centers of their cores are at least 6 inches apart, otherwise in sets with t-r-f- the r-f tube may oscillate. Even if a volume control in the r-f stage controls any oscillation present the recommended separation should be maintained, otherwise a critical circuit results.



The connections to make are diagrammed herewith. Bottom views of sockets are shown. For the 6-pin coil P-B RF goes to aerial and ground if there is no r-f. Standard UX and 6-pin sockets serve as coil receptacles.

HIGH-GAIN SHIELDED-COILS FOR T-R-F

DIRECTIONS FOR BEST RESULTS

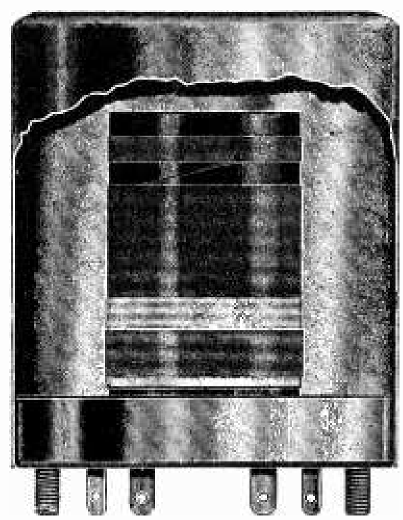
THE shielded coils for tuned radio frequency sets are supplied in matched sets of three or four, with secondary inductance equalized (plus or minus 0.6 microhenry). Thus any lack of sensitivity due to mismatched secondaries is avoided. As inductive discrepancies could not be compensated for by parallel capacity trimming, this high degree of inductive accuracy is important. Complete coverage of the wave band with the specified capacity condensers is absolutely guaranteed.

The coils may be used (set of three) for t-r-f, and with minimum value of negative bias for r-f tubes may oscillate a little at the very highest frequencies, say 1500 to 1580 kc, as they will be tuned below the broadcast band about that much. The negative bias should be increased until oscillation completely stops. Thus also selectivity is improved by heightened permanent or limiting bias.

In using four coils (three stages of t-r-f and tuned detector) each screen and plate lead should be carefully filtered, using 300-turn honeycomb coils and 0.002 mfd. or higher capacity in the filter, and the coil centers placed at least 4 inches apart.

The diameter of the form is 1 inch, the aluminum shield 2⅛ inch diameter, 2½ inches high. The shield has a small protected opening at top so the lead for the grid cap may be brought through. The opening is bevelled. This constitutes the protection against fraying the insulation of leadout wire to grid cap.

In the four-coil system, reversing connections to primary of second coil often stops oscillation in poorly filtered sets.



Cat. No. 1—Three t-r-f coils for 0.00035 mfd., 80-meter tap $1.35
Cat. No. 1-F—Four coils, 0.00035 mfd.....$1.80
Cat. No. 3—Three t-r-f coils for 0.0005 mfd., 80-meter tap $1.35
Cat. No. 3-F—Four coils, 0.00035 mfd......$1.80
Cat. DCH—Diode r-f choke, center-tapped..$ .40
Cat. 3DS—Three-deck long switch for above coils, to utilize 80-meter tap...........$2.50

80-METER TAP PROVIDED

EACH coil for the t-r-f sets has secondary tapped, so that if desired a long switch may be used to shift the tuning condenser stators to extreme of winding (200-555 meters) or to tap (80-200 meters). The tap is represented by a ground symbol stamped on the shield base. Please note ground is not to be connected to ground symbol. Grid return is the side lug inside the shield. P, B represent primary, G and side lug secondary.

The 80-meter tap does not have to be used, but is advantageous to those desiring to tune in television, amateurs, police calls, some relay broadcasting and other interesting transmissions in a band of frequencies replete with novelties for the usual broadcast listener.

High impedance primaries are used, the number of turns chosen so that the same coils may be used for antenna coupler and interstage couplers.

For diode t-r-f circuits, either full-wave or half-wave detector, a diode choke may be inserted inside the detector form. This choke has three terminals, with outleads: two extremes and center. For full-wave use two extremes to anodes of 55 or 85, center to cathode resistor. For half-wave use two extremes and ignore center tap.

Except in rare hookups the diode circuit requires an input free from grounding, and as the tuning condenser rotor and frame are grounded the choke pickup affords any potential output.

T-R-F sets using the 55 or 85 should have three stages of resistance audio, e.g., first stage the triode unit of the 55 or 85, second stage screen grid audio, third stage power tube or tubes (output).

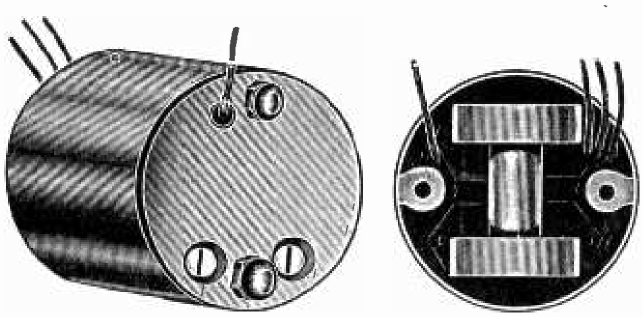
MIXER AND INTERMEDIATE TRANSFORMERS

PADDED SETS

For circuits using 175 kc. or 400 kc. intermediate frequency we have two coils for a stage of t-r-f and first detector, and accurately chosen inductance for the padded oscillator for these intermediate frequencies. There is no 80-meter tap provided on these mixer coils.

The coils are of the same type of mechanical construction as the t-r-f coils. Since there is no secondary tap, the code for connecting the t-r-f coils of the superheterodyne combination is different: P and B, primary; G and ground symbol, secondary. P would go to plate or antenna, G to grid cap, while B and ground symbol are the returns.

The oscillator has a smaller inductance secondary, for padding, and moreover is a three-winding coil. The three windings are: pickup, secondary and tickler. The pickup winding consists of 10 turns, and is brought out to two side lugs. The polarity of its connections unusually is of no importance. The secondary is represented by G and ground symbol, G going to grid and ground symbol to grid return, usually ground. The tickler connections for oscillation usually require that the lug at B be conected not to B plus but to plate, hence the P lug goes to B plus. In any case, if no oscillation results, reverse the tickler connections.



Cat. No. 4—Three mixer coils, for 0.00035 mfd. Intermediate frequency intended, 175 kc. Price includes padding condenser, 700-1000 mfd.......$1.80
Cat. No. 5—The mixer coils for 0.0005 mfd., 175 kc., 700-100 padder....$1.80
Cat. No. 7—Three mixer coils, for 400 kc; padding condenser included is 350-450 mfd. $1.80

INTERMEDIATE TRANSFORMERS

The intermediate transformers consist of two honeycomb coils, wound with low resistance wire, coils spaced 1 inch apart, and thus affording loose coupling, stability and high selectivity. Primary and secondary tuned.

Cat. FF-175—Shielded intermediate frequency transformer, 175 kc.......$1.10
Cat. FF-175CT—Same as above, center-tapped secondary, for full-wave diode detector $1.25
Cat. FF-450—Shielded intermediate frequency transformer, affording choice by condenser adjustment of frequencies from 380 to 480 kc...............$1.30
Cat. FF-450CT—Same as above, center-tapped secondary $1.45

Padding Condensers @ 45c Each

Cat. PC-710—For 175 kc intermediate. Put in series with oscillating tuning condenser. Capacity 700-1000 mmfd. Hammarlund, Isolantite base.
Cat. PC-3545—Same as above, except 350-450 mmfd. for 380-480 kc intermediate.

Cat. CH-300—A 300-turn r-f choke, inductance 1.3 millihenries $0.30
Cat. CH-800—An 800-turn r-f choke, inductance 10 millihenries..........$0.35

SCREEN GRID COIL CO.
145 WEST 45TH STREET, NEW YORK CITY

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RADIO WORLD

The First and Only National Radio Weekly
ELEVENTH YEAR

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Technical Editor

J. MURRAY BARRON
Advertising Manager

Vol. XXII | SEPTEMBER 17th, 1932 | No. 1. Whole No. 547

Published weekly by **Hennessy Radio Publications Corporation,** 145 West 45th Street, New York, N. Y.
Editorial and Executive Offices: 145 West 45th Street, New York
Telephone: *BR-yant* 9-0558

OFFICERS: Roland Burke Hennessy, *President and Treasurer;* M. B. Hennessy, *Vice-President;* Herman Bernard, *Secretary.*

Entered as second-class matter March, 1922, at the Post Office at New York, N. Y., under Act of March 3, 1879. Title registered in U. S. Patent Office. Printed in the United States of America. We do not assume any responsibility for unsolicited manuscripts, photographs, drawings, etc., although we are careful with them.

Price, 15c per Copy; $6.00 per Year by mail. $1.00 extra per year in foreign countries. Subscribers' change of address becomes effective two weeks after receipt of notice.

Battery-Operated Super

By Einar Andrews

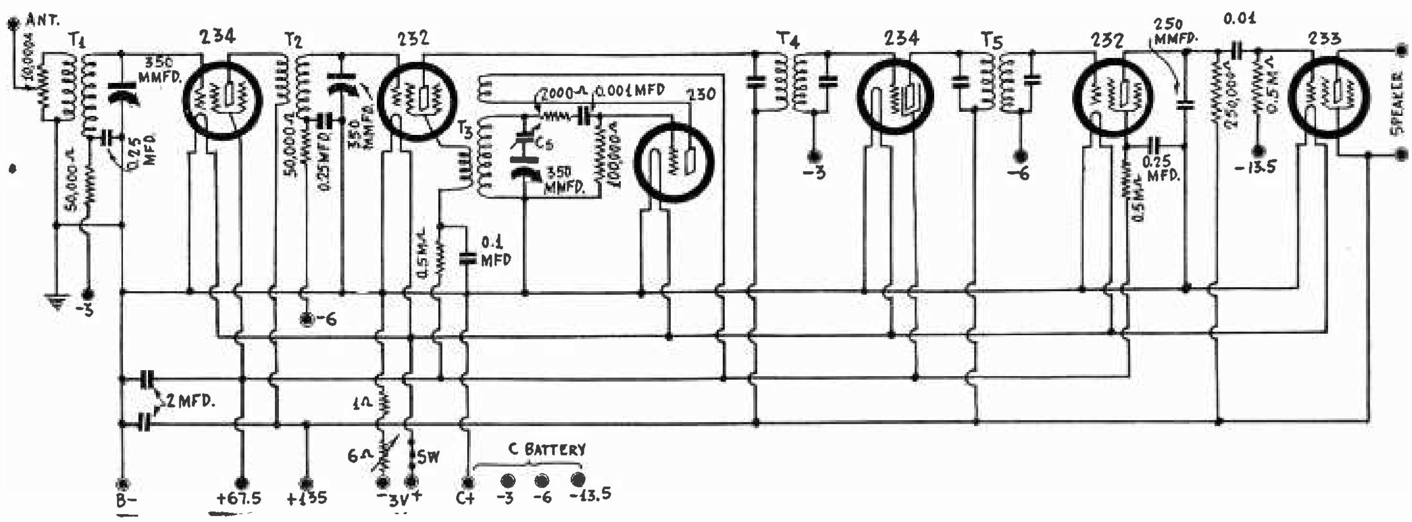


FIG. 1
A six-tube battery operated superheterodyne in which the 2-volt tubes are used throughout. Its greatest undistorted output is 650 milliwatts.

BATTERY-OPERATED receivers are not published very often now, and for obvious reasons. Wherever a-c receivers can be used battery-operated receivers is of little interest. But there are many sections of the country where there is no electricity available, and in these only battery sets can be used. Requests for battery-operated receivers are often received from these sections. Moreover, there are many who wish to take sets along with them on camping trips who either have no automobiles or who prefer to use independently battery-operated sets even in the automobile. Also, a portabl battery-operated set can be taken to many places where a car cannot be taken.

Those who want to build portable and battery-operated sets now are fortunate

(Continued on next page)

LIST OF PARTS

Coils

T1, T2—Two shielded midget coils for 350 mmfd. tuning condensers
T3—One shielded oscillator coil for 350 mmfd. tuning condenser and 400 kc intermediate frequency
T4, T5—Two shielded and doubly tuned 400 kc i-f transformers

Condensers

One gang of three 350 mmfd. tuning condensers, with trimmers
One 350-450 mmfd. padding condenser
Three 0.25 mfd. by-pass condensers
One 0.1 mfd. by-pass condenser
One 250 mmfd. condenser
One 0.001 mfd. condenser
One 0.01 mfd. stopping condenser
Two 2 mfd. by-pass condensers

Resistors

One 10,000 ohms potentiometer
Two 50,000 ohm resistors (Green body, Orange dot, black end)
Three 0.5 megohm grid leaks (Green body, yellow dot, black end)
One 2,000 ohm resistor (Red body, red dot, black end)
One 100,000 ohm resistor (Brown body, yellow dot, black end)
One 250,000 ohm resistor (Red body, yellow dot, green end)
One 1 ohm resistor
One 6 ohm rheostat

Other Requirements

One filament switch (may be part of 10,000 ohm potentiometer)
Four grid clips
Five UY sockets
One UX socket
Ten binding posts
One small metal chassis

(*Continued from preceding page*)
in that excellent and economical tubes are available. We have the 234 variable mu pentode for radio frequency amplification, the 232 screen grid tube for detection or amplification, the 232 for detection, audio amplification, or oscillation, and the 233 pentode for output tube. From these tubes we can select those which fit best the particular functions that must be performed.

A Portable Superheterodyne

In Fig. 1 we have a six-tube superheterodyne utilizing the battery type tubes. The r-f and i-f amplifier tubes are 234s, the two detectors ahe 232s, the oscillator is a 230, and the power tube is a 233.

Each of the first five tubes requires a filament current of 0.06 ampere and the last tube requires 0.26 ampere. Therefore the entire set requires only 0.56 ampere. The lowest voltage available with a dry cell battery is 3 volts, since a single cell does not give the required two volts. Hence we have to put in a ballast resistor to take up the difference between the 3 volts of the battery and the 2 volts required. The ballast should therefore drop only one volt. Thus we need a ballast resistance of nearly 1.8 ohms. However, we have to make some provision for the gradual reduction on the battery voltage. Therefore we have a fixed ballast resistance of 1 ohm and a rheostat of 6 volts. The rheostat will alos serve as a volume control and as an economizer of current.

Since the total filament current required is 0.56 ampere and since a No. 6 dry cell is rated at 0.25 ampere, it will require at least two such cells in parallel to furnish the total current. Mut it will be more economical to use three cells in parallel. Also, since the voltage of one cell is 1.5 volts and the circuit requires 3 volts, there should be two cells in series, and the battery therefore should consist of six cells, three in parallel and two such groups in series. However, where space must be conserved or when the receiver is to be worked occasionally for short periods, four cells would be all right.

It is also possible to operate the circuit on a storage battery. If there is only one storage cell, the ballast resistance should be shorted, since the entire voltage is required. If two storage cells are used the voltage will be 4 volts, but the six ohm rheostat is sufficient to take up the excess two volts. In case the storage battery has three cells, as is usually the case, and it it not desired to tap the cells, then it is best to increase the fixed ballast resistance to 6 ohms in order to reduce the danger of burning out the filaments.

Battery Bias Used

For grid bias a battery is used because this simplifies the circuit and reduces the danger of oscillation, both in the high frequency circuits and in the audio amplifier. The r-f and i-f amplifier tubes require a bias of 3 volts and therefore one terminal marked accordingly is indicated. The two detectors require 6 volts, and another terminal is provided for that. The power tube requires 13.5 volt bias, and a terminal is provided for that too. Of course, the grid returns are made directly to the battery so that no binding posts are required other than those on the battery.

There is on the market a small grid battery having a maximum voltage of 7.5 volts. Two of these batteries are required in order to provide the 13.5 volts for a power tube.

In the event there should be oscillation in the r-f or i-f amplifiers when the grid voltage is 3 volts, it may be increased to 4.5 volts by merely moving the grid returns of the two tubes in question one notch up on the battery.

As a means of preventing oscillation in the r-f amplifier a 50,000 ohms resistor is put in each of the first two grid returns, and the tuned circuit in each case is completed by means of a 0.25 mfd. condenser.

Plate and Screen Voltages

The maximum plate voltage is 135 volts, which is applied to all the plates with the exception of the oscillator. It is also applied to the screen of the power tube.

The screen voltage on the two high-frequency amplifiers is 67.5 volts. This voltage is also applied to the plate of the oscillator. The screens of the two detectors are also returned to the 67.5 volt tap on the B battery, but not directly. The detecting efficiency is higher if the screen voltage is lower, and it may be as low as 10 volts. To reduce the effective screen voltage on the detectors a 0.5 megohm resistor is connected in each lead. In the first detector the resistor is bypassed with a 0.1 mfd. condenser and in the second it is by-passed with a condenser of 0.25 mfd.

As additional means of stabilizing the circuit, especially when the B batteries approach exhaustion, one mfd. condenser isconnected across the 135 volt section of the battery and another of the same capacity across the 67.5 volt section.

The total plate current in this circuit will be about 28 milliamperes, of which will be diverted at the 67.5 volt tap. Since one-half of the B battery draws more current than th other half it would be well to rearrange the order of the batteries occasionally so that all the sections will become exhausted at about the same time. Incidentally it is permissible to apply 90 volts on the r-f and i-f screens and on the oscillator plate. If this is dont it is not necessary to change the resistances in series with the screens of the two detectors. This arrangement will give greater amplification, and at the same time it will make the drain on the two sections of the middle battery the same.

The Intermediate Tuner

The intermediate tuner consists of two doubly tuned i-f transformers adjustable to 400 kc. In order to get a high gain out of the circuit each of the four windings must be tuned to same frequency accurately, and this should be as near 400 kc as possible. It is best to use a modulated oscillator tuned to 100, 200, or 400 kc in making the adjustment. The signal is best impressed on the control grid of the first detector by running a wire from the output of the oscillator to the grid. There should be a grid leak between the grid and the chassis in order to prevent blocking. At the first signal should be strong for otherwise it may not come through, unless it should happen that the i-f circuits are approximately tuned already. When one circuit has been tuned the signal should be reduced so that it is barely audible before the second circuit is tuned. Proceed in the same way until all the circuits have been tuned.

When the i-f tuner has been adjusted the line-up of the r-f and oscillator circuits is in order. First tune in a station near the 1,500 kc end of the dial, with the gang condenser set at about six. There is a trimmer condenser across each of the tuning sections. Adjust each one for loudest signal on the selected frequency. This signal should preferably be 1,450 kc but may be any other between 1,400 and 1,500 kc. The higher the frequency selected the lower should the dial reading of the main condenser be when the trimmer adjustment is made. But if the frequency is 1,500 kc the dial setting should not be less than about 3 because between there and zero there is very little change in the capacity.

Next provide a signal of about 600 kc, either from a broadcast station or from a modulated oscillator. Throw out of the circuit everything between the first and second detectors, including the first detector but not the second. This is done simply by putting the grid clip of the first detector on the cap of the second, with an extension wire if necessary. Turn the condenser until the signal provided is heard as loud as possible. Then without disturbing the setting of the condenser put the grid clips where they belong and adjust the series padding condenser Cs until the same station comes in loudest. That completes the adjustment.

The Audio Amplifier

There is a single audio amplifier, but this is a pentode which has a high gain. It is coupled to the 232 detector with a 250,000 ohm plate resistor, a 0.01 mfd. stopping condenser, and a 0.5 megohm grid leak. The maximum undistorted output of the 233 is 650 milliwatts and this will be obtained with a peak signal voltage of 13.5 volts.

For loudspeaker a magnetic dynamic should be used, that is, a dynamic speaker with a permanent magnetic field. However, a magnetic speaker can also be used, but better desults will be obtained with the dynamic. An electro-dynamic speaker is not suitable because there is no way of getting the field current. To take it from the B battery would be too expensive since more current would have to be drawn for the speaker alone than for the rest of the set.

The volume control is a 10,000 ohm potentiometer across the primary of the first coil, with the antenna connected to the slider. If this does not completely control the volume the 6 ohm rheostat is available for doing the rest. That alone has a resistance high enough to control the volume but it should not be used any more than necessary because when the filament current is cut down sufficiently to cut out the r-f and i-f amplification the power tube and the detector will overload.

Coral Isle Station Is the Loneliest One

Located in the Coral Sea, about 400 miles east of Townsville, Queensland, Australia, is a small coral island about 500 yards long and 150 yards wide. This is Willis Island, the home of the world's loneliest radio station. On this island for a year at a stretch live two radio operators whose duty it is to observe the readings of weather instruments and transmit them to the mainland. By this means the weather bureau is able to forecast cyclone warnings and weather forecasts at least 24 hours before they would otherwise be able to do so.

The station has been in operation about ten years. For the last couple of years the monotony has been relieved by the installation of an amateur radio station with the call sign of VK4SK. For six months the operators see no other human besides themselves and the only company is that of the teons, noddies and gannets which come to nest in thousands. (The birds return for the egg laying at the same time each year, within a day or two of the same date, year after year.) Amateur radio enables the operators to obtain news of their friends and relatives and it is the pleasing duty of my station, VK2YK, to handle such news, weekly.

The amateur transmitter used at VK4SK is of conventional design using about 100 watts input power. The power supply consists of a petrol driven generator, and the resulting signal resmbles those of short wave marine stations.

Wattage Computation

Determining Rating of Resistors

By Brunsten Brunn

WHEN designing radio receivers the problem of determining the wattage rating or dissipation often arises. It is one of the simplest of all problems, but still it gives many trouble.

Suppose a current of I amperes flows through a resistance of R ohms. What is the power dissipation in that resistor? The power dissipation can be shown to be W=VI, in which W is the power in watts and V is the voltage across the resistor in volts. Now we know from Ohm's law that the voltage across a resistor in which the current is I and the resistance R is given by V=RI. If we put this value of V in the wattage equation we have $W=RI^2$. Stated in words this formula says that the wattage dissipation in a resistance of R ohms when a current of I amperes is flowing through it is equal to the resistance multiplied by the square of the current. Thus we have two expressions for the wattage dissipation, one involving the voltage and the current and the other the resistance and the current.

Examples

Let us illustrate the use of these formulas. Suppose that we know the voltage across a resistor and the current flowing. Let the voltage be 50 volts and the current 0.05 ampere. The wattage dissipation is 50 x 0.05, or 2.5 watts. Let us check this result with the second formula. To do so we must first find the resistance by applying Ohm's law. We have V=50 and I=0.05. Therefore R=50/0.05, or 1,000 ohms. By the second formula we have 1,000 x $(0.05)^2$, which equals 2.5 watts.

Now let us assume that we know the resistance and the current. Let R=50,000 ohms and I=10 milliamperes. What is the wattage dissipation? We have 50,000 x $(0.01)^2$, or 5 watts.

There are three quantities involved and we can always find the wattage dissipation if we know any two of them, provided that we remember Ohm's law which connects V, I, and R. If we know the current and the voltage, the wattage is simply W=VI. If we know the current and the resistance, the wattage is $W=RI^2$. And if we know the resistance and the voltage, the wattage is $W=V^2/R$. In all cases we must reduce voltages to volts, currents to amperes, and resistances to ohms, if the results are to be expressed in watts.

Voltage Error

The voltage involved is the voltage drop across the resistance and not the entire voltage in the circuit. The current, of course, is that which actually flows through the resistance. To obtain the voltage by measurement we should connect the voltmeter across the resistance only and to obtain the current we must connect the ammeter or milliammeter in series with the resistance. There is no difficulty about getting the correct current, but getting the correct voltage may at times be rather difficult. If the voltmeter used requires a current comparable with that of the current flowing in the resistor the voltage reading will be too low. Indeed, it will always be is used. If the current involved is high and itself comparable with the resistance of the low unless a non-current drawing voltmeter voltmeter, there will be a large error. Hence when measuring the drop across a high resistance only the most sensitive voltmeter should be used, that is, one that has a very high internal resistance.

It is customary in radio work to use a voltmeter that has a resistance of 1,000 ohms per volt. Let us assume that we have one of this type that has a range of 0-150 volts and that we wish to use it to find the voltage drop across a resistance of 100,000 ohms when there is another resistance of the same value in the circuit and a voltage source of 100 volts. What will the meter read when across the resistance, and how much should it read? We know from the fact that there are two 100,000 ohm resistors in the circuit that the voltage will divide equally between the two resistors. Hence the voltage drop across one of them should be 50 volts. But what will it be? The resistance of the voltmeter is 150,000 ohms, since it is a 1,000 ohms per volt meter. With the meter across one of the 100,000 ohm resistors the resistance of the combination is 60,000 ohms and the total resistance in the circuit is 160,000 ohms. The voltage across the meter and the resistance in shunt with it is 60.00/160,000 of the total voltage in the circuit. That is, the meter will read ⅜ of 100 volts or 37.5 volts. Thus the error will account to 25 per cent, being 37.5 volts instead of 50 volts.

Measuring the Current

The current can be measured with a negligible error. Suppose we measure the current in the preceding circuit consisting of 100 volts in series with 200,000 ohms. The addition of the milliammeter might add 40 ohms to the circuit, and that is entirely negligible in comparison with 200,000 ohms. Hence the addition of the meter will not change the circuit, and the milliammeter reading will be the correct current reading. In this particular case the current will be 0.5 milliampere. Now if we multiply this current by 100,000 ohms we get 50 volts. Therefore to find the wattage dissipation in a high resistance it is best to measure the current and use the appropriate wattage formula.

Of course, it may be that we do not know the resistance. It may not necessarily have the value at which it is rated. In that case the resistance value can be measured with a battery of known voltage and the milliammeter. If the battery, meter, and the unknown resistance are connected in series there will be a certain current reading. The known voltage divided by this current will give the resistance. Or, if a resistance meter is available, it way be used directly for reading the resistance.

As was stated above, if we have any two of the three values, voltage drop, current, or resistance, we can determine the wattage dissipation.

Wattage Rating

The wattage rating of a resistor that should be used is a matter of judgment after the dissipation has been obtained. The rating should never be less than the dissipation. But there is no limit in the other direction, except, perhaps, the cost of the resistor. The cost goes up rapidly with the rating.

The problem of rating a resistor is a matter for the manufacturer to decide. There is no simple rule by which it can be done, for it depends on the nature of the resistance material, on the shape of that material in the finished resistor, and on the location of the resistor in the circuit. If the resistor is not well ventilated it will get hot if it is working near its rating and it will be necessary to use a resistor rated at a higher value.

Selection of Resistors

When a circuit is being designed there is much latitude in selecting some resistors whereas in others there is hardly any latitude at all, except in respect to wattage rating. As a rule we have the voltages and the currents as soon as we have decided on the resistance value. Take the filament circuit, for example. We know the voltage of the source and we also know the voltage that should be given the filaments or the heaters. Hence we know the drop in any ballast that may be required. We also know the current when we have decided on the tubes. Hence we know the value of the resistance, by applying Ohm's law. Therefore, we know all that is required for determining the dissipation.

In the plate circuit of a tube we do not know the plate current that will flow under given voltage conditions, but we can always take a value which is larger than that which will flow, and we can determine the dissipation on that basis. For example, suppose that we are dealing with a tube which calls for a load resistance of 250,000 ohms. If the applied voltage is 250 volts, we know for sure that the current cannot exceed one milliampere. We also know that the voltage across the resistor cannot exceed 250 volts. Hence we know that the wattage dissipation cannot exceed 0.25 watts. Therefore we are safe if we select a resistor of this rating. But if we select one of one watt rating we have a still greater safety factor.

Voltage Divider Design

When selecting voltage divider resistances we usually know the voltage across any one of the resistors. In the bleeder resistor we also know the current, for we may select any current that we please, within certain practical limitations. Suppose, for example, that the voltage across the bleeder resistance is to be 100 volts. We might select a current of 10 milliamperes, when the resistance would be 10,000 ohms. The dissipation is best obtained from the voltage and the current, and it is one watt. Again, we could choose a bleeder current of 5 milliamperes, when the resistance would be 20,000 ohms. Now the dissipation is only 0.5 watt.

In selecting the other resistances in the voltage divider we have to know the current that will flow. This is the bleeder current plus current to the taps below the resistor in question. To obtain the current we can estimate from the currents demanded by the tubes. Suppose, for example, that we are determining the second resistor from the ground end and that only screen currents flow into the first tap. There may be three screens, each drawing 3.3 milliamperes. That tap would then take nearly 10 milliamperes. If the bleeder resistance is also 10, the total current is 20 milliamperes. The voltage drop across this resistance may be 150 volts. Hence the resistance should be 7,500 ohms and the wattage rating should be not less than 3 watts. In the next resistor additional current will be flowing and we have to determine the resistance as well as the wattage rating from the voltage drop and the actual current flowing.

AN 8-TUBE SUPER

For 110 or 220 Volt D-C Lines

By J. E. Anderson

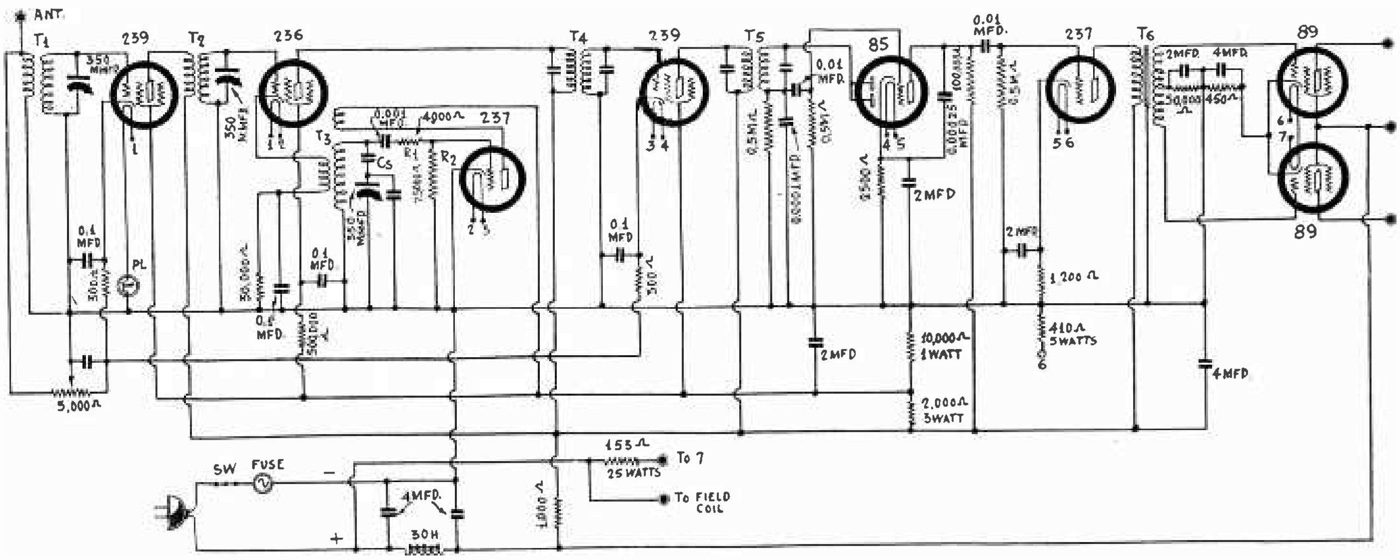


FIG. 1

The circuit of an eight tube superheterodyne that may be used on d-c lines of either 110 or 220 volts. It employs diode detection and two 89s in push-pull.

OUR six-tube automobile receiver has met with a favorable reaction and many who have built it have requested that the same circuit be modified for use on d-c lines, both 110 and 220 volts. Most of these requests have specified that the 89 tubes should be used in the output stage and that the 85 be used as detector, if these changes were practical.

The adaptation is quite simple, although many changes must be made. For one thing, we cannot use the heater circuit for grid bias as in the case of the automobile set, but self bias must be used throughout. The use of the 85 as detector makes the set slightly less sensitive, but this is more than offset by the facts that there is an additional triode amplifier and that a reasonably good antenna can be used in all cases, as well as a good ground. Moreover the 89 is a superior tube to the 238.

The major change in the receiver concerns the heaters. All the heaters must be connected in series. But a simple series circuit will not do, for the 89 tubes require 0.4 ampere whereas the other tubes require only 0.3 ampere. Therefore we must put a shunt across those heaters that require the less current and adjust this shunt so that it will take the extra 0.1 ampere required by the power tubes. There should also be a pilot light in the series, and this also takes 0.3 ampere. In case the pilot light is attached to a moving dial pointer, flexible leads will have to be used for making connections. Since there is danger of short-circuiting these leads to the chassis, the pilot light when used should be connected to the chassis on one side and to one heater terminal on the other. The connection is shown in Fig. 1 and the pilot light is indicated by PL. From there on the heaters are connected as indicated by the numbers near the heater terminals, equally numbered terminals being connected together.

Connections of Shunt

The shunt resistance across the 0.3 ampere tubes is connected between the chassis and the terminal marked (6). Its resistance is 410 ohms for this particular circuit and the wattage rating should be 5 watts or more. The value of this resistance is obtained as follows: It is assumed that the voltage across the pilot light is 3.2 volts when 0.3 ampere flows through it. This is an experimental value. It is also assumed that the voltage drop across each heater is 6.3 volts. There are six of these heaters. Hence the voltage drop across the six is 37.8 volts. To this we add the drop across the lamp and get 41 volts. This is also the drop across the shunt resistance. Since the current through the resistance is to be 0.1 ampere, the resistance value should be 41/0.1, or 410 ohms. Of course, it is all right to use 400 ohms, for this change would not make any practical difference. The wattage dissipation of the resistance is obtained by multiplying the current by the voltage drop. Hence the dissipation is 4.1 watts. The rating should be a little higher and therefore it is specified at 5 watts.

Another Problem

Another problem we have to solve is the value of the series resistance. We already have a drop of 41 volts. In addition we have two 89 tube heaters, each of which should have a drop of 6.3 volts. Hence the total voltage drop in the heater circuit is 53.6 volts. The average line voltage may be 115 volts. The difference between 53.6 and 115 should be taken up by the ballast resistor when the current through it is 0.4 ampere. The difference is 61.4 volts. Hence the resistance should be 61.4/0.4, or 153 ohms. Of course, slight variations are permissible and may be necessary in case the line voltage is different from 115 volts. If the voltage is consistently less, the resistance should be less and if the voltage is consistently higher the resistance should be higher. The amount by which it should be lower or higher is determined by the line voltage deficiency or excess, and by the current 0.4 ampere.

In the event the line voltage is 220 volts the resistance must be much higher. Assuming that it is just 220 volts, the voltage that must be dropped in the ballast is 166.4 volts and the ballast resistance should be 416 ohms.

The wattage dissipation in the ballast is obtained by multiplying the voltage drop by the current. In the case of a 115 volt line it is nearly 25 watts and in the case of the 220 volt line it is nearly 69 watts. The resistor used in each case should be capable of dissipating at least the amount obtained in each case. For example, the resistor for the 115 volt case may be just 25 watts while the other may be 75 watts.

Connection of Field

If the field of the dynamic speaker has been wound for 115 volts, it may be connected directly across the line as indicated. If the line voltage is 220 volts it is best to use a speaker the field of which has been wound for this voltage, when it may be connected directly across the line. But there are other speakers of different voltage requirements. One speaker has a field resistance of 125 ohms and requires a current of 0.3 ampere. This may be used as part of the ballast resistance. However, to prevent overheating it is necessary to shunt the field with a resistance which will take 0.1 ampere. This shunt, when across the speaker field alone, should have a value of 375 ohms. This makes the effective resistance of the speaker field and the shunt 93.75 ohms, and the ballast resistance should be only the difference between this and the value given in Fig. 1. That is, it should be about 60 ohms. The wattage is reduced in proportion to the reduction in the resistance. This connection may also be used when the line voltage is 220 volts, provided that ballast resistance is appropriately increased. How to dispose the speaker coil in any case must be determined when the characteristics of the speaker and the line voltage are known.

Bias Voltages

The minimum bias on the r-f and i-f amplifiers, both 239 pentodes, is deter-

List of Parts

Coils

T1, T2—Two shielded midget type r-f transformers for 350 mmfd. condensers.
T3—One oscillator coil for 350 mmfd. tuning condenser and 400 mmfd. intermediate frequency.
T4, T5—Two doubly tuned 400 kc i-f transformers.
T6—One push-pull input transformer.
One 30-henry, 50 milliampere choke coil.

Condensers

One gang of three 350 mmfd. tuning condensers, with trimmers.
One 350-450 mmfd. padding condenser.
Five 0.1 mfd. by-pass condensers.
One 0.0001 mfd. condenser.
One 0.001 mfd. condenser.
One 0.00025 mfd. condenser.
Two 0.01 mfd. condensers.
Four 2 mfd. condensers.
Four 4 mfd. condensers.

Resistors

Two 300 ohm resistors. (Orange body, brown dot, black end.)
One 450 ohm resistor. (Yellow body, brown dot, green end.)
One 1,200 ohm resistor. (Brown body, red dot, red end.)
One 2,500 ohm resistor. (Red body, red dot, green end.)
One 4,000 ohm resistor. (Yellow body, red dot, black end.)
One 10,000 ohm resistor. (Brown body, orange dot, black end.)
One 30,000 ohm resistor. (Orange body, orange dot, black end.)
One 50,000 ohm resistor. (Green body, orange dot, black end.)
One 75,000 ohm resistor. (Violet body, orange dot, green end.)
One 100,000 ohm resistor. (Brown body, yellow dot, black end.)
Three 0.5 megohm resistors. (Green body, yellow dot, black end.)
One 410 ohm, 5 watt resistor.
One 1,000 ohm resistor, 3 watts. (Brown body, red dot, black end.)
One 2,000 ohm resistor, 3 watts. (Red body, red dot, black end.)
One 153 ohm ballast resistor, 25 watt rating.
One 5,000 ohm potentiometer, with line switch attached.

Other Requirements

Six UY sockets (one for speaker).
Three six-contact sockets.
Six grid clips.
One dial with pilot light.
One fuse and mounting.
One metal chassis.

mined by a 300 ohm resistor in each cathode. Both values may be increased to 600 ohms, or more, if this becomes necessary in order to stop oscillation when the volume control is set at maximum sensitivity. The modulator tube, a 236, is biased for detection with a 30,000 ohm resistor, which has been proved experimentally to be a satisfactory value.

Triode Bias

The triode part of the 85 detector is biased with a 2,500 ohm resistor. This value is recommended for cases when the load resistance is 20,000 ohms, but in this case the load resistance is 100,000 ohms, which will make the bias on the triode less than the usual 20 volts. A greater gain will be obtained with the lower bias and the higher plate load resistance. In case there should be blocking in the triode grid circuit due to insufficient bias it is only necessary to increase the bias resistance. It may be doubled. Or the plate load resistance may be reduced to 50,000 ohms, or even to 20,000 ohms.

A bias resistance of 1,200 ohms is used for the 237 intermediate audio amplifier and a 450 ohm resistance for the two 89 tubes. This 450 ohm resistance is determined on the assumption that the plate current in each tube is 17 milliamperes and that the screen current is 2.5 milliamperes and also that the bias is 17 volts. Any value between 400 and 500 volts may be used.

By-passing

By-passing has been done rather thoroughly. Although the last stage is push-pull and therefore should not require any condenser across the bias resistor, one of 4 mfd. is used. There is a 2 mfd. condenser across each of the audio bias resistors. There are three 4 mfd. condensers in the B supply and one 2 mfd. from the screen voltage tap to ground. All the condensers in the audio amplfiier and the B supply should be of the dry type and electrolytic condensers should be avoided so that it is not necessary to observe any polarity in respect to the condensers.

In the r-f and i-f amplifiers and in the first detector the by-pass condensers are 0.1 mfd. There are five of these. The condenser across the diode load resistance is 0.0001 mfd. and a 0.00025 mfd. condenser is used in the plate circuit of the triode of the 85. The stopping condensers in the audio amplifier are 0.01 mfd. and there are two of them.

Plate Voltages

The plate voltage on the oscillator and the screen voltage on the two 239s is about 90 volts. The screen voltage on the first detector is less for a 500,000 ohm resister and is connected in the screen lead. This resistance may be much higher for the voltage required on this screen need not exceed about 10 volts. However, it is not critical.

To obtain a voltage of 90 volts on the screens we may choose a value of 10,000 ohms for the bleeder and resistance in the voltage divider and letting the current through it be 9 milliamperes. To get this current we have to select the proper resistors above the bleeder.

If the line voltage is only 115 volts we need all the voltage available on the plates of all the tubes with the exception of that of the oscillator. However, if the line voltage is 220 volts we should only apply the full voltage on the power stage. The wiring of the circuit in Fig. 1 is for this case. If the voltage is only 115 volts the 1,000 ohm resistance in the voltage divider next to the filter choke might be short-circuited. This throws two 4 mfd. by-pass condensers in parallel. which is all right.

Voltage for 89

While the highest voltage on the 89s should be 180 volts, it will be slightly higher in cases where the line voltage is 220 volts. But there will be a drop of nearly 20 volts in the bias resistance so that the voltage on the plates will be only 200 volts.

The value of R1, specified at 4,000 ohms, may be varied in case there is overloading of the first detector at the high frequencies. Or the value of R2, specified at 75,000 ohms, may be reduced under the same conditions. Or R1 may be made 5,000 ohms and R2 100,000 ohms.

Use only an antenna on the set. No ground is needed. If a ground is used it should be connected to the chassis through a condenser of about 0.001 mfd. Also as a precaution against shorting the line, the antenna may be connected to the set through a similar condenser.

Adjusting the Circuit

The first step in adjusting the circuit should be the tuning of the intermediate frequency amplifier. For this work it is best to use a modulated i-f oscillator which can be adjusted to 100, 200, or 400 kc. Tune each of the four condensers in the i-f transformers until the signal is loudest. Then the if-amplifier will be tuned to 400 kc, for the coils cannot be tuned to either 100 or 200 kc and when a signal is heard it comes through on 400 kc, provided the oscillator has been adjusted to one of the three frequencies mentioned.

The signal may be impressed on the grid of the first detector or on the screen grid of that tube. Run a wire from the output post of the oscillator and connect it to one of the grids. If the connection is made to the control grid remove the clip and connect a grid leak between the cap and ground.

The next adjustment is to trim the circuit at a high frequency, about 1,450 kc. Tune in either a station of this frequency or a signal obtained from a modulated oscillator. Adjust all three trimmer condensers while the dial is set near 6. After this adjustment has been made check the circuit to see that 1,500 kc can be tuned in. If not, set the dial at 7, 8 or 9 and retrim.

The Padding Condenser

It remains to adjust the padding condenser Cs. First provide a rather strong signal near 600 kc (between 550 and 610 kc). Convert the circuit to a t-r-f receiver by moving the grid clip of the first detector to the cap of the 85, removing the clip normally on that tube. Turn the dial until the selected station or signal comes in as loud as possible. The signal, of course, is impressed at the antenna binding post. When this adjustment has been made restore the circuit to a superheterodyne without disturbing the setting of the tuning condensers. Now adjust Cs until the signal comes in loudest, but touch nothing else. If it require much turning of the adjusting screw of the padding condenser, return to the 1,450 kc frequency and retrim. If only a little turning was necessary, it is not worth while to retrim.

One of the important considerations is that the inductance of the oscillator's tuned winding be just right, otherwise trouble can not be avoided.

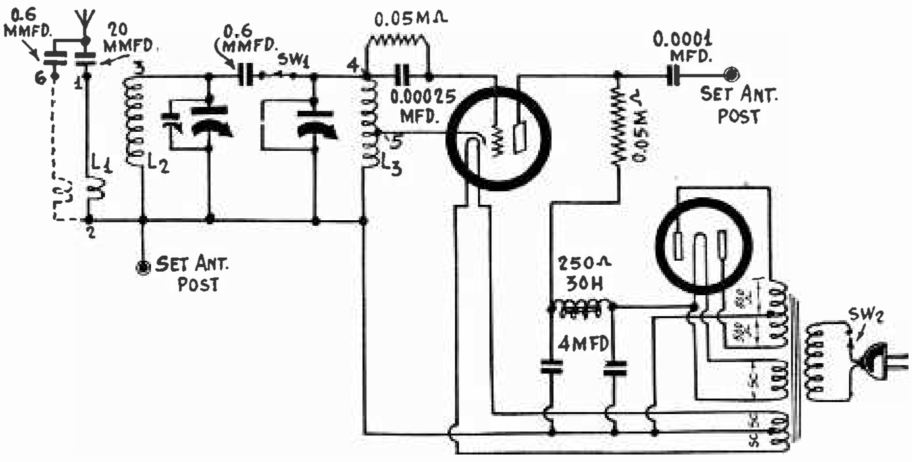
Tube List Prices

Type	*List Price*	*Type*	*List Price*	*Type*	*List Price*	*Type*	*List Price*
11	$3.00	'38	2.80	'24-A	1.65	'80	1.05
12	3.00	'39	2.80	'26	.85	'81	5.20
112-A	1.55	'40	3.00	'27	1.05	82	1.30
'20	3.00	'45	1.15	'30	1.65	'74	4.90
'71-A	.95	46	1.55	'31	1.65	'76	6.70
UV-'99	2.75	47	1.60	'32	2.35	'41	10.40
UX-'99	2.55	'50	6.20	'33	2.80	'68	7.50
'100-A	4.00	55	1.60	'34	2.80	'64	2.10
'01-A	.80	56	1.30	'35	1.65	'52	28.00
'10	7.25	57	1.65	'36	2.80	'65	15.00
'22	3.15	58	1.65	'37	1.80	'66	10.50

An Extremely Compact 2-Tube S-W Converter

56 TUBE AS MODULATOR-OSCILLATOR, '80 AS RECTIFIER

By Adam Russover



KEY TO WIRING DIAGRAM

The six pins of the plug-in coils are numbered 1 to 6. For three coils the primary is connected as shown in full line, to 20 mmfd. series condenser. For the fourth coil, highest frequency band, 13,000 to 39,000 kc, the coil is so wound that a pin not previously used is connected to the antenna side of the primary, to pick up the 0.6 mmfd. antenna series condenser. So only five pins are used at a time and a switching result obtains automatically by plugging in. SW1 is opened and 0.05 meg. grid leak is replaced with 5 to 7 meg. if a modulated oscillator service is desired. The builder will have to calibrate the oscillator himself.

RESISTOR COLOR CODE

Ohms	*Megohms*	*Body*	*Dot*	*End*
50,000	0.05	Green	Orange	Black
5,000,000	5.0	Green	Green	Black

WHAT is a short-wave-converter but a mixing circuit? If it has a B supply built in then you don't have to hunt around the recesses of sets to obtain B voltage. So, the requirements being a mixing circuit and a B supply, we meet both of them with the circuit diagrammed herewith.

In this circuit the incoming frequency is received by the first tuned circuit, this circuit is coupled to the oscillator's tuned circuit inductively and by a very small condenser, and the output of the combined oscillator-modulator tube is fed to the receiver that is to act as intermediate frequency amplifier, second detector and audio amplifier.

The small condenser uniting the two tuned circuits provides in reality additional coupling, because the signal frequency tuned circuit (at left) is inductively coupled to the oscillator frequency tuned circuit (at right), the three coils being on one form of the six-pin plug-in type. The reason for the extra coupling is to prevent the first tuned circuit from acting as a wave trap.

Coil Use

The six pins are used as follows, only five at a time with any one coil: (1) to 20 mmfd. antenna series condenser, (2) to grounded B minus, (3) to stator of signal frequency tuning condenser, (4) to stator of oscillator frequency tuning condensers, (5) to tap on oscillator tuned winding for cathode connection. Thus the primary L1 for the three lower frequency bands is represented by the heavy-line connected to 20 mmfd. (postion 1), whereas for the highest frequency band, the series condenser is only 0.6 mmfd. (six-tenths of one micro-microfarad, 0.000006 mfd.) The highest frequency reached should be below 15 meters, and for tuning that includes such high frequencies the series condenser ought to be about as small as that.

The smaller series condenser is represented by the sixth pin of the coil base, and the three coils for the lower frequency bands are wound to pick up five particular pins, whereas the coil for the highest frequency band is wound so that the previously unused single pin replaces the one used for aerial side of primary in the earlier instances. In this way, really, the fifth and sixth pins of the base serve as single-pole single-throw switch.

If the two optional pins are designated A and B, then A is used for three of the total of four coils, B is not used then, whereas in the fourth instance, highest frequency coil, B pin is used and A is not.

Coil In Rear

The plug-in coil system is used principally because it is necessary to get as much as practical out of the simple converter, and contact resistance losses are minimized, as well as stray coupling avoided, including dead spots consequent thereon. As the whole device is encompassed in extremely small space—the chassis top measures 5x7.5 inches—and this plane is fully occupied by other parts, the opening for the socket for plug-in coils is placed on the rear wall, and likewise the a-c switch, to turn the converter on or off, is at rear. However, it is not only for compactness in the coil receptacle on the rear wall, but leads are short and access handy if the converter is put into a cabinet. There is no need to lift any lid, for either the back is left open, as in commercial practice, or a hole is drilled in the rear cabinet wall large enough to admit the coil form.

Since the inductance functions are consolidated on one form the total number of coils is four. The range will be from below 15 to above 200 meters. The tuning at the signal frequency level—that of the channels of the incoming stations—is a fixture, being independent, and the coil data can be readily determined, since the maximum capacity, the capacity ratio, and the lowest frequency are known. But the oscillator winding depends on the intermediate frequency, and as that is not known it will have to be chosen. That intermediate frequency selected, a little variation either side is permissible, which is the main reason for a manual trimming condenser across the modulator.

Coil Directions

What intermediate frequency shall be selected? The lower it is, the better, in

LIST OF PARTS

Coils

Four six-pin plug-in coils as described.
One 30-henry B supply choke.
One power transformer.

Condensers

One two-gang 0.00014 mfd. junior midline condenser.
One 0.00025 mfd. grid condenser.
Two 20-100 mmfd. equalizers, one used at minimum for 20 mmfd., other at maximum for 0.0001 mfd.
One 35 mfd. equalizer.
One 35 mmfd. manual trimming condenser.
Two 0.6 mmfd. fixed condensers.
Two 4 mfd. dry electrolytic condensers with brackets.

Resistors

One 0.05 meg. pigtail resistor (plate load).
One 0.05 meg. tubular resistor (grid leak).
One 5 to 7 meg. tubular resistor (for modulation when device is used as an oscillator).

Other Requirements

Two milled bushings, 6-32 bore, for elevating tuning condenser.
One chassis, 7.55x2.5 inches.
One vernier dial, pilot lamp, escutcheon (0-100, left to right).
One grid leak holder.
One UX, one UY and one six-pin contact sockets.
One battery type switch (SW-1).
One a-c toggle switch (SW-2).
One a-c cable and plug.
Two knobs, one for dial, one for manual trimmer.
Tubes required: one 56 and one '80.

the sense that the difference between signal and oscillator frequencies will be least. It is true that in many t-r-f sets, and to a smaller extent in superheterodynes, the sensitivity will be least at the low frequency end, nevertheless some compromise must be established, or at least, some intermediate frequency selected so that the oscillator coils can be wound accordingly. Therefore, on the basis of 540 kc the coil data may be as follows:

L1	Sep.	L2	Sep.	L3	L3 Tap	Wire
1⅛	⅛"	3	1"	3	1	No. 18 enamel
1⅛	⅛"	7	¼"	6	3	No. 20 enamel
2⅛	⅛"	19.5	⅝"	16	8	No. 24 enamel
5⅛	⅛"	28	½"	18	9	No. 32 enamel

Since there is antenna-ground capacity, some of this will be reflected in the first tuned circuit (at left) and will tend to lower the frequency of response, whereas the manual trimmer lowers it some more. Therefore the oscillator has to have a fixed compensating condenser across it, adjusted when the manual trimmer is at mid-capacity, so that the manual trimmer may relatively add or substract capacity, that is, work in both directions.

Even so, this manual condenser need not be more than 35 mmfd., assuming that the fixed trimmer is of not more than that maximum, which means the fixed one could be adjusted, if need be, to a minimum of around 8 mmfd. Thus there is plenty of leeway.

Trimmer's Effect

It is necessary to add this extra capacity to the oscillator to make the manual trimmer effective. Moreover, it is advisable because it cuts down the frequency range of the oscillator, which even so tends to outrun the other, despite the manual trimmer, although the proper tracking can be established throughout by manual trimmer adjustment. This trimmer is not very effective, except on weak signals.

The oscillator ranges should be approximately as follows: 1,300 to 3,000 kc, 2,900 to 6,600 kc, 6,500 to 14,000 kc, 13,000 kc to 39,000 kc.

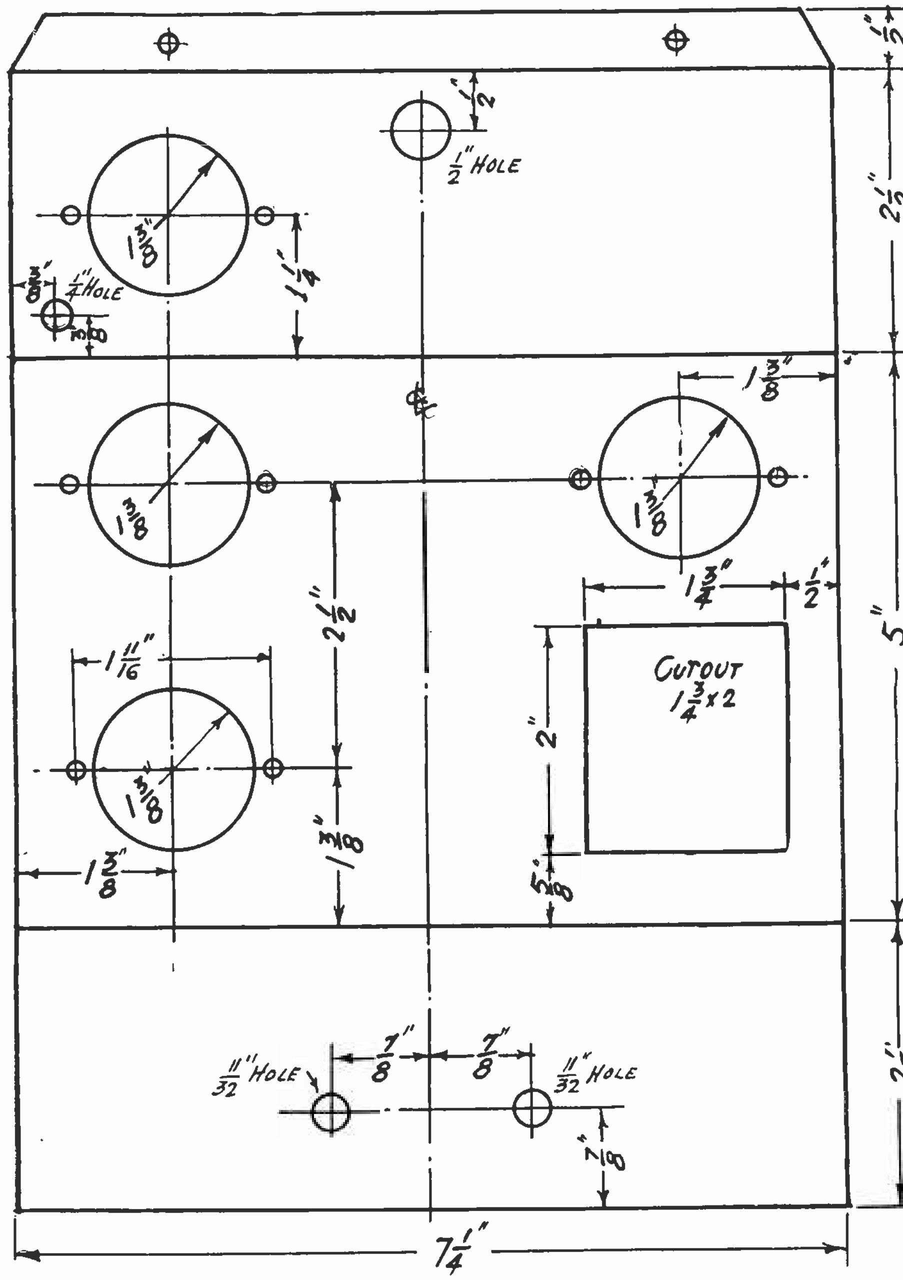
Since it is often handy to have a calibrated short-wave oscillator handy, and the present device may be simply changed to this for test purposes, a switch, Sw1, is provided that cuts out the signal frequency tuner, leaving only the oscillator tuned, and since some form of modulation is advisable, the grid blocking method is used. The grid leak, 0.05 meg. for converter use, is of low enough value so that such blocking does not exist, but if 5 to 7 meg. is used there will be blocking. So a grid leak holder is put on top of the chassis, and when the modulated oscillator is to be used the switch Sw1 is opened and the 0.05 meg. grid leak is replaced by the 5 to 7 meg. leak.

56 Tube is Oscillator-Modulator

The mixing tube is a 56, which lends itself readily to this grid-blocking method of providing modulation. The sound emitted is a continuous squeal, quite piercing, which is desirable, because a distinctive note is valuable. Phones between output post and ground will enable hearing the squeal, for this is a detecting type of oscillator. However, no bypass condenser should be put across the phones.

The oscillator is of a very effective type, being a Hartley as modified by Shiepe. The plate current through that part of the tuned winding—usually half of the tuned winding—sets up a magnetic field that is in phase with the magnetic field in that part of the tuned circuit between grid and cathode, hence there is sure to be oscillation. One of the fine things about the Hartley oscillator is that it certainly does oscillate. "If oscillation fails, try a Hartley" is still good advice. Moreover, the hookup is extremely simple, and eliminates an extra coil, or plate winding, otherwise usually necessary.

The load on the plate circuit has some effect on oscillation, in that if the load is highly resistive or inductive there might be a reduction in oscillation or indeed a stoppage unless there were compensation at that plate voltage supply.



KEY TO PLAN OF CHASSIS

The chassis is 7¼ in. wide, 2½ in. high and 5 in. front to back. The oblong at bottom of the drawing is the front elevation, with two 11/32 in. holes, the one at left for the manual trimmer, the one at right for the a-c switch. The next oblong is the chassis top, with cutout for the small power transformer and three circular holes for sockets. The rectifier tube would go at right rear, the left front hole would be for the 56 tube, the hole just behind it for the socket to receive the plug-in coil, provided cabinet renders this accessible, otherwise the hole at left rear of the back wall of the chassis would be used for coil receptacle. As many will realize, the modulator and oscillator tubes may be separate, and placed on top, if the rear hole is used for coil. The diagram of the three-tube circuit will be printed next week, the same chassis being used. The ¼ in. hole at left rear is for the decoupling switch when the device is to be used as an oscillator only. The a-c cable goes through a grommet-protected ½ in. hole at rear.

Frequency Stability

However, the normal voltage recommended for the 56 is not more than 100 volts, with zero bias, whereas here we have a fairly high resistance in the plate circuit, and zero bias only when there is no grid current, so we are permitted to raise the applied plate voltage, in fact we virtually double it, whereupon the effective plate voltage still will be less than 100 volts, due to the drop in the 0.05 meg. plate load resistor. With the high applied plate voltage—around 200 volts—we are safe against oscillation stoppage. If grid current flows the bias becomes negative and tends to reduce the flow, thus also aiding frequency stability by resistance constancy.

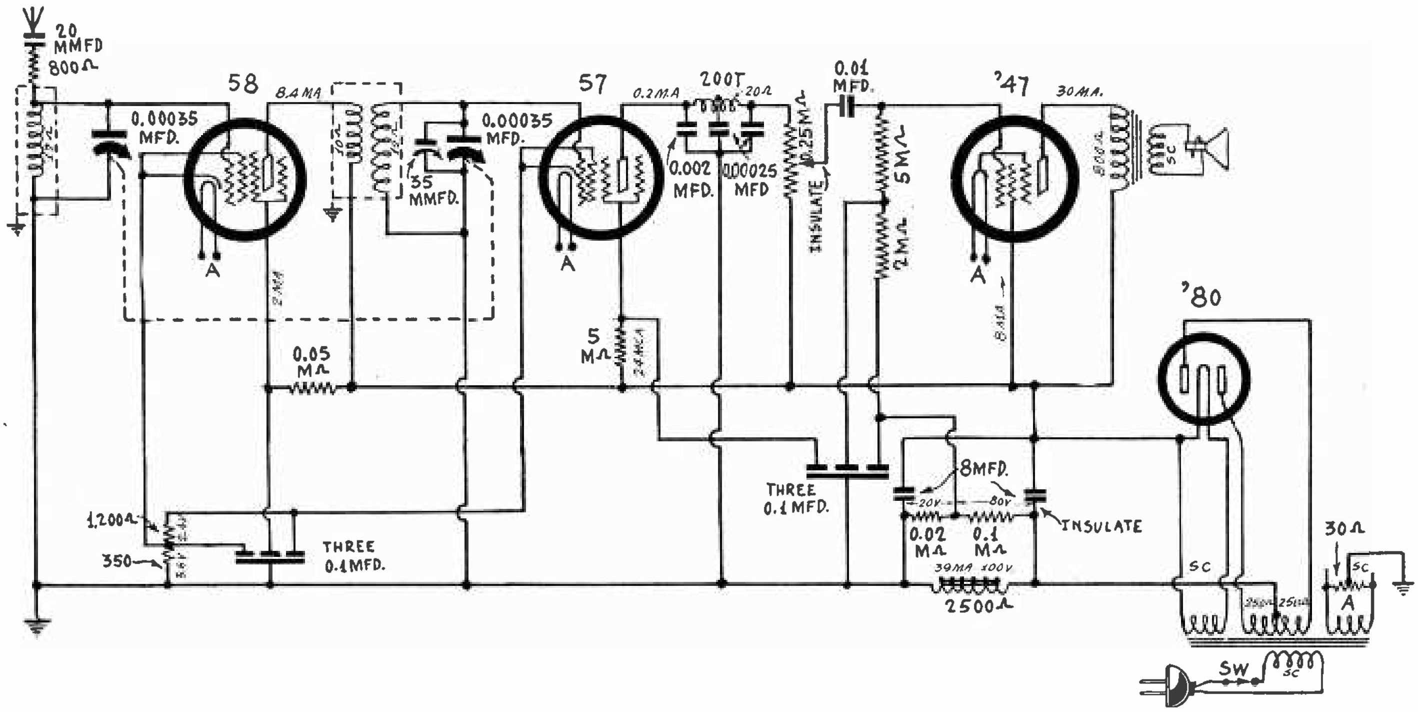
The load on the plate circuit is particularly apropos because the coupling probably will be to an antenna primary (to which no aerial is now connected, as aerial has been transferred to converter antenna post). But the secondary of that coil is tuned, the primary therefore also is resonant, and the resistive load on the plate circuit is satisfactory, as working into a relatively high impedance.

Although we are going to work only one tube, we desire a full-fledged rectifier and filter. A small B supply choke coil will do the trick, with two 4 mfd. condensers, as to filtration, but we want a regular rectifier, and the '80 tube is just that. So, too, we want a high-voltage winding, also a 2.5-volt filament winding and a 5-volt rectifier filament winding. A small power transformer will do nicely, and one can be bought for about $1.20.

There is virtually no d-c voltage difference between the cathode and heater of the 56 tube, which is highly desirable. At maximum it would be 0.02 volt, which is insignificant.

Wiring, Adjusting and Operating
4-TUBE DIAMOND
Methods To Pursue If You Encounter Trouble

By Herman Bernard



The schematic design coincides in all particulars with the pictorial diagram printed on pages 12 and 13.

[*The preceding installments of this article were published in the September 3d and 10th issues.*—EDITOR.]

WHEN the chassis is viewed from beneath, for wiring, if the front is toward you, then the tube arrangement is: right rear, 58 r-f tube; right front, 57 detector; left rear, right to left, '47 pentode and '80 rectifier.

Thus the antenna impedance coil is as close to the aerial binding post as is practical. The lead from plate of the r-f tube to P of the interstage r-f transformer, run in a straight line, is about 4 inches, although the line is not shown as straight on the picture diagram published on pages 12 and 13.

The entire picture diagram should be considered as giving the authentic connections, but without necessarily showing exactly the direction of each wire, because in wiring it is practical to have one lead above another, yet in a picture diagram this can not well be shown. Use the shortest routes possible. In general it will be found that the picture diagram subscribes to this rule.

Location of Parts

The tubes of the tuner are to the extreme right, while in line with them, to the left, are the coils coupled to them. Between each pair of coils and sockets is an 8 mfd. condenser, the one nearer the tuning condenser being insulated, the other not insulated. Merely tightening down the uninsulated condenser to the chassis serves to ground the case, and no lead need be run anywhere for this purpose. Last week a remark was so phrased that a different course might have been deemed recommended.

Naturally the manual trimming condenser is placed as close as practical to the tuning system with which it is connected. That of course is the secondary that serves as input to the detector tube. The connections to the tuning condenser stators are made by bringing down two wires from these stator lugs, penetrating the two panel holes (marked "To Stator Above") and connecting to the respective coils. In the case of the main condenser across the detector secondary a simple method of connection is to bring the stator lead from above to one side of the stator of the manual trimmer, using the equivalent plate connection of this little condenser at the other side for connection to the grid of the coil.

It is not necessary to make any connection between ground and the rotor of the manual trimmer or main condenser, because conductively coupled to grounded chassis. The antenna-ground binding post assembly, a bakelite block with the two posts, has the ground post automatically connected to chassis. As the manual trimmer likewise is automatically connected, the frame of this trimmer may be used for grid return (ground) of the tuned secondary serving the detector.

Care About Stator Connectors

The two leads brought down from the stators of the main tuning condenser require a little explanation. The condenser used is of the straight frequency line type, and as such condensers must have a large displacement area, the room occupied by the condenser, or really by its total shield, is pretty large. The condenser has an extra long shaft, about 2½ inches long, serving as a most excellent precaution against body capacity, of which nuisance then nothing will be suffered whatever.

The main condenser—a two-gang 0.00035 mfd. unit—has no trimmers built in, as none will be needed, the manual trimmer serving all such purposes of equalizing, and permitting resonance at all dial positions. Before this large condenser is placed permanently in the shield the stator connecting lugs, if not in the right position, will have to be put where they belong, as there are screw-holes at top and bottom, permitting an option.

When the lugs are in proper position see that the outleads are carefully soldered to the lugs, and test to determine whether the lugs or exposed part of the outlead shorts or many short against the grounded part of the condenser. This possibility exists, but one remedy is to cut some bicycle tape (friction type) about 2 inches long and ¼ inch wide, and carefully insulate the lug and soldered connection in this way for both stators. Another is to use long lugs.

The outleads may be 6 inches long provisionally, being cut to size later, as connection expediency requires. The chassis holes for the outleads have been made large on purpose, so that the leads will not be subjected to friction either in bringing them out, or during handling of the set. If you desire you may press small insulators into these holes, but it was not found necessary. Such insulators have a collar diameter of ¼ inch and

LIST OF PARTS

Coils

One impedance coil for antenna stage, for 0.00035 mfd.
One r-f transformer for interstage coupler, for 0.00035 mfd.
One 200-turn center-tapped choke coil.
One power transformer.

Condensers

One two-gang shielded 0.00035 mfd. straight frequency line condenser with shield.
One 20-100 mmfd. equalizing condenser.
One 35 mmfd. manual trimming condenser.
Two shielded blocks, three 0.1 mfd. in each block (black leads are common, go to ground).
One 0.002 mfd. mica fixed condenser.
Two 0.00025 mfd. mica fixed condensers.
One 0.01 mfd. mica fixed condenser.
Two 8 mfd. electrolytic condensers, one with two insulating washers and a special connecting lug.

Resistors

One 30-ohm potentiometer, setscrew adjustment.
One 350-ohm pigtail resistor.
One 800-ohm pigtail resistor.
One 1200-ohm pigtail resistor.
One 0.02-meg. pigtail resistor (20,000 ohms).
One 0.05-meg. pigtail resistor (50,000 ohms).
One 0.1-meg. pigtail resistor (100,000 ohms).
One 0.25 meg. potentiometer (250,000 ohms); insulating washers.
One 2-meg. pigtail resistor.
One 5-meg. pigtail resistor.

Other Requirements

One chassis, 13¾ inches wide x 2½ inches high x 6½ inches front to back.
One vernier dial, travelling light type, with bracket and pilot lamp; dial reads, left to right, 100 to 0.
One a-c shaft type switch.
Three knobs (one for dial, one for volume control-switch, one for manual trimmer).
One dynamic speaker, 2500-ohm field coil, output transformer built in, has matched impedance for '47 tube.
One shelf 6¼ x 2½ inches, with two brackets.
Two six-spring, two five-spring (UY) and one four-spring (UX) sockets. The extra UY is for speaker plug.
One a-c cable and plug.
One reducing bushing so ¼-inch condenser shaft will fit in ⅜-inch dial hub.
Two special aluminum shields for the 57 and 58 tubes.
One rubber grommet for a-c cable exit.
One extruded washer for manual trimmer.
Tubes required: one 57, one 58, one '47 and one '80.

permit about 6/32 clearance for the outleads.

The Shelf Assembly

The oblong object at the center is a shelf on which the r-f choke, two detector plate bypass condensers and the 0.01 mfd. isolating condenser are mounted. There are three condensers connected with the r-f filter in the detector plate circuit, but one of these is the 0.002 mfd. unit to be found at extreme lower right. This particular unit is soldered to a lug that the socket screw holds in place. The condenser lug, or the lug on socket, is bent to a right angle. Thus the 0.002 mfd. condenser is upright, one side now grounded, other side to plate. This position is helpful, as the 0.002 mfd. is the most effective of the three condensers in this filter, and it is most acceptable to have its bypassing effect introduced as close to the plate as possible.

The r-f choke is a 200-turn center-tapped unit. It has a wooden core. On one side of the choke is the rather flat surface of the dowel, on the other side is an insulated outlead strip with three lugs and leads. Actually the flat portion is toward the shelf and the three lugs on the terminal strip point downward, but the picture diagram makes it appear as if these lugs and the strip holding them bend to a right angle, which is not so. The liberty was taken intentionally, as the wiring connections thereby could be shown more clearly. The prime objection was to achieve utter clarity.

To secure the r-f choke to the shelf simply drive a wood screw, ½-inch long, through the shelf and into the center of the flat end of the dowel mounting.

To the right of the shelf at rear are the two blocks of 0.1 mfd. condensers, three such capacities in each block. These may not be in exactly the same position as diagramed, when you use the standard chassis, but follow the chassis holes, rather than the diagram, as the blocks were put where they are in the diagram, again, so that the connections would be clear.

Volume Control Insulated

The blocks have four emerging leads each—one black and three red. The black goes to ground. So the black leads in both instances may be soldered to the shield of these blocks, since the mounting screw and rear of the shield insure grounded connection of the entire shield. Also the shield of one block is used for ground in another instance, that of the return of the 350-ohm biasing resistor in the 58 cathode circuit.

The blacks must go to ground in the case of the 0.1 mfd., but the reds are interchangeable and even as between blocks.

The third instance of imperative insulation of parts from the chassis concerns the volume control. Two extruded fiber washers are used for this purpose.

The resistors on the left-hand side are 7 meg. in the pentode grid circuit (one 5 meg. and one 2 meg., the latter bypassed by 0.1 mfd.); the voltage-dividing resistors across the field of the dynamic speaker, which field is used as B supply choke in the negative leg; the center-tapped filament resistor, which may be a 30-ohm potentiometer, adjustable from top with a screwdriver, or may be a fixed center-tapped unit of from 10 to 30 ohms; and the volume control already discussed. This control has a total resistance of 250,000 ohms, and the slider connects to one side of the 0.01 mfd. stopping condenser.

It has been said the choke is in the negative leg. So it is. The 8 mfd. are from the high-voltage lead in each instance, one to B minus, the other to ground. The one to B minus is the insulated one, and a special lug is used for case contact on the 8 mfd. condenser, the lead being run directly to left to B minus, so designated and identified on the pictorial diagram. It will be found that the pictorial diagram coincides exactly with the schematic diagram republished this week.

Speaker Socket

The speaker socket is shown as UY, although only four outleads are used. The bias would be a little low if an 1,800-ohm field coil with tap at 300 ohms were used, but some may want to use a speaker of that kind, that they have, and for their benefit it is stated that in such an instance the connections already on the speaker cord likely will be: P to ground, G to 300-ohm tap, K to B minus, H and H interchangeable for plate of power tube and maximum B plus. Thus P and K represent the field coil. Where a tapped speaker is used the voltage dividing resistors, 0.02 meg. and 0.1 meg. should be omitted. It can be seen that the UY socket is imperative for such use, whereas for the present use it serves the purpose but so would a UX socket, and you may use UX if you have a speaker with UX plug.

Reverse connections to primary of output transformer to determine which way produces best quality and least hum.

It should be remembered that the field coil in the present instance is recommended at 2,500 ohms, which will produce a drop across the field of about 100 volts, or supply a field power of about 4 watts. The volume of sound depends in part on the power used in energizing the field coil.

Interstage Coil

The only point of possible confusion exists in the connection of the interstage r-f transformer. If factory-made coils are used, normally they will have only the four connections, which will correspond to the pictorial diagram as to indentities. The marks will be found stamped on the inside of the shield base, and should be copied in pencil on the other side of the base, so that you can read the identities without turning the chassis around or removing coil shield. In some instances, where the coil has a tap, *the ground symbol represents the tap which is not used in this circuit,* and the real ground connection is to a side lug within the coil. Look for the side lug, and if it is there, solder a wire to it, bring the wire through the base of the shield to the under side of the chassis and connect to the frame of the manual trimmer. Otherwise connect the ground symbol lug to this frame.

The designations on the turner sockets are H and H, heater; K, cathode; Gsu, suppressor grid; Gs, screen grid; P, plate. In both instances suppressor grid is connected to cathode.

III

Adjusting, Tuning and Trouble-Shooting

THE circuit uses some audio frequency regeneration, in fact about as much as can be utilized without oscillation in the form of motorboating or continuous high-pitched squealing. Thus the operation is just below the oscillation point, excellent for highest audio sensitivity, just as operation in the same region is most advantageous for radio frequencies. Again, at radio frequencies the closeness is about the same. The result is that in some instances there may be too much regeneration of either kind, and as none is desired, the means of getting rid of either or both will be discussed.

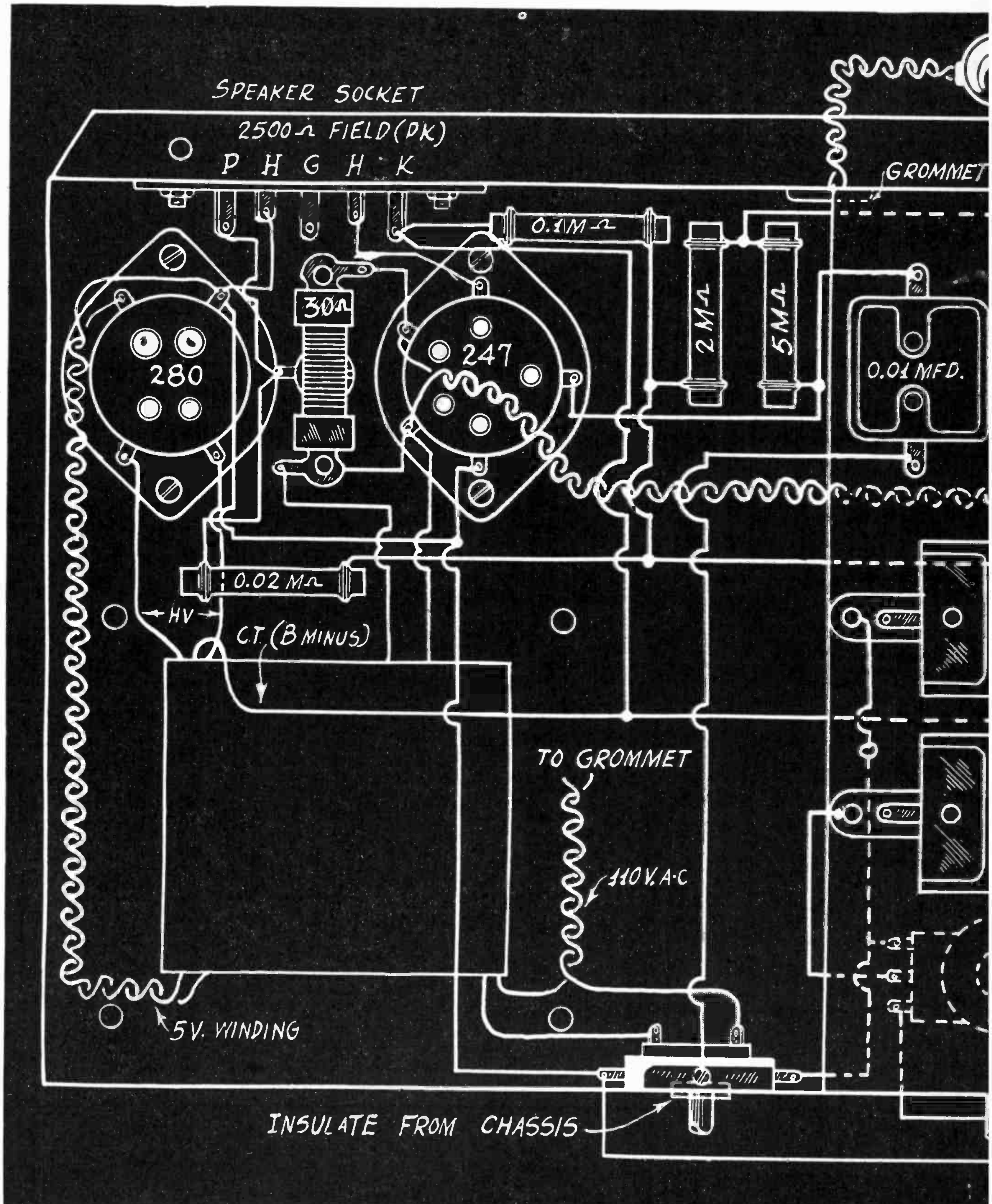
It will rarely happen that there will be audio frequency instability, but if it is encountered, the 2 meg. grid leak should be placed in the position occupied by the 5 meg., the 5 meg. should be omitted, and the 2 meg. replaced by a resistor of 0.05, 0.1 or 0.5 meg., whatever you have handy. This expedient will work in every instance. It will even cure the incipient audio oscillation trouble evidenced only by the failure of the speaker to respond properly to the low notes because they are so strongly present. This would really have to do with the speaker rather than with the circuit, but as means of adjusting the speaker response are not at hand, the circuit should be treated as outlined.

R-F Stability

On the radio frequency side, however, the situation is not quite so simple. Whether there will be r-f oscillation at the higher radio frequencies will depend on the voltage of the line, the power transformer, the capacity of the commercially rated 8 mfd. condensers, the resistance of the field coil and the condition of the tubes. It can not be said that the 58 and 57 tubes are running completely uniform yet. While all are very sensitive, some are more sensitive than others. In general there will be no

(*Continued on next page*)

PICTURE DIAGRAM



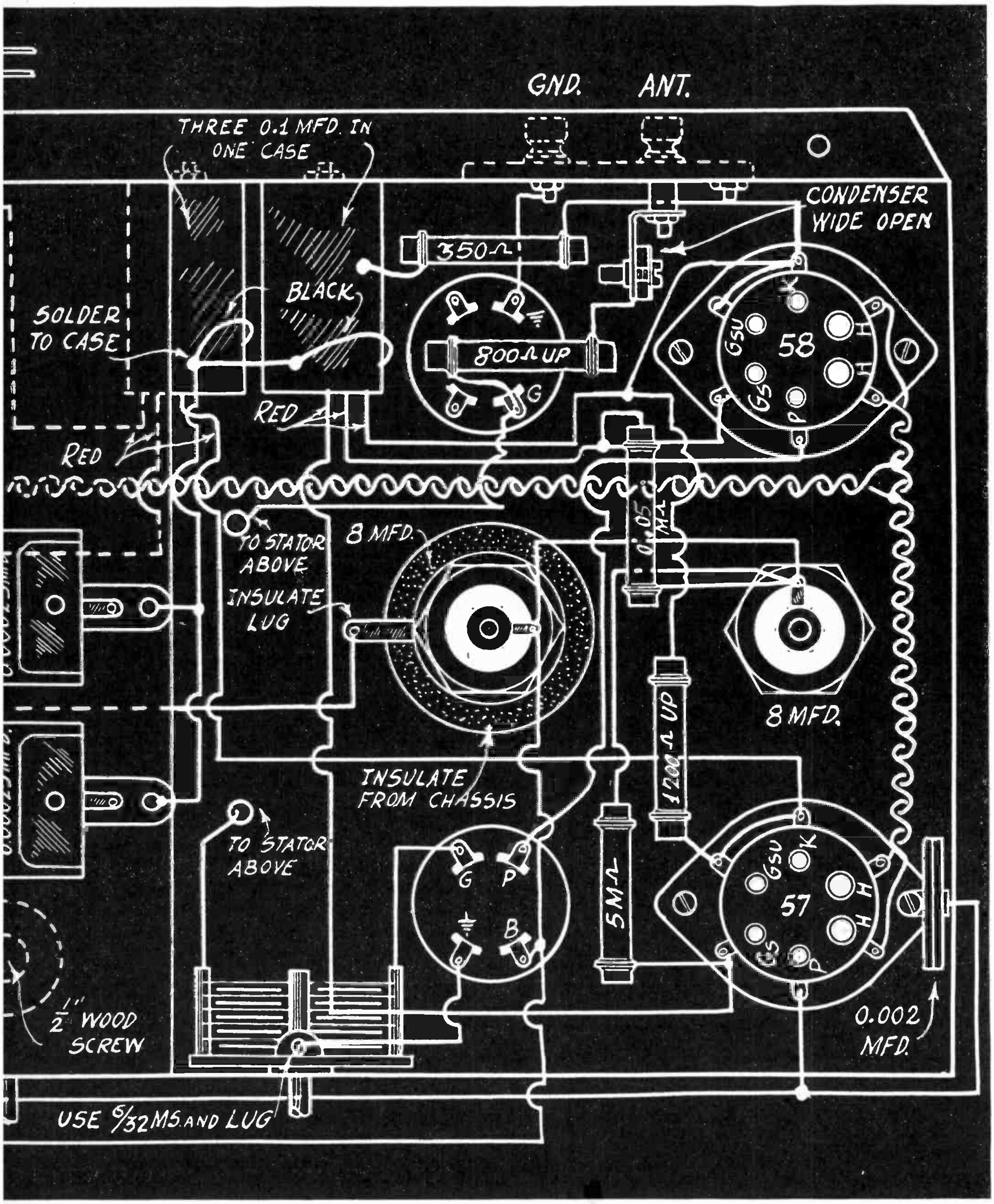
(*Continued from preceding page*)

trouble from r-f oscillation, but if there is, the following remedies may be applied:

1. Increase the value of the series resistor in the antenna circuit. This may be raised to around 5,000 ohms, but increasing it much beyond that simply reduces the volume of sound, or sensitivity, without affecting the oscillation, if at all.

2. The 57 detector may be oscillating, rather than the r-f amplifier, an unusual condition, yet one encountered, and substantiated by the effect of increasing the series antenna resistor beyond 5,000 ohms, discussed under 1. If this is true, increase the value of the extra resistor used for additional bias on the 57, making it around 2,000 to 2,500 ohms, instead of 1,200 ohms, or increase the value of the screen grid resistor, now 5 meg., by adding another unit of 2 meg. or more in series. If this is not handy, instead of

OF 4-TUBE DIAMOND



using 0.1 mfd. for bypassing this resistor, leave the resistor at 5 meg. and use 0.02 mfd.

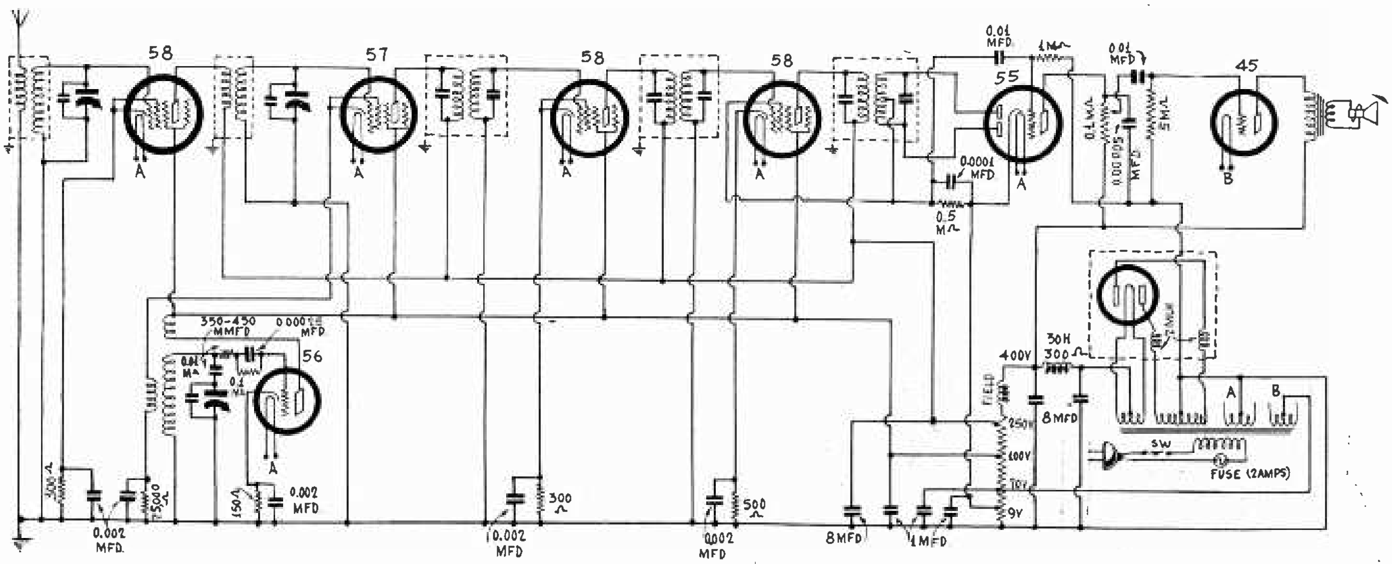
3. Screw down the series antenna condenser, despite the pictorial diagram's direction of "Condenser Wide Open," for in exceptional instances it may be necessary to use more capacity than the wide-open condition affords.

4. Use a longer aerial and a better ground. Avoid grounding to a gas fixture, gas pipe, electric fixture or other such device, and use instead a cold water pipe, even if you have to run a long lead to reach this pipe. A ground clamp on the pipe is advisable.

5. Remove 5 turns from primary of the interstage coupler. The test for r-f oscillation of course is made at the high r-f end of the dial, perhaps at the ex-

(Continued on next page)

Performance Requirements
Dictate Choice of Valves in a 5-Tube A-C Receiver



The 55 is most suitable for a superheterodyne. Also, if there is automatic volume control the manual volume control may follow the detector instead of preceding it.

THE performance demand of set builders determines to a large extent the tubes to be used. Assuming that an a-c receiver is to be built, consisting of five tubes, the choice naturally is confined to two 58's for radio frequency amplification, 57 for detector, 47 for output tube, and rectifier either 80 or 82. Of course the 24 could be used as detector, in place of the 57, but the sensitivity would be less. When the combination stated is used the results are of the very highest order of sensitivity, with all-sufficient selectivity for general modern needs.

As against the choice of tubes the only arguments that can be raised are that the 57 does not stand much of a signal voltage input and may be microphonic, while the '47 has a strong third harmonic content and stresses the high audio frequencies.

Let us first take up these objections.

Capabilities of the 57

It is true that the 57 bias voltage will be actually around 6 volts, which isn't large, and therefore a peak signal voltage in excess of 6 volts will start grid current, with consequent distortion. This condition is readily detected by ear when the volume control is worked, with a very strong local tuned in. When the control is at mid-position let us assume a volume of sound of 20 per cent. of the possible maximum. When it is at three-quarters position the maximum is reached, and when it is turned to "full on" position the volume declines. This is due to tube overloading, and in all likelihood, in such a circuit as outlined, the detector tube is at fault.

When tuning in a weaker station maximum volume is attained when the volume control is at "full on" position, for then no grid current flows, and no tube saturation results.

When the detector tube saturates, its output is severely reduced. But in such a system as described, if the detector did not overload the power tube would, so it is a choice between the two, and one is no worse than the other. Besides, with a volume control that governs the amount of signal voltage fed to the detector it does not matter if the detector can be overloaded, since prevention of overload is possible at all times. Therefore in a receiver using such high-gain tubes, with only two or more stages of t-r-f and 57 detector, the volume control should be ahead of the 57 detector, although with only one stage of t-r-f the control could be placed after the detector.

Question of 57 Gain

Since the 57 will take a signal voltage not exceeding 6 volts peak, and the '47 will take a peak signal of 16.5 volts (the amount of the negative bias), the detector need provide a gain of only 2.75 to load up the '47 when the maximum allowable signal voltage is fed to the detector.

The audio frequency detecting efficiency of the 57 is not known, that is, not revealed in any tube chart characteristics, and some method should be provided for simple determination of such a quantity. A circuit is being analyzed with the object of providing the result. The measurement, of course, will have to take into account not only the signal voltage but, since it is modulated, the percentage of modulation.

In the first detector of a superheterodyne, where the modulation need not be con-

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How to Select Manual Trimmer Capacity

(*Continued from preceding page*)

treme. It will be found that 1,500 kc will come in at 3 or 5 or so on, and that 550 kc at 98, so the full broadcast band is covered.

If there is no oscillation, leave out the 800 ohms, if practical to do so.

The voltages come under the heading of adjustment, but if the power transformer is correct, one intended to deliver 250 volts or thereabouts at around 40 milliamperes, and the resistors not far from the recommended values, these voltages will take care of themselves. The voltages were listed completely, and data on determining what they are, printed in two previous issues (Setpember 3d and 10th). Most of the voltages will be found on the schematic diagram, likewise the resistance values, but not all the voltages can be read accurately with the run of meters, and the intimate details were printed in the previous issues.

In tuning it is obvious that certain dial settings should prevail for certain frequencies, but since there is a manual trimmer there is a chance of mistuning. That is, the trimmer may make the detector resonant to the desired frequency when the r-f end is resonant to a somewhat different frequency.

When this condition exists you may hear two stations at once, and assume that the set is not as selective as intimated. But the real cause of the trouble will not be in the receiver but in the operator. A little experience will determine just where the main stations come in, and the best, without interference, and these positions you may use as reference. For instance, WMCA, 570 kc. came in 95; WEAF, 660 kc, at 85; WOR, 710 kc, at 80; WJZ, 760 kc, at 75; WABC, 860 kc, at 65; 1,400 kc at 8 and 1,500 kc at 4.

When the manual trimmer is at minimum capacity, plates disengaged, resonance is established for the lowest frequency, whereas for the highest frequency the plates should be fully enmeshed. If the manual trimmer affords resonance with plates, say, three-quarters enmeshed, it shows that the capacity of this condenser is too high. Therefore remove one plate and retest. If again less than full capacity is needed for the highest radio frequency, remove another plate. If first a stator plate was removed, next remove a rotor plate. Condensers commonly supplied may require the removal of one plate. Do not use a larger capacity condenser than actually necessary, as too large capacity confuses tuning.

sidered because of the exclusive radio frequency values treated, the practical gain of a '58 was found to be 3.3 by computation, based on prescribed signal and oscillation voltage values. (These values were: bias 10 volts negative, oscillation voltage 9 volts, signal voltage, 1 volt.) Though the situation is quite different in an audio frequency detector, when the '57 tube is used it is expected that practical gain will prove to be more than 3.3.

Low-Signal Detector

But assuming 3.3 as the factor, the maximum allowable signal voltage on the detector would be 5 volts, for the bias on the power tube is 16.5 volts. So, with a very sensitive detector such as the 57, and a very sensitive power tube, such as the '47, the problem really centers on the power tube, for all high mu tubes take relatively low bias, and both the '57 and the '47 are in the high-mu class.

So when one says that the '57 does not stand much of a signal voltage one speaks the truth, but the limiting factor rather will be found in the power tube stage, and besides a sensitive detector does not have to receive much of a voltage to produce a sufficiently large output. Therefore the '57 is a suitable detector, as stated from the time the tube was announced, for use with low signal values of input voltage, and the correct design requires that the voltage be not as high as it can be made but no higher than it should be.

This brings up another although incidental consideration. If there is to be some intentional limiting of the voltage put into the detector, what is the sense of using such high-gain tubes as the '58 only to waste some of the amplification to obtain which the tubes were selected originally?

The Answer

The answer is that there is no such "waste." The circuit is designed to produce as much as possible, consistent with utter absence of oscillation and cross-modulation.

To attain stability of this sort at reduced amplification is no different in principle than using 1-to-4 transformation ratio in the r-f coils, rather than 1-to-1, for the effective gain is larger with the unity ratio, because of the consequent tighter coupling and larger transfer of energy, but where is the selectivity? We must have stability in one instance, we must have selectivity in the other, and indeed all requirements converge on the prime essential that we must meet the performance demand.

When the circuit is properly designed, the detector tube will not be wholly free from overload in all localities and under all conditions (no tube would be), but in tests made in New York City, with more local stations and more powerful ones than almost anywhere else, the overload took place on only one station, WOR, and as for all others the volume control had to be "full on" for maximum volume of sound.

Microphonic Effects

A condition may arise that would lead one to call the 57 microphonic as a detector, but this microphonism is usually due to magnetic or static coupling between the detector tube and the speaker, and if the speaker is turned screw-fashion in a chassis so as to change the angle of coupling, or its position otherwise altered experimentally, it will be found that the microphonic effect will disappear. Now, that is no argument against the tube, but against the location or position of parts. Any audio frequency detector that is sensitive is sensitive to acoustic feedback as well as to modulated radio frequency input.

Another consideration is that incorrect voltaging of the tube will create erratic operation that invites microphonic trouble because of the very instability. This mistake usually takes the form of having a higher effective voltage on the screen than on the plate and arises from forgetfulness or worse. If the plate load is 0.25 meg., and the plate current is the recommended 0.0001 ampere (0.1 ma), then the voltage dropped in the plate load is 25 volts, and if 250 volts are applied 200 are are effective. If the same value of resistor is placed in the screen leg, assuming one-third as much current in the screen as in the plate, then the voltage drop is 250,000 x 0.000033, or 8.33 volts, or, more simply, the voltage drop is one-third of 25 volts, and the effective screen voltage is 241.67 volts, or 41.67 more than the effective plate voltage. In such an instance the tube might even turn oscillator by the dynatron method.

That Third Harmonic

The actually measured screen current in a given circuit, virtually duplicating standard voltage application, with plate current limited to 0.1 ma, was 0.000024 ampere (24 microamperes), so that the effective screen voltage when 5 meg. were in the screen lead and returned to maximum B plus, was 120 volts less than the application, or around 110 volts. (The applied voltage actually was 230 volts).

The strong third harmonic of the pentode tubes is found principally in the older pentodes intended for battery operation, and in the '47 may not be much over 5 per cent. There is no gainsaying it is better not to have any, but against this it may as well be admitted that with confinement to five tubes the output tube must be the most sensitive type available, and also is it true that the ear does not readily distinguish the third harmonic distortion. Probably the worst phase of this distortion is the annoying fact that no means of getting rid of it are known. Second harmonic distortion can be balanced out by push-pull. Third harmonic distortion is in the nature of fundamental distortion, in that you cannot get rid of the third without eliminating the signal. The tone may well be fully satisfying to the ear, although not to meters, but one listens to a set with the ear, and not with meters.

Leak Values

The high audio frequency accentuation introduced by the pentods can be compensated. The trouble is severe only when the audio system itself is unstable somewhere in the high audio frequency region. But the instability can be readily transferred to the low frequency region, and the mitigating methods employed to balance the circuit acoustically in both extreme directions. Thus, to reduce the high audio frequency response, so it will not be too strong, a bypass condenser of 0.002 to 0.006 mfd. may be put across the primary of the output transformer.

The inherent instability of the circuit as a whole may be transferred to the low frequency region by using high value of pentode grid leak. With 20 meg. there would be low frequency oscillation, so 5 meg. may be used as the principal load and 2 meg. more used in conjunction with a bypass condenser across the 2 meg., for hum filtration. Then at low frequencies the load is 7 meg., whereas for high frequencies it is 5 meg., because the bypass condenser, usually of 0.1 or 0.25 mfd., is effective on high audio frequencies only.

The '45 as Output Tube

No doubt many wonder if the '55 tube cannot be used. Of course it can. First, it is a true linear detector under optimum conditions; second, it has an amplifier triode to help make up for the absence of amplification in the detector. But the triode does not nearly make up for the difference in gain, comparing the '55 to the '57. The final volume of sound is not high enough. The performance demand is not achieved as to sensitivity. Tone may be improved, but the expense is prohibitive. You get no enjoyment out of the stations you can't hear, and the number you can't hear gets to be annoyingly large. The '55 is most suitable for superheterodynes, where there is plenty of amplification to spare.

Nor can the '57 be retained and the '45 tube be used as output, for the final volume of sound is about comparable to that obtained from the '55 with the pentode as output.

B Choke in Negative Leg

The B supply choke had better be in the negative leg of the rectifier, as this introduces audio frequency regeneration, and the negative feedback cancellation thus achieved is about equal to that developed by 50 mfd. of capacity.

It must be assumed that economy is one reason for selecting a five-tube set, and when results of this kind can be accomplished so economically, they should not be ignored. Moreover, the B supply choke may be the field coil of a dynamic speaker, also for economy reasons.

This regenerative audio applies only if the detector is a screen grid tube. As an experiment the '56 tube was tried and the large sensitivity drop was not due to the difference in detecting efficiency alone, but also to the absence of audio regeneration.

An Audio Tube

The detector tube is an audio frequency tube because it handles audio frequencies. The virtual cancellation of negative feedback takes place principally in the detector tube, in the screen and cathode legs, although really the audio circuit should be considered as a unit, as what affects the detector affects the output tube. The two tubes are like resistors in parallel.

As intimated, so much cancellation may be introduced, as by extremely high leak values, that the feedback becomes positive. Then oscillation results. It may be motorboating, a low frequency, or it may be a continuous squeal, a high frequency, and is likely to be at one extreme or the other. Special precautions should be taken to avoid this, and two methods have been stated.

Small Condenser

Across the detector biasing resistor and the detector screen resistor, since cancellation of negative feedback has been established virtually in a complete form, only relatively small bypass condensers need be used. Thus 0.1 mfd. is sufficient. Across the grid biasing resistor of the detector a high capacity electrolytic condenser may be put, because the resistance is low, and the result should be either a small increase in volume of sound, no difference in volume of sound or motorboating. In any of these instances it is clear that a condenser of that capacity is not required. This is a good way to check up on how close you are to the motorboating region. If the circuit motorboats with the 8 mfd. from detector cathode to ground, then you are pretty close. Of course then do not permanently leave the condenser in that position.

Screen Resistor

As to the screen resistor, it is quite likely that an electrolytic condenser across it, or from screen to ground, will stop the signal completely. The reason is that the screen resistor is so high, 5 meg., that the d-c resistance of the electrolytic condenser is much less, and therefore the screen voltage actually is raised so much that the detector is removed from its detecting bias.—H. B.

[A circuit predicated on the above tested theory has been built and will be described next week, in the September 24th issue.— EDITOR.]

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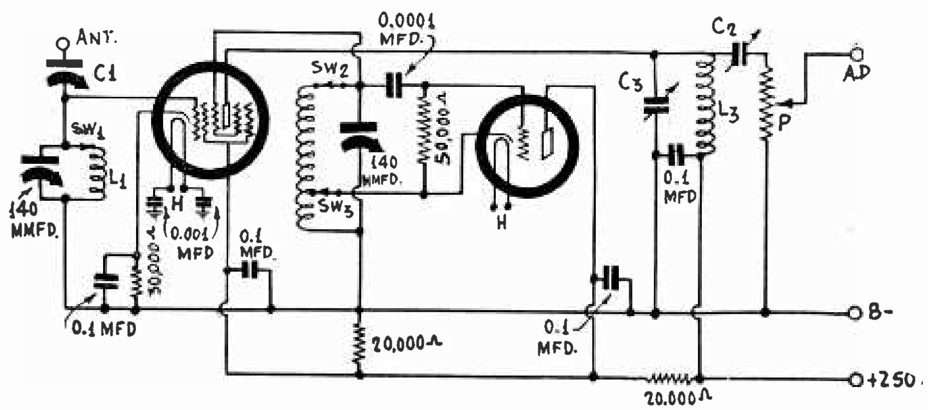


FIG. 1028

The circuit of a two-tube short-wave converter utilizing the 57 tube as detector and the 56 as oscillator. The oscillation voltage is impressed on the suppressor grid of the detector.

Two-Tub Converter

PLEASE publish the circuit diagram of a two-tube short-wave converter utilizing the 57 and the 56 tubes. I have two 140 mmfd. tuning condenser and I wish to use them, one for the r-f tuner and the other for the oscillator. I also have a set of short-wave coils for these condensers. lease show all values.—W. V. L., New York, N. Y.

You will find a circuit diagram in Fig. 1,028. C1 is a small midget condenser, say one having a maximum capacity of 50 mmfd. C2 may be a similar condenser but having a maximum capacity of 100 mmfd. L3 should be a regular r-f midget tuning coil, secondary only, and the condenser C3 across it may be a regular 350 mmfd. tuning condenser. However, it may also be a trimmer type condenser that may be adjusted to a capacity of 100 mmfd. If C3 is a 350 mmfd. variable condenser the L303 circuit may be tuned to any frequency to which the broadcast set is tuned, and thus the intermediate frequency may be varied over a wide range. Notice that the oscillator is of the Hartley type in which the cathode of the tube is connected to a tap on the coil. This tap may be about one-third of the turns up from ground. If the oscillator coils you have are of the tickler type. connect the cathode to ground and put the tickler in the plate circuit, that is, run the plate lead through the tickler before it goes to B plus. P may be a potentiometer of 500,000 ohms and it is used for controlling the input to the broadcast set.

* * *

Converting an Old Set

SEVEN years ago I bought a Neutrodyne receiver in which all the tubes are 201A. This receiver has given splendid results all this time but I think now that it is out of date. I wish to build me a modern set utilizing the very latest a-c tubes, small shielded coils and a dynamic speaker. I should like to use as many of the parts from the old set as possible. Will you kindly give me a circuit that would be all right? It should not contain more than 5 tubes. —F. W. R., Pittsburgh, Pa.

We have published a number of five-tube midget receivers during the last year. Any one of these utilizing the latest tubes should be all right. About all that you can retain of the old set is the memory.

Making Auto Set More Sensitive

CAN YOU suggest a way of making my five-tube automobile receiver more sensitive? Out of the car the set is fairly satisfactory but in it it will hardly pick up the local stations. I don't know whether the trouble lies in the car or in the receiver.—R. L., Harrisburg, Pa.

It is difficult to make a 5-tube set sensitive enough for automobile use because there is so little pick-up in the car. However, you can improve it some by increasing the number of turns on the primaries of the tuning coils. In some cases as many turns are used on the primaries as on the secondaries. On the first coil the primary is sometimes omitted and the antenna is connected directly to the stator of the tuning condenser, and sometimes a small condenser is put between the antenna and the stator. Whether you can use this arrangement depends on whether or not the volume control is in the antenna circuit. If you have a 5,000 ohm potentiometer across the primary you might improve the set by increasing the value, or by connecting the resistance in the cathode leads only so that it will vary the bias. You should arrange the very best pick-up system that you can. The best possible in a car is none too good.

* * *

Long Delayed Signals

A YEAR or two ago a report came from Norway that signals had been received 13 minutes after they had been sent, suggesting the possibility that they had traveled to the moon and back. Has any plausible explanation of the delay been given which did not necessitate that the waves leave the earth? If so, what is it?—W. H. C., Cleveland, Ohio.

No completely satisfactory explanation has been given. However, it has been suggested that the long delay took place in the ionized region known as the Heaviside layer. If a wave travels some distance in an ionized region there will be a long delay because the speed of propagation would be much slower in such a medium. It is hardly possible that the waves traveled back and forth between the two surfaces of the layer and that they finally emerged toward the earth. Such multiple reflections are known in optics. However, as far as we know this has not been offered seriously as an explanation. Multiple reflections are used to explain certain radio phenomena, but they are supposed to be due to more than one layer.

* * *

Power and Filament Size

MOST POWER TUBES have large filaments. Is there any relation between the size of the filament and the output power of a tube? If so, what is the relations?—F. R. C., Providence, R. I.

The maximum output power of a tube depends on two things, voltage and current. By increasing either the power can be increased. It is desirable that a power tube have a low output impedance because then it is easier to effect proper matching than if the tube has a high impedance. This means that the current will be large. The voltage is limited by the geometry of the tube, which in turn is related to the output resistance. Hence for a given voltage in the plate circuit, to get high output power we must have a high current. The only way we can get current is to have plenty of electrons available from the filament. We cannot increase the available electrons by increasing the voltage but we can by increasing the size of the filament, or of the cathode. We may make it low, but then the filament voltage necessary is high. We can also put two or more filaments in parallel, thus increasing the filament current. When the filament voltage is the same for all the tubes in a given series, then the power tube always requires more filament current because the filament is heavier or because it consists of two or more filaments in parallel. The more active surface of the filament the more electrons will be available, and the greater will be the output power. The 238 power tube takes the same filament voltage and current as the other tubes in that series. This shows that the cathode of this tube is the same as those of the other tubes in the same series. It also shows why this tube overloads easily. The 89 tube in this series has the same voltage requirement but it takes 0.1 ampere more filament current, and therefore it has a greater output power.

* * *

Padding Adjustments of Supers

I HAVE ATTEMPTED a number of times to pad a superheterodyne. I have followed directions very carefully, but so far I have had no success. My trouble is mainly in the middle of the tuning range. At both ends I can trim so that the set is sensitive but so far I have not succeeded in making it sensitive in the middle. Will you kindly suggest possible reasons for this trouble?—A. L. S., Denver, Colo.

If you run into much squealing at the middle of the tuning range it may be that you are "crossing the carrier." You did not say what the intermediate frequency of your circuit is, but let us assume that it is 175 kc. In that case your high frequency adjustment of the oscillator may be such that the frequency is 175 less than the signal frequency. This will bring in the low-wave stations all right. At the low frequency end the adjustment of the oscillator may be such that the frequency is 175 kc higher than the carrier, which is correct. When this adjustment has been effected there will be some point in between where the oscillator frequency will be equal to the signal frequency and nothing but squeals can be obtained. Over a wide band in the middle the receiver will otherwise be dead. In order to correct the trouble the oscillator should be adjusted so that the frequency is 175 kc higher than the signal frequency at the high frequency end of the tuner. If there is much distributed capacity in the oscillator the correct adjustment may not be possible and it will be necessary to get a new oscillator coil, or to rewind it so that there is more space between the primary and secondary windings. Another possibility is that the inductance of the oscillator is too high. Removing a few turns should remedy that.

135-MILE SPAN BY 'ULTRAS' AT TOTAL ECLIPSE

The data collected on the effect of the total eclipse of the sun on radio wave propagation are not conclusive. Some indicate that the eclipse had the expected effect, others that it had no effect, and still others that it produced effects not expected.

From England comes the report that the waves behaved normally as no peculiar effects were noted on signals received from United States or Canada. Neither was there any apparent disturbances with the signals transmitted from the station at Rugby and received in America. There may have been some alteration in the results, according to a statement by an engineer of the British Post Office, but nothing definite can be said until data collected in America have been compared with those taken in England.

Signal Changes

Signals received at the Case School of Applied Science in Cleveland from a special short-wave station set up in the path of totality shown marked changes. The signals were normal until a few minutes before totality, when they surprised observers by fading away entirely, and they did not return for three-quarters of an hour. These signals were carried on a wave of 40 meters. The signals increased in intensity as the eclipse progressed from a normal of four microvolts per meter to 30 microvolts at the peak.

Several observers reported a slight increase in static during the eclipse, but it has not been established whether this was caused by the eclipse or by the atmospheric conditions at the time. Fading seemed to be greater on signals sent from East to West in the United States, but fading was slight on messages transmitted in the opposite direction. There was nothing unusual in transmission from North to South.

WABC observers reported an effect similar to that reported by the observers at Cleveland. An airplane over Long Island equipped with a 195-meter transmitter sent out signals continuously. For an hour during the height of the eclipse the signals from this station faded out entirely.

A receiver at Riverhead, L. I., tuned to the 22-meter wave of the Canadian Marconi Company showed slight fluctuations in intensity. The effect on broadcasting stations' signals, if any, was not perceptible to the ear.

Ultra Wave Result

An interesting report came from the National Broadcasting Company. An ultra short-wave station was set up on the top of the Empire State Building in New York. Receiving stations tuned to this transmitter were located at many points in the surrounding countryside. One was at Riverhead, L. I., and another on top of Greylock Mountain, North Adams, Mass. The respective distances were 80 and 135 miles. The ultra-short waves were received with unusual strength at Riverhead during the eclipse and were just audible for a brief moment at Greylock Mountain. This is the greatest distance such short waves have been received in the United States. Ordinarily the waves are not even audible at Riverhead.

Vital Facts May Impend

The engineers point to this record as especially significant in view of the recent announcement by Marconi that he had succeeded in sending waves 167 miles. The significance, however, fades when it is remembered that Marconi was not aided by a total eclipse of the sun.

Apparently only the receiving stations between the transmitter and the area of totality were affected as reception at other points was normal. Commenting on the tests, C. W. Horn, general engineer of the National Broadcasting Company and in charge of the tests, said: "It is impossible to explain the condition until the data have been studied. Present reports would indicate things on the ultra-short waves that have never been noted before during either day or night transmission. Frankly we are mystified, but we realize that we may be on the verge of important discoveries."

Fading of WGY

The Radio Corporation of America reported no effects on transoceanic radio communication. The reception of WGY, Schenectady, at Riverhead, L. I., showed two marked periods of fading at the time of the eclipse. Transmission to South America on waves of the order of 15,000 meters was improved, but transmission on short waves showed no changes. From Berlin came the report that the reception of an 18-meter wave from America was greatly improved.

Improvement on 2,100 Meters

A report from Chatham, Mass., on communication between that point and ships in the St. Lawrence River was improved when coming from the South than when coming from the North. This transmission was carried on 2,100 meters.

Exceptionally heavy static was reported by Mackay Radio and Telegraph Company. This started about two hours before the eclipse and attained a maximum when the eclipse was maximum. This company also reported that interference on 2,100 meters was great, while short waves were normal in this respect.

Five-Sixths Drop in Illumination

An interesting report on the intensity of illumination during the eclipse came from the Electrical Testing Laboratories in New York. The natural illumination of the skies dropped from 12,000 foot-candles at 4 p.m. to 200 foot-candles at 4:34. Most of the illumination during the period of maximum obscuration was due to reflection in the sky and a bright band about the horizon. The 5 per cent. exposure of the solar surface did not account for the illumination as was thought by many observers.

Unfairness Charged to the Commission

Washington.

Louis G. Caldwell, former chief counsel of the Federal Radio Commission, now engaged in the private practice of law, as chairman of the committee on communications, American Bar Association, reported the Board was unfair at hearings.

"Important matters which, to all intents and purposes, are given the effect of regulations are not embodied in the regulations, and no one can be certain in a particular case whether such matters will or will not be determinative in his case," says the report.

"Another instance of such uncertainty is in the field of discipline of broadcasters for alleged shortcomings in their program service. * * * * *Formal regulations are strictly enforced in some cases and completely ignored in others.

"Owners of small stations are frequently required to expend large sums of money, wholly out of proportion to their investments and their means, in defending their interests in proceedings before the commission."

STATIONS MAY BAR POLITICS, BOARD RULES

Washington.

Acting Chairman Lafount of the Federal Radio Commission issued the following statement:

The Radio Act permits the broadcaster to refuse the use of his station to any and all candidates; but to adopt such a policy would be short-sighted, in my opinion. The law also provides that, if a broadcaster permits one candidate to use his facilities, equal opportunity must be offered to all other candidates for that office.

The broadcaster, under the law, has no right of censorship over the material broadcast by political candidates other than to see that no obscene, indecent, profane or defamatory language is used.

An Opportunity

Broadcasters have a wonderful opportunity in the present campaigns for public offices to render a distinct and outstanding public service. They have a rare chance to develop good-will and to popularize their stations by providing a forum whereby candidates can freely and fully discuss paramount issues.

Of course, all of our people are vitally interested in the election of a President, Members of Congress, Governors of many States, and other leading officials. Radio stations should prove a big factor in transmitting speeches caluculated to inform voters and to quality them to vote intelligently.

Wholesome Effect

I know of no greater public service to which broadcasting stations could devote themselves at this time than to permit a liberal use of their facilities to candidates. Personally, I hope broadcasters will be as liberal with their facilities as their Government has been with them.

Dispassionate discussion of public questions by candidates, in my judgment, will have a wholesome effect on listeners, arousing their interest in governmental affairs and public questions. The transmission of such intelligence to our people should prove most stimulating and add to the cultural progress of the Nation by keeping the electorate fully informed on public matters.

WJZ-WBAL Resume Synchronization Tests

Washington.

A three-month extension of special authorization to WBAL, Baltimore, and WJZ, New York, to synchronize on 760 kc, has been granted by the Federal Radio Commission.

At first the renewal was refused, as the prior experiment, lasting about a year, was not deemed successful, and there were many listener complaints of interference and some of reduced service area. Despite trouble, some advance was made, and the renewal was issued in the hope that more experience will yield further improvement.

The stations were gratified.

POLICE RADIO EFFECTIVE

So effective has police radio moved in New York City that the green signal lights to summon policemen on beat to the phone have been discontinued. The broadcast alarms and presence of patrol autos rendered the "blinkers" unnecessary.

A THOUGHT FOR THE WEEK

NOW we have "Crooner" on the screen—and what an arraignment of the megaphone "genius" it is! Rian James, from whose book of the same title this picture was made, has his crooner stand midway between plain idiocy and downright meanness. We thoroughly agree with the critic who said of this film story of a mike celebrity: "Its intent is malicious."

RADIO WORLD

The First and Only National Radio Weekly

Eleventh Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York. N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor; J. Murray Barron, advertising manager.

COMING: THE $10 SET

BUSINESS in radio is improving, but the road to the restoration of high dollar volume sales is a long way off. It is distressing for a dealer whose mind is on thousand-dollar unit sales to have to consider a set that will sell to the public for a measly $10. And yet there will be many thousands of $10 sets sold this winter, and manufacturers are now busy making them.

Yes, it has come to that—a receiver with speaker, for a-c operation, nothing fancy, but a device that really works—for the small sum of only $10. Tubes are extra, but there are only four of them, and these can be bought by the customer at $3.17 extra, so that with $10.17, a piece of wire to run to the cold water pipe for ground, and any convenient aerial, indoor or outdoor, the home can be radio-equipped. And how!

The manner whereby such can be brought about is this: The manufacturer decides to take a flier with 5,000 sets, the quantity being necessary to meet the price. He turns them out and to gain his necessary funds, as so far he has spent credit rather than money, he must sell the sets for cash. The manufacturer's profit is about 50 cents per set. You buy the set, pay for it, and that's the last the manufacturer wants to hear about it. The purchaser takes over service and repair troubles, for at that price such is the tacit part of the bargain. Nobody can object. Certainly the manufacturer has no profit wherewith he can finance service. He kisses the sets a fond farewell, and not a mere goodbye!

It seems funny. It is funny. And yet the $10 set will be a most serious thing. It will sell in far greater quantity than any radio sets have ever sold in the past. And many constructors will build such sets from designs that the radio press must publish. Factory wiremen, getting $3 a day, average six sets per day, so by building the set yourself you save 50 cents. Not much, but you can't expect to save $12 out of $10. Remember that 50 cents is 5 per cent.

Most manufacturers wish the situation were otherwise. They offer the biggest values in radio history, really fine receivers of the imposing console types, for less than $100, but the competition they fear is not that of the other manufacturers selling sets in the same price category, but that of the smaller manufacturer with sets that sell to the public for $10. And the big manufacturer is not now able to enforce a cash basis, and moreover the dealers' margin has to be big enough to support the finance charges which may be about 20 per cent.

The $10 set doesn't have to be sold on time—can't be, under the circumstances—and indeed the total payment is less than the down payment on some more imposing and better sets.

The large manufacturers will have to do something about the biggest unit volume field, even if they establish a dual discount and a dual credit basis, or net price, no discount, on the $10 sets, C.O.D; long discounts, usual time on the sets that must be sold on credit to be sold at all.

Ten Years Ago This Week

"HOW to Make a Two-Tube Super-regenerator" was described in the September 16th, 1922, issue of RADIO WORLD. That was the twenty-fifth issue published, and RADIO WORLD thus was about to hit the one-half-year mark.

The author of the super-regenerator article was Frederick J. Rumford, and in listing the parts he gave the prices. Just as a comparison the prices prevailing in the retail market to-day for equivalent apparatus are given also:

	1922	1932
Two 201 tubes, ($6.50 each)....	$13.00	$1.04
Two sockets, ($1 each)	2.00	.22
Two rheostats ($1.50 each)	3.00	.60
Two variable condensers 0.001 mfd., ($ .50 each)	9.00	1.80
One variocoupler	6.00	1.00
12 binding posts (10c each) ...	1.20	.60
One bakelite panel, 16 x 9	4.32	1.10
One 1250-turn duolateral coil..	2.75	.85
One 1500-turn duolateral coil..	3.50	.85
One switch assembly	1.50	.30
One wood base, 16 x 11	.50	.25
One bracket and shelf	1.00	.35
Screws, wire, accessories	1.00	.40
Total	$48.77	$9.36

So you can see it pays to buy now, rather than then!

A loop was not listed among the parts, although one of the requirements. That would add, say, a few thousand dollars more to the 1922 total, and a few cents more to the 1932 total. In fact, some dealers might consider it a favor if you carried away without paying a cent some of the loops that have grown dusty in the cellar. All that is needed is the courage of severance, and the customer can supply that.

The diagram illustrating the wiring showed two tube symbols, marked UV201 and UV202 respectively, the first being the r-f amplifier, the second the detector. But the list of parts called for two 201 tubes. So the niceties of unbalance that will adorn technical articles from time to time, even in our day, were well known to the remoteness of ten years ago.

The Bedloe's Island Station

The front cover illustration that week a decade back showed a soldier operating the transmitter of WVP, Fort Wood, Bedloe's Island, New York. The wavelength was 1450 meters, and the coverage was reported to be the widest in the United States. Significant, perhaps, is the fact that the Statue of Liberty is on this little island. Significant of what, however, in connection with WVP, we are at a loss to say.

Then there were two very simple hookups of one-tube sets, using vario-coupler, the grid winding being tapped, and a slider moved over the taps, to augment the tuning done by a series ground condenser. Yes, sir, the requirements were as modest as that in those days.

Secretary of State Hughes visited the Brazilian Centennial Exposition at Rio de Janeiro, duly recorded in that issue, because there was a large reproduction of a photograph of the transmitter and receiver aboard the steamship Pan America. This outfit kept the Secretary in touch with Washington. Messages could be received 4,000 miles, which was going some in those days.

All over the world there was progress in radio, as Carl H. Butman duly recorded, with England licensing sets, French going in for weather reports, Japan and China again threatening to come to an agreement, this time concerning radio stations at Tsingtau and Tsinan, while Sweden, England and points north, east, west and south chipped in with items of information about "progress."

Aircraft and Police Radio

Radio for aircrafts was serious business, although methods had not been standardized, but the Navy's Aircraft School of Instruction was not without its ambitions and laboratory instruments to help make radio the great aid to flying that it has become. Also, police radio was in the making, with a few cities trying it out, one of them Washington, D. C., while New York City was about to start its police transmitter, all in the interest of protecting the citizens at the expense of the citizens.

"Don'ts" were popular then. One illustration follows:

"Don't make the fatal error of connecting the plate battery terminals to the filament terminals of the tube."

That advice holds as true to-day as it did then, thus proving that much of enduring value was going the rounds.

The muse was smitten by the thrilling exploits of radio, and in that issue of ten years ago there appeared the following strictly original poetry:

THE RADIOMAN'S LOVE SONG

By John Webster

I am high on the breast of the swelling sea,
And your voice comes from faraway home to me;
It comes clear and true from the weird above—
And you sing of love—you sing of love.

I start—I look! But you are not near!
I wonder—I ask: Is it you I hear?
Yes—'tis you!—though your voice comes o'er leagues of sea—
For you sing to me—you sing to me!

$100,000 ORDER FROM NAVY

An order amounting to more than $100,000 has been received by the Westinghouse Electric and Manufacturing Company from the Navy department for aircraft radio transmitting and receiving equipment. The equipment will be built in the Chicopee Falls Works, a radio product division of the Westinghouse Electric and Manufacturing Company.

STATION SPARKS

By Alice Remsen

Crack a Smile

For Ed Wynn

WEAF—Tuesday, 9:30 p. m.

What is better than a smile
And a cheery song?
Help to make our life worth while,
As we jog along.
Goodness knows life can be sad
Anywhere we go.
Even good things may be bad
If we make them so.
Pessimists will always say
Things just can't be right.
Their blue sky is always gray,
Outlook black as night.
If they'd only crack a smile,
Sing a cheery song,
They'd be, in a little while,
Right instead of wrong.

—A. R.

* * *

AND SO, ALL YE PESSIMISTS, crack a smile with Ed Wynn, "The Perfect Fool." Your misery will be over. Depression will disappear. Broad grins will take the place of pessimistic frowns. For Ed is that boon to humanity, a jester. With his tongue in his cheek, he laughs at us all, and we laugh right along with him, for who could resist that sparkling personality and spontaneity! Tune in on Ed Wynn and laugh your blues away.

* * *

The Radio Rialto

To-day everybody has been all agog over the eclipse . . . I was just as bad as the rest of them . . . craning my neck to look up at the sun . . . squinting through an exposed film which a friend of mine was kind enough to send me. Yes, I watched the eclipse and it was marvelous . . . and while it was taking place, another old friend of mine, Allan Broms, the scientist, was explaining the phenomenon over WEAF . . . rather puzzling to a layman, but infinitely beautiful . . . no wonder our ancestors worshipped old Sol.

Just before the neck-craning started, ran into Leonard Joy, who used to do such a good job on the Coca-Cola program and is repeating it all now on Nestle's. With Leonard was Henry Redfield, one of those fine musical arrangers; he does all of Harry Reser's work; mighty good work, too. . . . A little later on met John Quinland who hails from New Zealand and doesn't mind it. . . . John told me of a curious thing—the three folk who broadcast on the Littman program over WOR mornings, all hail from different British colonies; John, himself from New Zealand, Yolande Langworthy from Canada and Norman Pearce from way down yonder in Australia. . . . Do you remember Carl Fenton, who had that grand orchestra on the Cremo program with Bing Crosby last season? . . . Of course, you do; well, he's still smoking cigars almost as big as himself, and has several programs up his sleeve for the coming season; glad to hear it, Carl; that orchestra of yours is a pip.

That's a swell-looking gal crossing the street—she's Helen Gordon, who plays violin and also sings a mean song; very clever girl; should be a good bet for radio. . . . Did you know that Roger Bower calls himself "radio's biggest mistake"? . . . Could mention a few others, Roger, but—well, I'm a good-natured sort of person. . . . Must pop up to see Elmore White; he's an old pal of vaudeville days; deserted Lady Vaudeville for the music business; was with De Sylva, Brown and Henderson for a number of years and now in business with Buddy Green, the song-writer.

Here we are in the heart of Tin Pan Alley. . . . "Hello, Elmore, get my key on that swell song of yours, 'Moonlight on the River,' will you?—plenty requests for it, boy." . . . As I go out, cute little Beth Challis comes in; she's had requests for it, too. . . . There's a boy that you're bound to hear of sooner or later, Bob Keller. . . . Can that lad arrange for voices! Well, rather, as they say in dear old Lunnon! . . . At present he has a male quartet, a mixed quartet and a female duo that sound good to me. . . . Out on the street; taking another squint at the sun. Gee, but that's a marvelous sight!—but how it dazzles the eyes. . . . Mose Gumble also thinks it's fine, he's taking a look. . . . "Hello, Mose Look out for the cars!"

I would pick out a day like this to search for radio news. . . . Have you ever heard of Meyer Davis? . . . Of course, you have; he has oodles and oodles of orchestras, and now he's opened a swell penthouse studio where rehearsals are held and private auditions given for clients interested in radio talent; some day I'll take you on a personally conducted tour of that very nice place. . . . Speaking of auditions, I understand that Chrysler listened to a few at WABC, pretty big names, too, but came away unsatisfied. When will sponsors realize that mere names don't mean much in radio; talent and personality are everything. Listeners are very choosey these days; they have their favorites—and names don't lure them any more.

Over to 711 Fifth Avenue, squinting through the back of a taxicab window now. . . . It's getting darker and darker . . . there's a beautiful red glow surrounding the sun . . . taking a look through my dark film, there's just a thin little crescent left . . . looking at it with the naked eye again . . . there's a shimmer of light—green, pink and gold; it just makes you shiver with delight.

My goodness, there's the Pickens girls, entering the sacred portals of 711. . . . Go upstairs with the girls and listen in on their rehearsal and what do you think —they're using Elmore's song tonight— and I'm not going to miss it, either. . . . Something else I heard to-day at the Mobiloil rehearsal; Nat Shilkret's own composition, "Just a Bit of Sunshine"; it will be played over the air to-night for the first time and sung by the Men About Town. Quite a graceful little thing. . . . Gladys Rice will sing "L'Amour, Toujours L'Amour" on the same program. There's a clever girl. . . . Always enjoy her work.

Well, the eclipse is over and it's time for me to go home, where I have something waiting for me that eclipses anything in the eating line—Octavia's steak and kidney pie. . . .

* * *

News of the Studios

WABC

Abe Lyman's Orchestra, with Frances Langford as soloist, has been engaged for another 13 week series over the basic Columbia network, to be heard thrice weekly—each Tuesday, Thursday and Saturday from 8:15 to 8:30 p.m., sponsored by Sterling Products, Inc., manufacturers of Phillips Dental Magnesia. . . . Another renewal of contracts on the Chesterfield program, for an additional 14 weeks, for Ruth Etting and the Boswell Sisters. . . . Stoopnagle and Budd began a new series of sustaining broadcasts on September 5th. They may now be heard every Monday and Friday from 10:15 to 10:30 p.m., over a nationwide network of over sixty Columbia stations, including the Pacific Coast.

* * *

NBC

More mystery over at 711; The Shadow has flitted from Madison to Fifth and will be heard from that ether palace. . . . Sherlock Holmes will be back again this month. . . . The Phantom of Crestwood will be heard for a few more weeks. . . . The Rin Tin Tin Thrillers are still holding their own. . . . Several other sustaining dramatic thrillers will help to make the air-customers shiver in their boots. . . . As I write this Lucky Strike has taken me on its magic carpet to Berlin and I'm listening to a genuine German band play a heavy German waltz; perfect tempo and not a bad relay; hardly any static; fades slightly once in a while; instrumentation goes into a huddle, but the old oom-pah sticks out like a sore thumb; now they're playing a tango—rhythm in this is terrible—oompah still pounding away without the loss of a beat; the Germans take even their dance music very seriously.

* * *

WINS

The Dixie Nightingales, a trio of colored girls whose close harmony won a great following among the WINS audience last year, have resumed regular weekly broadcasts. They may be heard every Thursday evening at 8:15 p.m. . . . Billy Benedick's time has been changed. His reports on the doings of New York society celebrities will now be heard at 1:15 p.m. Thursdays, instead of 1:00 p.m. . . . There's a very interesting program on Wednesday nights at 8:15—The "Gossip Column" dramas.

* * *

WOR

A new series of humorous skits has been inaugurated over WOR and, under the title of "The Luck of Joan Christopher," are on the air each Monday, Wednesday and Friday from 8:15 to 8:30 p.m. . . . Marjorie Logan is another newcomer to this station; she will be featured in a program of songs, accompanied by Jack Erickson, every Monday night at 10:45. . . . The Bachelors, a male quartet, is now being featured over WOR twice weekly, Wednesday and Friday at 7:45 p. m. . . . Floyd Neale's secret ambition is to see Lady Godiva riding up Broadway singing "Bend Down, Sister." I'd like to witness that myself; bet it would draw a crowd.

* * *

Biographical Brevities

SOME FACTS ABOUT IRENE BEASLEY

This long tall "gal from Dixie," as she calls herself, was born in the small town of Whitehaven, Tennessee, not far from Memphis, on her father's farm. When Irene was only two years old she received her first music lessons from her 85-year-old grandmother. She used to climb up on the piano stool and play the bass accompaniment to her grandmother's rendition of "Dixie." . . . When Irene was six years old, the Beasleys moved to Amarillo, Texas, where she attended grammar and high school. . . . Her first piano lessons under a professional musician started at the age of seven, and she has vivid memories of long hours spent memorizing ten selections to win a singing canary named "Yankee Doodle," a prize offered by the

(Continued on next page)

RADIO ABROAD; TAX UNIVERSAL, OFTEN DIVIDED

London.

Ten years ago, six British radio manufacturers contributed £10,000 each to a common fund with which to commence a system of domestic broadcasting in Great Britain. They formed the British Broadcasting Company, Ltd., which, for four years, pioneered broadcasting. In 1926, the company obtained a royal charter and became the British Broadcasting Corporation—known familiarly as the B. B. C.—licensed by the Government to transmit broadcast material of all descriptions with only one fundamental restriction: the B. B. C. cannot accept monetary consideration from outside interests in return for broadcasting programs. In other words, it cannot transmit advertising programs for payment; its revenue is solely derivable from a license fee paid by owners of receiving apparatus.

At the present time the British radio industry represents £80,000,000 of invested capital and employs directly and in its auxiliary trades more than a million people, and caters for some twenty million listeners.

How Fees Are Divided

The broadcasting system of Great Britain (which includes northern Ireland) is unique. It is controlled by a Board of Governors appointed by the Government with Sir John Reith, Director General, as the executive head. It operates under a license granted by the Postmaster General, who charges every set-owner ten shillings per annum for the right to install and operate a receiving station, or, in other words, a dadio set. From this ten shilling fee the Post Office allots a proportion (about 48 per cent.) to the B. B. C. as a contribution towards the expenses of broadcasting programs and another portion goes to the National Exchequer. There is nothing to insure that the B. B. C. shall receive any contribution at all from the Post Office license revenue and if the present 48 per cent. were stopped, or reduced, the B. B. C. might be forced to accept "sponsored programs."

The B. B. C. is a semi-State department as its directorial personnel is appointed by the Government and its revenue granted by Also, the Government of the day has first the Postmaster General almost ex-gratia. call on any air time and has more than once exercised that right. The B. B. C. as a semi-state department, can be criticized in parliament on the estimates of the Post Office, or by question addressed to the Post Master General in the House of Commons. No fundamental alteration in the constitution of the B. B. C. and the present policy of British broadcasting can be effected until 1937 when the Charter expires and comes up for renewal or modification.

Broadcasting is vastly different both on the Continent and in the U. S. A., the latter being entirely on a commercial basis. Canada has now decided to remodel of commercialization to the British method of centralized control directed to securing highest entertainment value. Government control is also effective in Czecho-Slovakia, whence the Prague station broadcasts some of the most popular programs. Danish broadcasting is governed by the State Radio Council and financed by the proceeds from license fees.

Methods Used Elsewhere

France has its own method. While there is no monopoly, as there is in Great Britain, the majority of the stations are owned by the Government through the Ministry of Posts, Telegraphs and Telephones. There are twenty-eight broadcasting stations in that country. A license fee of one franc per year is charged French citizens while foreigners have to pay 10 francs per year.

A broadcasting monopoly is enjoyed by the Postal Service in Germany while broadcasting is prohibited in Freece, although the Government is contemplating creating a monopoly. Monopolistic control is also effective in Hungary where radio is under the control of the postal administration and about 2s. 6d. per year is charged to receivers. Broadcasting is also a monopoly in the Irish Free State and 10s. license fee, as in Great Britain, is charged. Before the end of this year a new high-powered station will be opened in Ireland, working on 80-100 watts whence "sponsored programs" will be transmitted.

The broadcasting situation in Holland is peculiar and almost resolves itself into a war between the non-Partisan Association of Listeners, with about 100,000 paying members, the Socialist and the Catholic broadcasting organizations. There are two Duptch stations—Hilversum and Huizen—but only one station can function at a time and the time allotted to each organization is computed on the basis of the number of members belonging to each. The authority which decides all radio matters is the Radioraad, which is presided over by a high Government postal official.

Mostly Batttery Sets

The outstanding tendencies of the British trade are the segregation of set-owners into two main categories and the increasing popularity of the radio-gramophone. The battery-operated set is still in greatest demand. This year's set sales should be in the region of two million, of which it is estimated that 1,250,000 will be battery-driven and the remaining 750,000 will be operated from the electric supply.

It is becoming noticeable that listeners are settling down into two primary classes—those who are content with the two chief B. B. C. stations and three or four European transmissions, obtainable on a good two- to four-tube set; and those who want to range the ether for anything and everything, which necessitates a multi-tube set in the superheterodyne class. Concurrent with this —and invading both classes—is the radiogram demand. "Two entertainments in one" is becoming an enticing slogan.

Station Sparks

By Alice Remsen

(Continued from preceding page)

teacher—and then one day the bird died as Irene pounded out "The Battle Hymn of the Republic."

Sweet Briar College in Virginia was her Alma Mater. . . . After that followed school teaching in a small Mississippi town. . . . Irene was superintendent, principal and teacher of seven grades, with eleven pupils in all. . . . While teaching Irene began to compose popular songs and sang them for her companions. The ballad, "If I Could Only Stop Dreaming"—her first published effort—paved the way for her debut in radio over a small local station. . . . She very soon left for Chicago, and sang over larger stations in a tour of the middle west. . . . She returned South to work in a Memphis music store, where she met a representative of a large recording company and received an audition. . . . It brought her to New York on a contract for a year's recording, and in April, 1929, she was persuaded to try her hand a radio in New York. . . . The result was a contract as an exclusive Columbia artist. She is still working under that contract and has gained a nation-wide following.

Irene has appeared as guest soloist on many of Columbia's leading hours. She was featured as "The Lady in the Smoke" on the Burns Panatela program; and as the star on the Peter's Shoe Parade. . . . In appearance Irene is tall, slender, has nice brown hair and eyes, with a very humorous quirk to her mouth and a twinkle in her eye. Always well-dressed and perfectly groomed, Irene is the complete personification of Southern ladyhood.

* * *

ANSWERS TO CORRESPONDENTS

ETHEL DARWIN, N. Y. C.—The Lady Bugs are Muriel Pollock and Vee Lawnhurst. They have both composed many songs and instrumental pieces. You may hear them every week-day morning except Friday at 9:15 a.m. over WJZ. They are not sisters and are unmarried.

CARLOS—Lowell Thomas was a newspaper reporter in Chicago twenty years ago.

(If you would like to know something of your favorite radio artists, drop a card to the conductor of this page. Address her: Alice Remsen, care Radio World, 145 W. 45th St., New York, N. Y.)

FIELD WORKERS OUSTED, BOARD TO DROP MORE

Washington.

The Federal Radio Commission began economy reduction of its field force by dismissing seven employes of the Grand Island, Nebr., monitoring station, according to a Commission announcement.

Four employes, whose salaries total $9,220, have stopped work, it was stated, while three others, whose salaries total $5,040, will be discharged at a date not yet determined.

As an added economy measure, the Commission will not operate test cars for broadcasting stations during the remainder of September, the announcement declared.

The following additional information was made available in the announcement, according to "The United States Daily":

The Commission must reduce its field force expenses by $35,000, and this is the first step in this economy. It is expected that at a later date about 15 more persons will have to be dismissed. These dismissals probably will be made at the Grand Island, Boston, New York, Chicago, and Detroit field stations.

Under the economy move, all field employes must take five days' legislative furlough each month, beginning in August and ending when 24 days' legislative furlough has been taken.

All field employes are now under the new "Division of Field Operations," instead of under the Radio Division of the Department of Commerce, as they were before the two agencieswere merged by executive order under the economy bill.

The dismissal of seven field employes follows close upon the heels of the Commission's first economy move of discharging 17 workers at the Commission's offices at Washington, D. C.

GALVANOMETER SUSPENSION

A new galvanometer suspension is announced by the G-M Laboratories, Inc., Chicago. This unit is designed to provide a stable means of support for instruments of the suspended mirror type for all kinds of measurements.

Edwin C. Hill's Rise; Air Reporter on Way To Becoming Celebrity

The Master in Action

Edwin C. Hill. Speaks into a table microphone raised on a pair of telephone books. . . . Leans forward whenever he wants to stress a particular point. . . . Taps his feet vigorously throughout his 15-minute talks. . . . Wears horn-rimmed glasses attached to a black silk ribbon. . . . With his right hand he removes the sheets of his manuscript and lets them drop noiselessly to the carpet. . . . His left elbow is on the other side of the microphone, while his hand is in the air, fist clenched. . . . Works hard and perspires generously even in a cooled studio. . . . Has his material perfectly timed.

Succeed from the very beginning, seems to be the motto of Edwin C. Hill. He decided while at school that he'd be a reporter, went to New York after a brief apprenticeship in Indiana and Ohio, and in four months was being paid space rates in the metropolis, a high mark of esteem. The general rule was that space rates were granted only to those who had been on that newspaper—the N. Y. "Sun"—more than eight months. But Hill made the grade in half the time, and almost in a jiffy he was in the front ranks of reporters in the metropolis.

Space rates meant he got paid so much per inch for so much of what he wrote that got into the paper, but as that consisted of everything he wrote for the "Sun," he began to profit handsomely at once. He needed more money than a mere beginner would get even in New York, for he dressed rather expensively and lived well. He carried himself with an air of dignity. He still does but he is one of the most likable fellows.

His Strong Background

Hill as a reporter is one of those rarities, a reporter honored and admired by reporters, no less than by his editors. He has several remarkable faculties, including a brilliant and original style that enables one to say of an unsigned story, "Hill wrote that"; a highly developed faculty of observation; a clear appraisal of values, and now a reservoir of experience that tends to make a man well past forty become reminiscent, and if he can do it well, delight the present day with those side views of the past. It is all a part of his gift for comparisons whereby he so profusely spreads the seeds of memory in the garden of his work.

Hill is on the "Evening Sun" now, and reported for it the recent conventions of the Republican and Democratic parties, for he is familiar with politics and politicians. He made his radio debut recently as a six-times-a-week sustaining feature of the Columbia Broadcasting System, giving the human side of the news from WABC, New York, beginning at 8 p.m. EDST. "The Literary Digest," looking for some one to act as its radio spokesman and reporter-interpreter of its Presidential poll, did not have to do any looking at all, for there was Hill, and that ended it.

Hill as a Reporter

So three of the six nights a week Hill will be heard as the news chronicler-commentator, and also as diffuser-interpreter of poll results, while the other three nights he will just be his sustaining self.

By the way, the choice of Hill marks the switch of the "Digest" from the National Broadcasting Company to the Columbia Broadcasting System, although for the past few months the "Digest" has been off the air.

I remember Hill first as one of the "Sun's" official observers at the trial of Charles Becker, a policeman accused of instigating the murder of Herman Rosenthal, a gambler, about twenty years ago, and at the trial of the four gunmen accused of the actual killing. Hill's hair was jet black then (it's grey now), his attire faultless, a black silken cord hanging from his pince-nez (no fault to one so erectly set up and so fittingly attired as to produce a sense of distinction). I half expected of a man who looked so important that he would step up to the rail before the bench and make the main plea for the defendant, for I could consider nobody else in the courtroom had more urgent business there than this man (save possibly the defendant). Well, he was Hill, the reporter, and that was Hill all over: nothing more important on earth than the thing he was doing. And how well he did everything! He is a greater man than most of the great men he has interviewed.

The radio audience has been hearing Hill for some weeks now, and he must be recognized for the great skill of his presentation of the news, his intimate comments, and his comparative recollections. He recalls nothing for the sake of something that has happened, but only for the sake of what light it sheds upon the present happening he is discussing. And the light of other days certainly does shine through the years with penetrating effect as Hill holds the truthful torch.

The Nation-Crier

There has been nobody who has brought to the air quite the combination of gifts possessed by Hill in reporting the news. The vogue was started by Floyd Gibbons, and what a treat it is to hear Gibbons' oral cannonading! Lowell Thomas contributes the charm of his personality, the whimsicality of his observatory powers, and the cultured voice, one of the best speaking voices on the air. H. V. Kaltenborn, first in point of time at this work, has dynamic personality, vigorous emphasis and strong opinions, also keen intimacy with matters European as well as American. But they haven't Hill's uncanny literary gift, one that should have lifted him out of purely journalistic accomplishments long ago.

Now Hill, three nights a week, will be heard on a national chain, his first national radio outlet, and he is bound to give the country a new conception of the nation-crier.

Maybe one of his ancestor's was a town crier, and Edwin C. is merely carrying on the tradition in the scope of the times. However, the farthest back we get is that Edwin C. was born in Aurora, Ind., the same as Elmer Davis was, his mother a school teacher, his father a county superintendent of education. Hill went to the University of Indiana after being graduated from Aurora High School, and while at college, majoring in English, decided to become a reporter on the N. Y. "Sun" because that newspaper was in such high esteem that the English teacher used it as classroom exemplary text.

Presenting himself to the city editor of the "Sun," Hill got the job on his looks, and the city editor found out that appearances are not always deceitful.

On the Celebrity Path

So Hill has been reporting most of the time since he came out of college, except for a brief stay in the moving picture business, when he edited a newsreel and

(Continued on next page)

Schedule of Talks By Edwin C. Hill

(Continued from preceding page)

supervised scenario writing. But he soon returned to his chosen field.

It is hard to say now that the newspaper business isn't still his chosen sphere, but it is more than likely that he will take the country by storm and that radio will capture him completely, although in the face of his reluctance. Addressing the nation even three nights a week means a full day's work seven days a week, with the mail to consider, and the other public exactions on the time of a celebrity. For Hill is making the grade to becoming a national celebrity.

He is doing that because of his natural gifts, including the phenomenon of being the veteran when in the fact of the moment he may be the novice; of reading his ment he should be the novice; of reading his passioned spontaneity, and unreeling the news with the alluring admixture of force and finesse of one who has spent his endowed life at it.

HILL'S SCHEDULE

8 to 8:15 p.m., EDST, Monday, Wednesday, Friday; WABC—Columbia network. For "Literary Digest."

11 to 11:15 p.m., EDST, Monday, Wednesday, Friday; rebroadcast for western stations; WABC—Columbia network. For "Literary Digest."

8 to 8:15 p.m., EDST, Tuesday, Thursday, Saturday, WABC, N. Y. City and network. "The Human Side of the News." Sustaining feature.

—Herman Bernard.

KDYL Replaces KSL on NBC's Network

KDYL, Salt Lake City, Utah, has become an associate station of the National Broadcasting Company. KDYL replaces KSL as the NBC Salt Lake outlet.

The newest member of the NBC networks operates on a wavelength of 232.6 meters, frequency of 1,290 kilocycels. It is owned by the Intermountain Broadcasting Corporation.

KDYL is licensed for full-time operation on a cleared regional channel.

HAUGH IN NEW POST

Arthur T. Haugh, former president of Radio Manufacturers Association, Inc., and one of its founders, has become president and director of the Echophone Radio Company, Waukegan, Ill. Mr. Haugh was also elected a director of Western Television Corp. with which Echophone is affiliated.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.*

Chas. A. Schutt, 2642 E. 11th St., Tulsa, kla.
L. E. Smith, P. O. Box 2353, Boise, Idaho.
G. C. Hairston, Jr., Mobile, Ala.
T. J. Johnson (automobile radios), Drawer E, Bowlegs, Okla.
The Edison Store, Electrical Appliances, Le Roy, Minn.
Harry Colfer, care Andrus Hotel, Dillon, Mont.
Walter L. Silvers, 37 Riverside Drive, New York City.
Luther Bradley Sound Equipment, 2003 So. Akard, Dallas, Texas.
Edwin R. Pelton, 581 Potomac Ave., Buffalo, N. Y.
Norman Holland, 6337 School St., Chicago, Ill.
Clarence Adams, Rt. No. 3, Elmore City, Okla.
Roy B. Hall, P. O. Box 1943, Denver, Colo.
Yale McFate, 16 E. Birch, Flagstaff, Ariz.
T. E. Ivins, Portland, Ore.
Daniel L. O'Hair, N. Y. S. Canals & Waterways, Lock No. 27, Lyons, N. Y.
Clair Lewis, 400 W. Main, Pullman, Wash.
E. L. Derrick, 2431 Seldon St., Columbia, S. C.
Norman L. Hardinger, Tinley Park, Ill.

SHORT-WAVE CLUB

G. C. Hairston, Jr., Mobile, Ala.

Tradiograms

By J. Murray Barron

There are in New York City some unique institutions. Within its radio district we find not only the largest assortment of retail establishments to be found in any city, but here too are to be found out-of-town representatives for radio equipment. All this surely goes to help make the radio district a thoroughly live and pulsating artery of trade. Every day is like Fair Day. In other words it is a perpetual radio exposition. Here new ideas are created overnight. An unusual institution is the radio auction conducted for the public, not the type where sales are held once or twice a day, but here every day all-day sales are in order. Business is done on a cahh basis. The point is that to warrant stores of this kind means that a radio-minded public must visit this district in large numbers.

* * *

It is announced in connection with the Dealers Radio Show to be held at Hotel Edison, New York City, September 19th to 25th that exhibitors from Chicago, Buffalo, Pittsburgh, Ann Arbor, Newark and Long Island will be represented. Among the speakers will be Walter Lemon, chief engineer for Television Corporation of America.

* * *

A very different and unusually attractive display was inaugerated at Nussbaum's, 85 Cortlandt Street, N. Y. City, who exhibited a Philco Bar Radio. Here is an actual bar about six feet long, with brass foot rail, and placed in center of front panel is the Philco receiver. There can be no mistake as to the popularity of this out-of-the-ordinary design. For those who may not care to display as a bar, a hinged arrangement permits both ends to fold back, and outer top of bar to drop down, thus forming a smaller console type cabinet. In either way the receiver is always ready for performance.

* * *

Notwithstanding the big market for electric receivers in the United States there are still millions of homes that are not wired for electricity. The battery-operated radio receiver market is still very large. There is hardly a large city in the country that is not surrounded by a battery receiver market. Somebody must be selling some of these markets, but it seems a very excellent field is being passed up by many. Servicemen and mail order houses should look more carefully into this source of revenue.

* * *

Servicemen and those who may build radio receivers or equipment and who want to get off the beaten path might well bear in mind that there is an unusually large field for battery-operated receivers. Today there are no less than twenty-five manufacturers of the Air-Cell receivers. Now this in itself shows that here is a market, and yet most factory and custom-made receivers are built for the electric trade. Those seriously interested in building or selling this type receivers and are in business if only in small communities might be interested in a very interesting and educational booklet issued by the National Carbon Co., 10 East Fortieth Street, New York City.

* * *

Blan the Radio Man is now fully established at his new store, 177 Greenwich Street, N. Y. City. The large neon sign and well-illuminated windows make the establishment stand out. Blan the Radio Man has years of radio knowledge and experience behind his establishment. That, together with the much-enlarged quarters, with a greater variety of stock, should enable him to serve the public even more efficiently.

Cuban Dealers Fear They Must Defray Tax

Washington.

New Cuban radio taxes which cover all types of receiving sets are expected to reduce the already small profits of radio dealers in the Republic, according to advices to the Commerce Department from its Havana office. The former tax on radios, it is pointed out, covered only those with nine tubes or over and therefore affected comparatively few owners.

Under the new law graduated taxes based on the number of tubes range from $3 to $10 annually. While these taxes appear to be nominal and are presumed to be paid by the owner, dealers believe that in most cases they will have to be absorbed by them, at least for the first year. This was the situation, it is pointed out, which resulted after the imposition of the 5 per cent. luxury sales taxes several months ago.

It is also believed in the trade that the new taxes will result in the return of a considerable proportion of sets now in possession of installment buyers who will not want to pay additional levies. Some criticism has been heard, the report declares, of the method in which the schedule has been applied.

Photo-Cell Announced By Western Electric

A compact photo-electric cell outfit, which can be used in virtually any of the countless applications that are being found for the photo-electric principle, is being produced by the Western Electric Company under the name of Photomatic Equipment.

The system, designed by Bell Telephone Laboratories, consists of two small units, one the light source and the other a light-relay which contains the photo-electric cell. Both are designed to operate from commercial 50-60 cycle, 115 volt alternating current mains. The connection of the A-C supply and of the circuit to be controlled by the photo-electric action comprise the only electrical connection required. The equipment may be arranged to open or to close an electrical circuit on either the interruption or completion of the light beam.

The light unit is 5⅛ inches square at the base and 8⅜ inches high. It contains an ordinary automobile headlight bulb which is fed by a suitable transformer and furnishes the light for the geam as well as a condensing lens to produce an essentially parallel beam of light.

New Incorporations

Leon L. Adelman, New York City, radios—Atty., A. B. Kurtz, 246 West 59th St., New York Citiy.
Pennsylvania Radio and Music Shop, New York City, radio—Atty., M. M. Alpert, 2 Lafayette St., New York City.
Steinway Radio Corp., New York City—Atty., L. D. Schwartz, 150 Nassau St., New York City.
Refrigerating Electric Service & Installation Corp., New York City—Atty., R. Goldstein, 205 W. 34th St., New York City.
Flexible Record Corp., New York City, sound recording devices—Atty., A. H. Goodman, 29 Broadway, New York City.
Collingswood Electric Co., Collingswood, N. J., electrical appliances—Atty., F. G. Toram, Camden, N. J.

ASSIGNMENTS.

In Queens County, N. Y. City

Long Island Music Shops, Inc., 40-14 82nd St., Jackson Heights, L. I., N. Y., to Harold J. Craft, 480 Lexington Ave., Manhattan, New York City.

CRPORATE CHANGES

Name Change

Okeh Phonograph Corp., Manhattan, New York City, to Okeh Radio & Record Corp.
Rudworth CSommercial Refrigeration Co., to the Commercial Refrigeration Co., Inc., Washington, D. C.

CORPORATION REPORTS

Dubilier Condenser Corporation—Year ended June 30: Net loss after depreciation, obsolescence and other charges, $165,895, against $188,741 loss in preceding year.

RIDER'S PERPETUAL TROUBLE SHOOTER'S MANUAL

Vol. 1 and Vol. 2

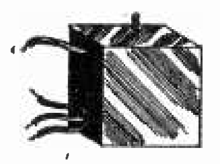
Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1, but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00

Volume No. 1 (8 lbs.). Order Cat. RM-VO @ $4.50

We pay postage in United States on receipt of purchase price with order. Canadian, Mexican and other foreign remittances must be in funds payable in New York.

RADIO WORLD
145 WEST 45th ST., NEW YORK, N. Y.



Three 0.1 mfd. @ 29c

Three 0.1 mfd., in one shield; 250 v. d-c rating, mounting screw; size, 1⅛" square x ⅞" wide. Black lead common; reds interchangeable. Cat. S-31, @ 29c. Direct Radio Co., 143 W. 45th St., N. Y. C.

SPEAKER REPLACEMENT HEADQUARTERS!

If your dynamic speaker suffers lost insensitivity or develops rattling or buzzing sounds, it usually needs a new cone and voice coil. We have the unit cone-and-voice-coil assemblies for all the popular speakers, some listed below. Others are available. Inquire for prices.

Service men can make the cone and voice coil replacements but any who desire that the installation and adjustment be made for them on precision jigs, in the same manner as in the speaker factories, may send their speakers to us for repair. There is a 25c extra charge for this labor.

The name of the speaker is listed under the caption, "Speaker," the outside diameter in inches of the frame that holds the cone is given under the initials "O.D.," and the price of cone-voice coil combination unit is given next.

Speaker	*O.D.*	*Price*
Atwater Kent	11	$2.75
Bosch	11	2.75
Bosch	10	1.90
Brunswick D.	9¾	2.25
Brunswick B.	14½	2.75
Brunswick E.	14½	2.75
Colonial 33...	12¼	2.25
Decatur	9½	1.90
Eveready ...	12¼	2.25
Eveready ...	10	1.90
Earl Inductor	10	.95
Farrand	7	2.25
Farrand Inductor ..	11	1.35
First Nat'l ..	10	1.90
Freed-Eismann NR 80-87...	10	2.75
Majestic G1..	9	1.80
Majestic G2..	9	1.80
Majestic G3..	11	1.80
Majestic G5..	14	2.75
Jensen D9, D15 ...	8½	1.50
D4	9½	2.25
D7 Concert.	11¼	2.25
Auditorium	13	4.50
Magnavox ..	9	2.25
Newcomb-Hawley	9	2.25
Oxford	9	1.95
Oxford	8¾	2.25
Peerless copper coil.	8½	1.60
Peerless copper coil.	10¾	1.95
copper coil.	12	2.10
copper coil.	14½	2.85
Peerless wire-wound coil.	8½	2.85
wound coil.	10¾	1.65
wound coil.	14½	2.75
Philco 65-90..	11	1.50
Philco 20		1.50
RCA 106.....	10¼	2.00
RCA 105.....	8	2.00
RCA 104.....	8	2.00
Symington ...	10	1.90
Symington ...	12¼	2.25
Sterling	9	2.25
Stromberg-Carlson	12½	2.75
Carlson	9	2.25
Sparton 737..	9	2.25
Steinite	10	1.90
Temple	9	2.75
Temple	11	2.75
Temple Auditorium	14	3.75
Utah	9	1.90
Utah Stadium	12	2.75
Victor RE32-45 ...	9	1.35
Wright-De Costa ..	10	2.25
De Costa ..	12	2.75
Zenith 52....	12¼	2.25

MAGNETIC SPEAKERS

Ready to Play, but Not Including Cabinet or Baffle

Farrand 9" O.D., burtex cone...............$1.50
Timmons (as used in Philco sets) 9" O.D., burtex cone $1.80
Auto speaker, 9" O.D., burtex cone..........$1.50

The magnetic speakers are new speakers, and the prices are for the speakers, not for replacements on such speakers.

DIRECT RADIO CO.
143 West 45th Street
New York, N. Y.

FOUNDATION UNIT

for 1933 A-C 4-Tube Diamond

Drilled metal plated subpanel........	$ .85
Two-gang 0.00035 mfd. SFL condenser, brass plates, 2½" long shaft........	1.39
Two special tube shields for 58-57........	.22
Center-tapped 200-turn honeycomb coil........	.40
Five sockets (one for speaker plug)........	.55
Two Polymet 8 mfd. electrolytics; insulators; lugs........	.98
One pair of r-f coils, consisting of impedance antenna coil and interstage transformer........	.90
20-100 mmfd. Hammarlund equalizer........	.19
Cat. DFU at........	$5.48

DIRECT RADIO CO., 143 West 45th Street, New York City

Parts for the 1933 DIAMOND

Cat. POLY-8. one 8 mfd., wet electrolytic condenser, inverted mounting, with two insulating washers and one special lug, 49c.

ONE of the outstanding circuits, the 4-tube 1933 Diamond for a-c operation, 105-120 volts, 50-60 cycles can be constructed most economically. The circuit uses a 58 r.f. amplifier, with special antenna treatment boosting the gain mightily; a 57 power detector, a '47 output tube and an '80 rectifier. You never in your life heard such performance on four tubes!

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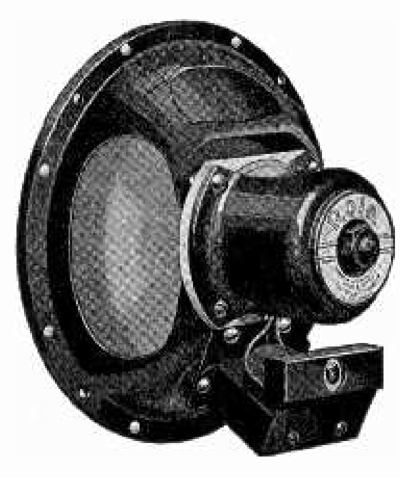

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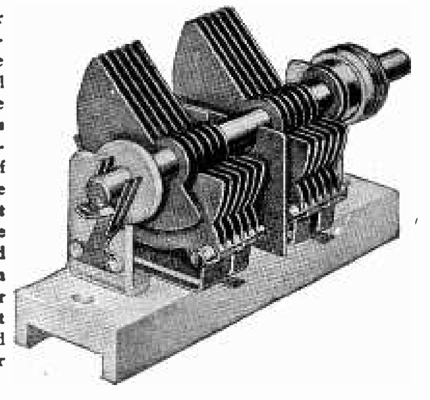

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