WHAT IS A GROUND? DOES ANYONE KNOW?

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Eleventh Year—523d Issue

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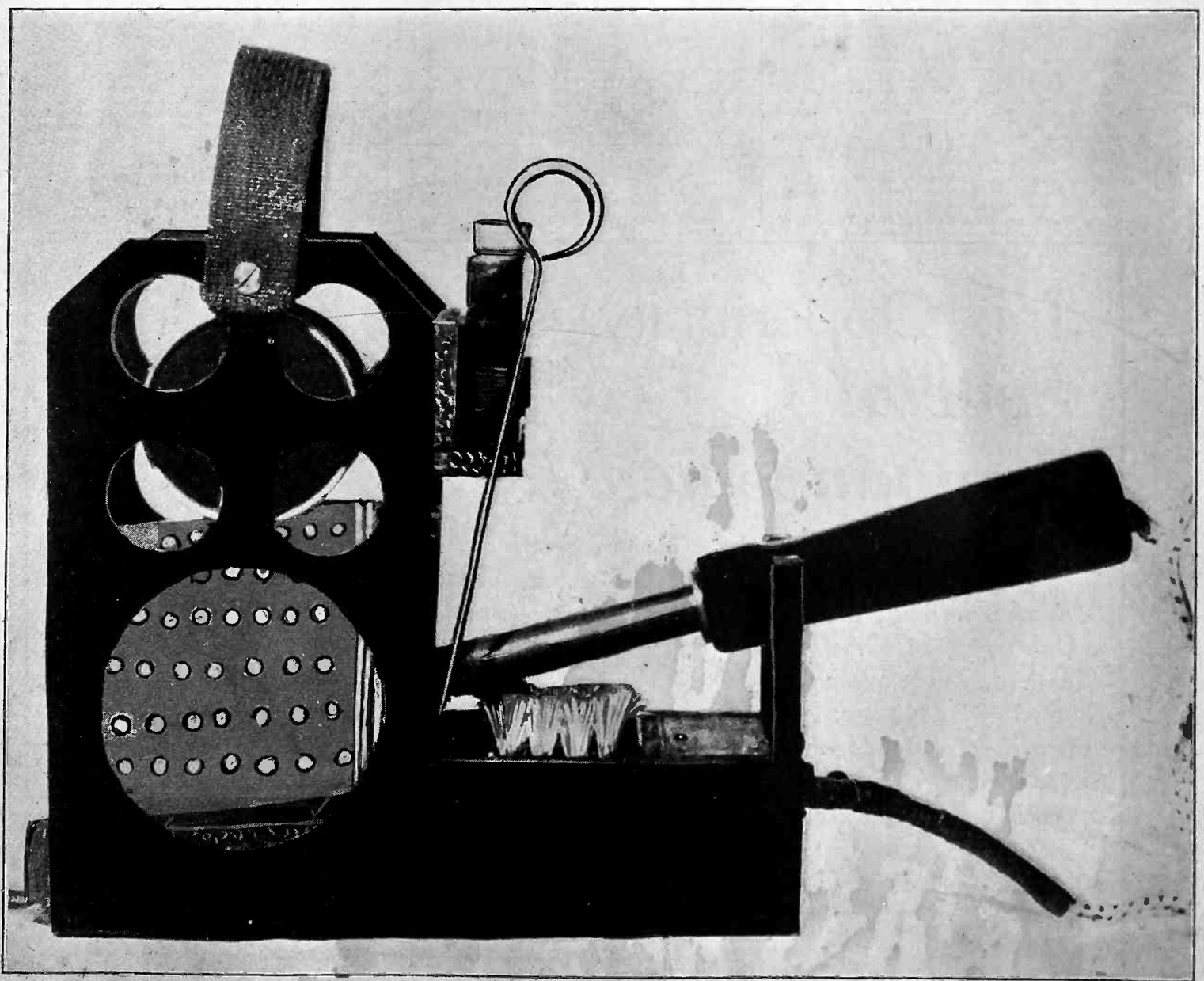

A simple assembly for housing the iron and insuring cleanliness of work. See page 9

ROLAND BURKE HENNESSY
Editor

HERMAN BERNARD
Managing Editor

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ELEVENTH YEAR

J. E. ANDERSON
Technical Editor

J. MURRAY BARRON
Advertising Manager

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Simplified Feedback

UX Plug-in Form Works Hartley Oscillator

By Jack Tully

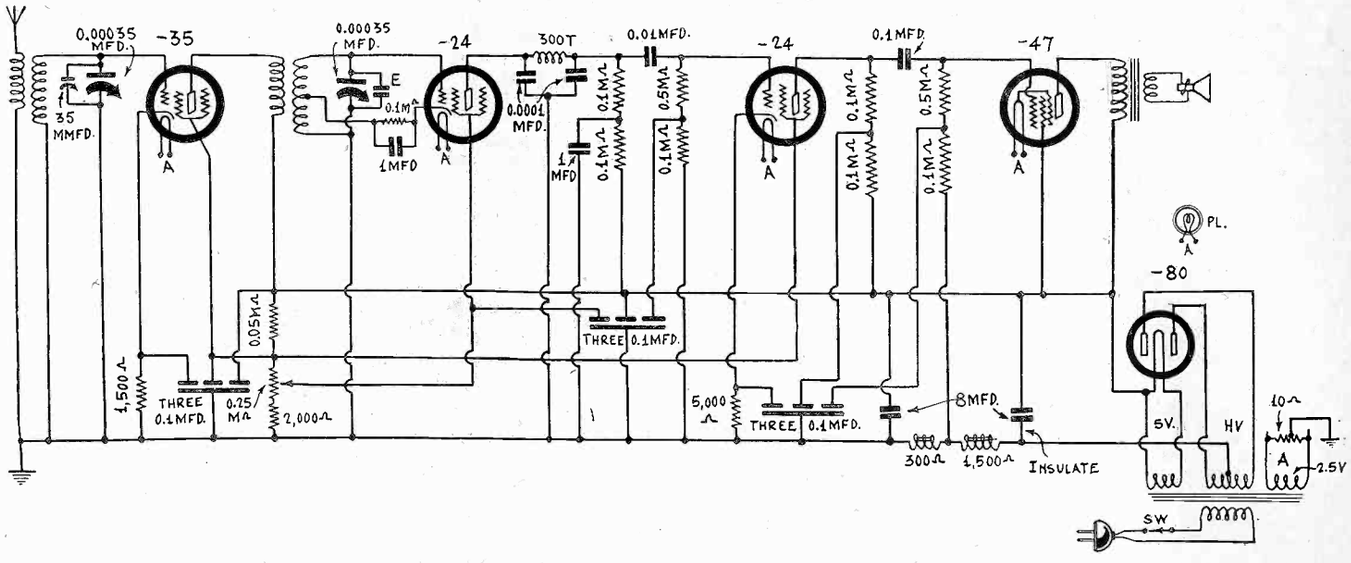


FIG. 1

A Hartley oscillator used as detector makes possible excellent results with UY type of plug-in coils. Ordinarily six-pin coil forms would be needed, but this special circuit permits as good results with the five-pin type.

THE problem of how to use a five-pin (UY) plug-in form for a regenerative detector may be solved as shown in Fig. 1.

Ordinarily a six-pin form would be needed, and such is virtually unobtainable. The six connections would be to r-f plate, B plus r-f, grid of detector, grid return of detector, plate of detector and load on detector plate (primary of a transformer or one end of a resistor). The fact that the tickler winding would not go directly to B plus makes the sixth connection necessary. A way out, but a poor one, would be to use an r-f choke coil in the r-f plate circuit, returning primary from one side of a stopping condenser to ground. The Fig. 1 method is better, as the right impedance for the r-f plate circuit is obtainable all the time.

Ripe for Oscillation

An a-c five-tube design is shown, for the regeneration method is not workable on battery-operated tubes, because the secondary tap would be grounded. Here, however, we use the biasing resistor for the detector as we would anyway, but return it to the tap on the coil, and thus the current eventually reaches ground. The bypass condenser has to be across the resistor only, and not from cathode to ground, otherwise the same fault would obtain as in battery-operated sets.

The 0.1 meg. biasing resistor carries plate current, and this current plus the cathode current flows through the lower leg of the center-tapped secondary.

It might seem that there would be no oscillation, because the plate current is naturally out of phase with the grid r-f current, and negative feedback could be assumed. However, it would be a wrong assumption. The requirement is that the variations in the respective fields—each half of the secondary—be in the same direction. Hence the induced feedback voltage must be in the opposite direction. There two requirements are fulfilled in the detector circuit, which is a Hartley oscillator.

Since plug-in coils are used, the primaries as well as the secondaries would have different numbers of turns. The detector coil's secondary is the total winding, hence antenna secondary and detector secondary are wound alike, save that the detector secondary is center-tapped.

Biasing Resistors

The high value of biasing resistor in the r-f stage is due to the use of the full voltage of the rectifier output, some 230 volts obtaining in usual practice, although much higher than recommended resistance values in tube charts. The detector biasing resistor is 0.1 meg, also high, but the detecting efficiency is good when the screen voltage is maximum. Since the screen voltage on the detector is varied to control regeneration, the

(*Continued on next page*)

Simplified Hartley Oscillators Usi Circuit Arrangem

By Bruns

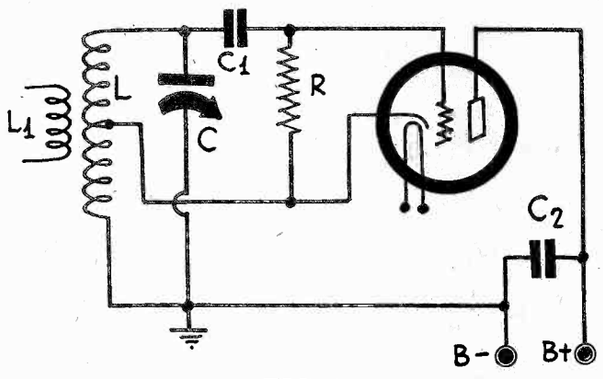


FIG. 1

A simplified Hartley oscillator made possible by the use of heater type tubes. One side of the circuit is grounded and the cathode is returned to the tap on the coil.

THERE is, perhaps, no better oscillator than the Hartley. It is the simplest to construct and is dependable at nearly all frequencies. However, it has been subject to one difficulty, the rotor of the tuning condenser could not be grounded without sacrificing some of the simplicity. This difficulty is obviated if we use heater type tubes.

A Hartley with the proper construction with such tubes can be used advantageously in laboratory equipment and in superheterodynes and the frequency range is practically unlimited. We can construct audio frequency oscillators, superheterodyne oscillators of any desired frequency, broadcast and short wave oscillators.

In Fig. 1 we have a circuit of utmost simplicity. One side of the coil L in this circuit is grounded, as is the rotor of the tuning condenser C. Thus hand capacity effects are eliminated. A tap is provided on the coil to which the cathode of the tube is connected. This connection and the tuning of the entire coil make the oscillator a Hartley. We need no tickler for the lower part of the coil serves that purpose.

Plate Is Grounded

The plate of the tube is grounded for the high frequency by the use of a large condenser across the B supply. If a battery is used for B supply this condenser is not strictly necessary but it is desirable, and if a B battery eliminator is used this condenser is already a part of the B supply. Its value, when needed, depends on the frequency which the tuned circuit is to cover, and for the broadcast band and higher frequencies a value of 0.001 mfd. is large enough.

Condenser C1 and the grid leak have the usual values and for the broadcast band C1 might be 0.00025 mfd. and R 100,000 ohms. This value of grid leak is also suitable for any other frequency, but the stopping condenser might be increased for lower frequencies and decreased for higher, although the value specified may be used for any frequency higher than broadcast frequencies. A plate voltage of 45 is ample.

The coil LI is a small winding on the form containing L and may be used for taking off the oscillator. For example, it may be used as the pick-up in a superheterodyne or it may be used for coupling coil between the oscillator and any other circuit into which the oscillation is to be introduced.

A Modified Circuit

In Fig. 2 we have the same circuit except that a potentiometer P has been connected in the plate circuit. This provides another means of taking off the oscillation, particularly if an amplifier is to follow the oscillator. The resistance of this potentiometer must not be too high, for it will reduce the intensity of oscillation and may even stop it. From 5,000 to 10,000 ohms would be all right. However, if the resistance should stop it may be started again by increasing the applied plate voltage. This is particularly the case if a small by-pass condenser is connected between the plate and ground. This added condenser might have a value of 0.00025 mfd. in the broadcast band and in the higher frequency bands. The condenser should not be connected between the plate and the cathode for this would stop the oscillation since the feed back would be short circuited.

The potentiometer might also be used for impressing a variable modulation on the oscillation. Of course, for this purpose we need a source of audio frequency, such as an audio oscillator, either of the vacuum tube or neon type, or simply a 60-cycle voltage from a power line. This audio oscillation would be impressed between the slider on the potentiometer and ground.

Modulated Oscillator

In Fig. 3 we have an oscillator of the type shown in Fig. 1 modulated by the output of an audio oscillator of the same type. In this case the oscillating coil is an iron core transformer with a ratio of one-to-one, or rather a single winding with a tap at the center. The tuning condenser is C2, which should have such a value as to give the desired audio frequency.

The stopping condenser C4 in this circuit should be much larger than if the oscillator were to operate at radio frequency, but it is hardly necessary to make it larger than 1 mfd. A suitable value of R2 is 100,000 ohms.

A switch, Sw, is provided for stopping the oscillation in this circuit when an unmodulated radio frequency is desired. This switch simply short circuits the grid of the tube. Closing it makes a minimum of change in the radio frequency oscillator so that the calibration of this will hold for either position of the switch.

The by-pass condenser C5 serves the same purpose as C2 in Figs. 1 and 2. C3 serves the purpose of the condenser suggested in connection with the previous circuits; that is, it serves as a by-pass for the radio frequencies. For broadcast and higher frequencies it might be 0.001 mfd.

Coupling Between Oscillators

Not much coupling is needed between the two oscillators to impress the audio frequency on the radio oscillator, but it should be variable so that various degrees of moduation can be used. A rheostat Rh is provided for this, and its resistance need not be more than 1,000 ohms. When it is set at zero the degree of modulation is very low and when it is at maximum the modulation is not excessive, yet satisfactory.

The choice of L2 depends on the frequency that is to be generated in the audio amplifier. It may be the primary of an audio push-pull output transformer or it may be a centertapped of low inductance. If we select a value of 0.05 mfd. for C2 and an audio frequency of 1,000 cycles the inductance of the choke, or transformer winding, should be approximately one-half henry, which is a very low inductance as audio chokes go. Of course, it is possible to use a smaller condenser in case the coil available has a much higher inductance, and it is also possible to use a much lower frequency of oscillation. Since we have a wide latitude in the choice of frequency and capacity, there is also a wide latitude in the choice of the coil. It is not even essential that the coil should be centertapped just so the ratio is not greatly different from unity. In case the ratio is different from unity the larger of the two windings should be in the grid circuit. Another point is worthy of mention. It is not essential that both windings be tuned in this audio oscillator for the circuit will oscillate if the condenser is put across either winding, assuming that we have a good tube and a reasonably good coil. The circuit will oscillate more readily if the tuning condenser is small and the

Coils for Broadcasts

(*Continued from preceding page*)

best detecting efficiency should prevail at the highest screen voltage. To make a greater portion of the angular displacement of the regeneration control effective, a limiting resistor should be placed at the low end. A value of 2,000 ohms is suggested, but experiment will confirm whether in your particular instance this should be raised a little.

The detector output is well filtered. There is a pi-filter in the plate circuit, consisting of an r-f duolateral choke of 300 turns, with 0.0001 mfd. condensers on either side to ground. These condensers may be 20-100 mmfd. equalizers set at maximum. The filtration is completed by the resistor-capacity filter, 0.1 meg. and 1 mfd., the high value of capacity being very effective also as a hum-killer. Plate and grid circuits of both audio tubes are filtered, also.

Coil Information

One section of a condenser block (0.1 mfd.) is across the output condenser (8 mfd.) of the rectifier, to assure adequate bypassing of radio frequencies, which some electrolytic condensers for some reason do not accomplish.

The rectifier now is standard, using the field coil of the dynamic speaker as the B supply choke. Note the tap at 300 ohms, and the use of the drop in this section for pentode bias.

The set may be built for broadcast reception alone, if desired,

g Heater Tubes;
nt is Suitable for any Frequency

n Brunn

coil large. In some cases there may be sufficient self capacity in the coil to make the coil oscillate at a suitable frequency without any external condenser. If the frequency of oscillation is too low when C2 is not used, then the only way to get a higher frequency is to use a smaller coil.

Radio Frequency Coil

If we use a 350 mmfd. tuning condenser for C in any one of the three circuits, the inductance of L should be 240 microhenries to cover the broadcast band. The actual physical dimensions of the coil is of little importance just so it has the required inductance. If we wind the coil on a two inch bakelite form, using No. 26 double cotton covered wire, we will need 84 turns. For L1 it is sufficient to use 15 turns of the same wire and wound close to one end of the tuned winding. Both terminals of LI should be brought to binding posts so that the coil may be used without restrictions in connections to other circuits.

In case it is desired to use the oscillator in a short wave circuit it is only necessary to change this tuner. In any short wave coil for a given condenser, the tuned winding alone should be used and a tap should be brought out from about the center of the winding to be connected to the cathode.

Using Smaller Condenser

If the oscillator is to be used for receiving short wave signals in a converter or a superheterodyne, the tuning condenser should be smaller than when the tuner should cover the broadcast band. While a small condenser will cover a narrower band of frequencies than a large condenser and therefore will require more coils to cover the short wave band, the tuning will be less critical because the narrow band will be spread over the entire dial.

A suitable condenser for a short wave oscillator is one of 140 mmfd. Let us assume that this has a minimum of 10 mmfd. and that the circuit otherwise has a distributed capacity of 20 mmfd. The total capacity in the circuit will then be 160 mmfd. and the minimum will be 30 mmfd. The ratio of maximum to minimum will be 5.33 and the frequency ratio will be slightly more than 2.3. If we design the first coil so that it will tune to 1,500 kc, it will tune up to 3,950 kc. A second coil might go from 3,900 to 9,000 kc, a third from 9,000 to 20,000 or more. Therefore four coils will cover the entire short wave band with plenty of overlap.

Let us select a coil form having a diameter of 1.25 inches. If we use No. 24 enameled wire we need 57 turns for the first coil, that is, the largest. If we use No. 20 enamel wire for the next largest coil we need 23 turns. Using the same wire on the third coil we need 10 turns, and finally for the fourth coil, 4 turns. The number of turns we need for the pick-up depends on the purpose of the coil. If it is to be used in a converter with the pick-up in the cathode lead, the turns might be 5, 2, 1, and 1, with the single turn on the smallest coil more loosely coupled than the single turn on the next larger coil.

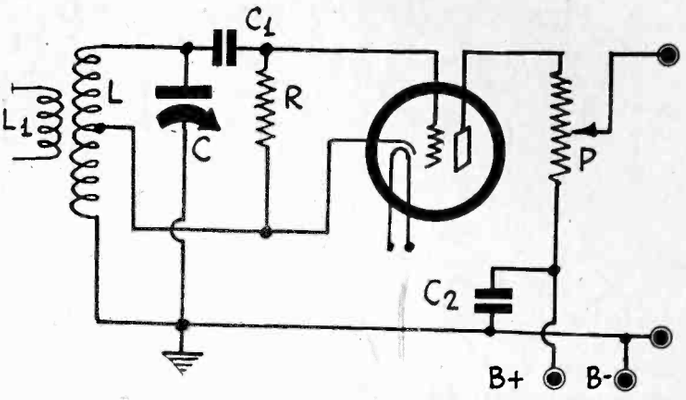


FIG. 2
This circuit is the same as that in Fig. 1 except that a potentiometer has been connected in the plate circuit for the purpose of coupling to an amplifier.

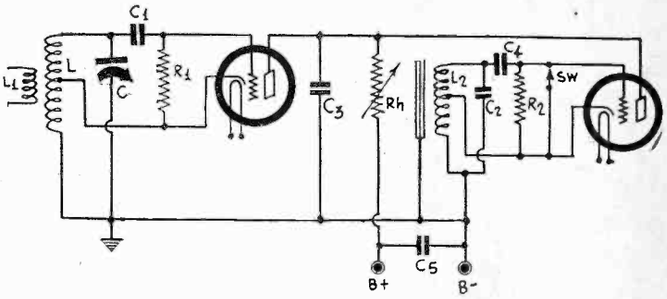


FIG. 3
In this circuit an oscillator of the type shown in Fig. 1 is modulated by the output of an audio frequency oscillator also of the same type.

"Needs No One To Speak For It"

I am glad to report that after two months of constant use the Super-Da-Lite-R has never failed to bring in KFI after 9 p.m., although some nights not clearly. I have had as many as nine coast stations in one night before 1 a.m. XER, Mexico, can be listened to any night after 6 p.m. and four or five other Mexican stations a little later in the evening.

Last Saturday afternoon between 1 and 3 p.m. I had three Chicago stations, including WMAQ and WBBM, which came through with no crosstalk; also WTAM, WLW, WHAS, CKAC; also Boston, Providence, Portland, Me., Norfolk, Va., Clearwater, Fla. The set needs no one to speak for it.

A. G. CLARK,
Bay Driveway, Manhasset, L. I.

nd Short Waves

and the plug-in coils left in the sockets intended for them. Using 1.25 inch diameter (usual tube base type, except that axial length is about 2.5 inches), put on 120 turns of No. 32 enamel wire, or size thereabouts, and then wind 15 turn primaries, any kind of insulated wire, over the secondaries, some insulation between. The primaries are near the bottom or grid return end. The detector secondary would be tapped at the 60th turn.

The next pair of coils would be constructed with primaries beside, not over, secondaries. The primaries would consist of 10 turns of any kind of wire, ⅛ inch separation, and secondaries of 30 turns of No. 28 enamel, the detector secondary tapped at the 15th turn.

The third pair would consist of 6-turn primaries, any kind of wire, 10 turn secondaries, No. 18 enamel wire, detector secondary center-tapped.

These data are for tuning with 0.00035 mfd. condensers, and the coils need not be shielded. In fact, the inductance would be less if shields were used, and the data given would not apply strictly.

The antenna secondary's trimmer may be around 35 mmfd., the equalizer may be 35 mmfd. maximum, lined up with the other circuit when the manual trimmer is at half maximum capacity setting.

One precaution necessary, if a metal panel is used, is to insulate the regeneration control from the panel, as no part of this control is grounded.

What is a Ground? Radio So Here Are the

By J. E.

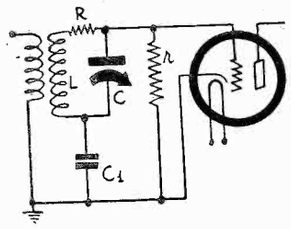


FIG. 1
At radio frequencies a circuit may be grounded through a condenser as in this case. The drop in Cl is negligible and therefore the rotor of C is practically grounded.

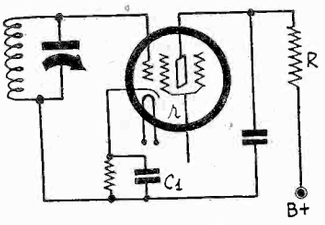


FIG. 2
In this circuit the cathode of the tube is grounded for radio frequencies by condenser Cl if Cl has a large capacity. The cathode also would be grounded to high audio frequencies.

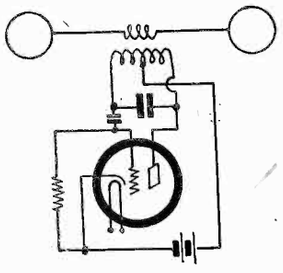


FIG. 3
The circuit of a Herzian doublet transmitter. The power is applied inductively at the middle point of the symmetrical antenna. This may be vertical or horizontal.

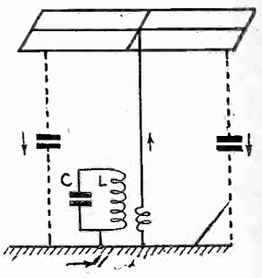


FIG. 4
The circuit of an inverted T type grounded antenna. The power is applied inductively near the ground. The arrows show the current direction during one-half cycle.

WHY is a ground used in electrical circuits? What is a ground? It has been suggested that these questions be discussed and answered because they are not taken up in any text books on radio or electrical subjects.

A ground is any conductor the potential of which is the potential of the earth. But is the earth at the same potential all over the surface or does it vary from point to point? It can be shown readily that the potential at all points of the earth is not the same. Hence a ground cannot be a conductor having the potential of the earth, for the potential would be entirely indefinite. Perhaps a ground is a conductor having a potential equal to the average potential of the earth. That is nearer the truth, but if it were the whole truth there would be little chance of getting a ground anywhere because to get it we would have to run a resistanceless conductor between the point we wish grounded and some point that had the average potential of the earth. There are two obstacles to that. First, we would not know at what point to terminate the conductor, and, second, we could not find a resistanceless conductor.

Definition of Ground

We might define a ground as a conductor having the average potential of all conductors in contact with the earth in the immediate vicinity. A definition of that kind is tenable against more objections than any other.

A person who is in contact with the earth assumes the potential of the earth in the immediate vicinity of that person. The contact may not necessarily be metallic, but it must be conductive. The better the conductivity the more thoroughly is that person earth bound electrically. And the more thoroughly he is earthed the greater is his danger if he should come in contact with conductors which are charged to a high potential differing from ground potential.

And here we come to one reason why electrical power lines are grounded. It is protection. At first this may seem contradictory, but it is not. Since a person is connected to ground and therefore is at ground potential, exposed parts of an electrical system are grounded so that if the person comes in contact with them he will be at the same potential and the contact is not hazardous. If he is to do anything requiring contact with the ungrounded side of the system, he has to do something definite, and therefore he knows he must insulate himself from ground before he can proceed with impunity.

When the power is transmitted on three lines, or two lines with a neutral, the neutral is grounded, and this also is conducive to safety, for if the total voltage is 220 volts, say, the voltage between either side and the ground is only 110 volts, and this is much safer for an operator than if there should be 220 volts between the hot conductors and ground. Of course, the operator has twice as many chances of getting in contact with a live conductor when the voltage is thus divided, but just the same there would be less danger. This statement might not hold if the voltage were much higher than 110 volts.

Economy Reasons

The use of the earth as the return conductor is for economy. A wire conductor costs money but the earth does not, since we are not talking about real estate. This is undoubtedly the principal reason for using ground as the return.

In a line of this kind in which the loads on the two sides are equal there is no current in the ground path. Hence the ground at one end would be at the same potential as the ground at the other. But it is not often that the loads are equal and in general there is a current through the earth. Since the ground necessarily has some resistance there will be a voltage drop in the ground. Hence the ground at the generator is not at the same potential as the ground at the load.

The operator at one end would be at the potential of the ground at that end and the operator at the other end would be at a different potential. Yet each would say that he was at ground potential, for each would be at the potential of earthed conductors in his own immediate vicinity. Each would be at zero potential measured by his own standard but A would say that B was negative and B would say that A was positive. They would, of course, agree as to direction.

They would not be able to measure the actual potential by which their grounds differed unless they knew the resistance of the ground path between them and the actual current flowing between the two points. The current that flows is a very indefinite quantity, for it would not be the current pertaining to this system alone but the sum total of all electrical currents flowing in between. The currents might come from a thousand electrical systems, and they might flow this way and that.

Earth a Reservoir

We might regard the earth as a large reservoir into which electric charge is continually pumped at one point and poured back at some other point. At the generator a lot is pumped out at one point but the same quantity is returned to earth at many different and widely separated points. At each point only a few drops, so to speak, are poured back, but on the whole just as much is poured back as is taken out. There is no change in the level of earth potential although there may be small local disturbances.

In this view of it we must not forget the effect of other electrical systems which may be overlapping geographically, or which may even be co-extensive. It may be that one system pumps electric quantity out of the earth at one point and another system pours the same quantity back in the immediate vicinity. The same electrons taken out of the earth by one system do not have to be returned to the same generating

Literature Barren of Answer, Full Details for First Time Ever!

Anderson

station, for others supplied by another system can supply the demand just as well.

The ground is not essential to establish an electric circuit but there must be a return path if there is only one system in the field. There is no current unless there is a circuit. When we have many systems in the field we resort to the reservoir view and say that there must be a ready supply of electrons. When there are many systems the earth really acts as a coupler among them, for the same portion of earth may be in the return circuit of all of them. It is conceivable that the current distribution is such that in this portion of the earth there is no current, and if there is no current there is no difference of potential. For this reason the earth may be a very much more effective conductor than the earth's conductivity would indicate.

Why Ground Radio Circuits?

Why should a ground be used in a radio system? There is no current between the transmitter and the receiver, for transmission takes place by radiation. The electromagnetic energy is hurled out into space just as a stone is thrown, although not in such a definite direction. It is not necessary to provide a return path for a stone that is thrown. Transmission by electrical circuits is like transmitting energy by a belt; there must be a return for the carrier of the energy.

Since there is no need for a return path, why is it necessary to establish a ground? It is not necessary. Much radio transmission is conducted without a ground. For example, when a loop is used at the transmitter no ground is needed. Neither is a ground needed at the receiver when a loop is used there. A ground is useful, but not necessary. Even in some transmission with so-called open antennas a ground is not needed, for example, in beam transmission, and in transmission where the electric field is horizontal rather than vertical. But still a ground is useful even here.

When a grounded antenna is used at the transmitter the radio wave is earthbound, or at least a portion of it is. This fact helps to confine the wave to a plane so that it will not spread out in the form of a sphere, and signals will carry further by that fact. If we could confine the wave in an earthbound beam the wave would carry still further. But such a system would not be useful for broadcasting purposes.

Why Ground Is Used

A ground is used at a transmitter to establish a good local circuit. The circuit is composed of the antenna, the ground about it, and the capacity between the antenna and the ground. This circuit must exist or there will be no current in the antenna and no radiation. At the transmitter there are two parts of the field. One is called the induction field and the other the radiation field.

The energy in the induction field does not leave the vicinity of the antenna, and its effect does not extend more than a few wavelengths. The current associated with this field must not encounter much resistance, for if it did there would be much power loss and the system would not work efficiently. That is why such pains are taken to establish a low resistance ground around the antenna, such as erecting the antenna in marshy ground and burying a network of wires all around the antenna, or setting up a counterpoise system.

Ground at Receiver

The radiation field extends much further than the induction field and there should be as much resistance in this field as possible, for this resistance is a measure of the energy that is transmitted. The greater this resistance in comparison with the total resistance the more efficient is the transmitter. If the wave were not earth-bound, or otherwise constrained, the radiation field would die out just as quickly as the induction field.

It was said that the earth was a necessary part of the antenna system in order to establish a circuit. This is only true when the wave is earth-bound. The transmitter could consist of two plates of a condenser, the plates rather far apart. The simplest form of this condenser is a Herzian doublet, which in one form is a straight wire with the power impressed at the middle. The circuit here consists of the conductor and the capacity between the two ends. To insure that the current in the

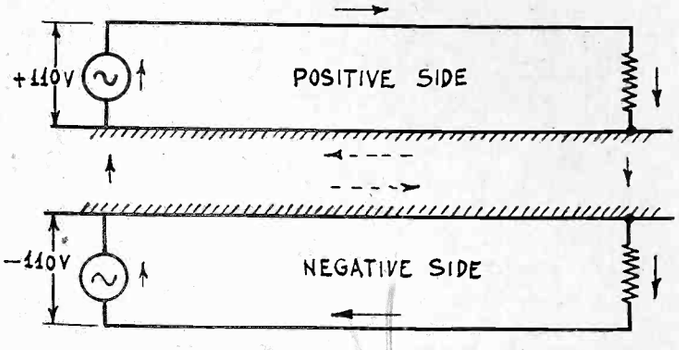


FIG. 5

This illustrates two transmission lines of 110 volts each, one positive with respect to ground and the other negative. Generators at left and loads at right. If loads are equal no current flows back to either generator through ground but follows the course of the dotted arrows.

wire between the two ends is uniform the capacity is lumped at the two ends. One way of doing this is to terminate the wires in two large balls of metal. A circuit of this type has low resistance.

A ground at the receiver is used for a similar reason. The radiated wave strikes the vertical portion of the antenna and in doing so induces a voltage in it. But if a current is to flow we must have a circuit. This circuit is composed of the ground path, the antenna, and the capacity between the antenna and the ground. The object is to get a circuit of low resistance, and the better ground we provide the lower the resistance. Hence the greater is the received signal for a given voltage induced in the antenna. We must also see to it that the resistance in the antenna wire and in the capacity between it and the ground is low. We can use a heavy wire for antenna to lower its resistance, and we can avoid high resistance joints with the same object in view. To get low resistance in the capacity we can avoid all power absorbing objects under and around the antenna. For example, we might avoid trees, buildings, other antennas, and the like. A counterpoise system is just as advantageous at the receiver as at the transmitter. Low resistance in the local circuit is the object of both a good ground and a counterpoise.

Other Uses of Ground

The objects of the ground so far discussed perhaps do not seem to be the most important to a person who is operating a receiver. We all know the importance of eliminating body capacity in tuning. That, to be sure, is one important use of the ground. That is, it is a stabilizer of the circuit. The ground connection ties the circuit down to the steadiest thing we have, electrically. It acts as an anchor, so to speak. A radio set without a ground is somewhat like a pendulum clock would be if that clock were allowed to swing on another pendulum. It would not keep good time, if any at all. As a matter of fact, a good pendulum clock will not keep good time if it is mounted on the wall of a building if that building vibrates ever so little. It is necessary to mount it on a solid cement block imbedded firmly in the ground. In other words, we have to ground the clock mechanically, since the clock is a mechanical device.

Just how does grounding stabilize the circuit?

Let us consider hand or body capacity in a radio set. The hand assumes the potential of the ground in the immediate vicinity, unless it is thoroughly insulated. If one side of the circuit is not grounded, say the low potential side, its potential differs from ground potential. Hence when the grounded hand is brought near the condenser a current flows back and forth between the condenser and the hand and the potential of the circuit changes. As soon as the hand is removed the potential changes to its former value and the circuit is detuned. If the condenser is grounded on the side which comes near the hand this effect does not occur because the condenser and the hand are at the same potential. Without the ground connection the

(*Continued on next page*)

Body Capacity Analyzed

Current Flow to Hand Causes the Trouble

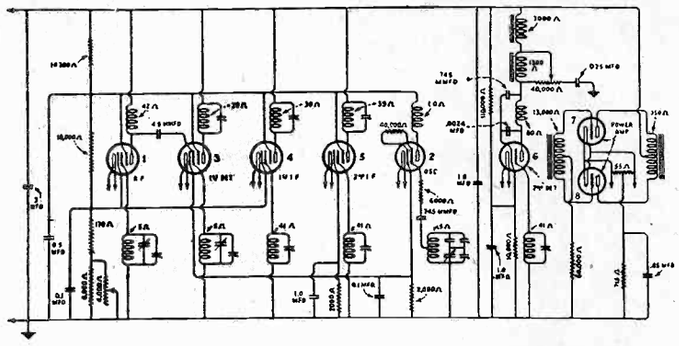


FIG. 6

This eight-tube superheterodyne has been drawn in such a manner as to show clearly the relation of the various parts of the circuit to ground, especially with respect to the steady operating voltages.

circuit assumes a potential determined by various considerations, but it would be a rare thing if it assumed ground potential. If it is grounded the condenser can only assume one potential, and that the same as the potential which the hand assumes.

Stray Fields

Grounding the condenser on the hand side does not eliminate all hand capacity. A movement of the hand will change the position of the ground with respect to the ungrounded side of the condenser, as well as with respect to the coil and the grid of the tube. This will change the capacity across the circuit, and again we have the detuning effect. To avoid this we put a conductor between the circuit and the hand, and then ground this conductor. This leaves the distribution of the grounded conductors about the tuned circuit the same whether or not the hand is moved. Hence this eliminates hand capacity, provided the shield is not so thin and such a poor conductor that the electric field gets through it.

Typical Cases

When we are dealing with high frequency alternating currents and voltages we do not have to have a conductive path to establish a circuit, or to effect a ground. Alternating current can flow "through" a condenser. If the reactance of the condenser is small, which it is if the frequency is high and if the capacity is large, or more accurately, if the product of the capacity and the frequency is high, the potential difference between the two plates of the condenser is small. Hence we can ground a circuit with respect to high frequencies by using a condenser. We might, for example, ground at 550 kc. the rotors of a set of tuning condensers by connecting a 0.001 mfd. condenser between the rotors and the actual ground. At 1,000 cycles this condenser would not establish a ground at all. In order to effect the same ground at this frequency we would have to use a condenser of 550 times the capacity, that is, a condenser of 2.75 mfd.

A case where a condenser of 0.001 mfd. establishes a ground is shown in Fig. 1. Here Cl is interposed between the tuned circuit and ground. The current through Cl is very small because it is not in the tuned circuit and because the resistance *r* is large. Hence the voltage drop in the condenser is small and the potential of the rotor of C cannot differ much from ground potential. If L is 245 microhenries, R, 10 ohms, C, 350 mmfd., Cl, 1,000 mmfd., and *r*, one megohm, the drop in C is 1,200 times greater than the drop in Cl. This is a typical case.

Another typical case is illustrated in Fig. 2. Cl is a large by-pass condenser across the bias resistance. If the resistance is of the order of 30,000 ohms and Cl is 2 mfd., the cathode is grounded for radio frequencies that may exist in the circuit, and it is nearly grounded for all but the lowest audio frequencies.

Potentials in a Receiver

In an a-c operated receiver voltages are generally measured from B minus, and this point is grounded. Since B minus is the lowest potential point available in the circuit, ground is zero potential and any voltage measured is positive. This is clearly illustrated in the eight-tube superheterodyne in Fig. 6, which has been drawn especially to emphasize this point. We note the similarity between this circuit and a power transmission line having distributed loads. At some distance to the left of the circuit the generator is supposed to be located and the line connects to the two arrows. The generator in this case happens to be a rectifier-filter, but the circuit would be exactly the same if the source were a d-c generator at some distance away. The section of the circuit shown is only the load. There are many parallel parts of this load, each tube being one. The voltage divider also appears as a load in parallel with the various branches.

The grounded side of the circuit is ground for both signal and steady voltages, but the upper side of the line is not "hot" for both, only for the steady voltage. For the signal this line is also ground by virtue of the large by-pass condensers across the line, at least two of which are shown. In respect to steady voltage the highest line is the highest potential line and would so appear with a d-c voltmeter.

In respect to the signal, whether high, intermediate, or low frequency, the grids of the tubes are the highest potential points.

For d-c voltages the grids are positive with respect to ground, because the return of each grid is made to the lowest possible potential point. This does not mean that any grid has a positive bias, because the bias is measured with respect to the cathode of the tube involved, and the cathode is at a higher potential than the grid returns and therefore it is positive with respect to it. This is equivalent to saying that the grid is negative with respect to the cathode, or that it is lower in potential than the cathode.

It was stated that the grids were positive with respect to ground. This statement is not true unless there is grid current. In the absence of grid current, the grids are at ground potential, or at zero potential. In a properly biased tube there is no grid current.

The signal voltage is introduced in the grid circuits between the tube and ground so in respect to the signal voltage the grids are alternately raised and lowered in potential. The alternating signal voltage oscillates with ground as a base or reference point. That is, the signal makes the grids alternately positive and negative. This does not hold in respect to the cathode, however. With respect to the cathode the grid should always be negative.

Patent Questions and Answers

Patent questions should be addressed to Ray Belmont Whitman, Patent Editor, RADIO WORLD, 145 *West Forty-fifth Street, New York, N. Y.*

WHAT ARE the rights of an employe to a patent on his invention as against his employer?—E. F., Cincinnati, O.

If he is hired to improve a machine for instance, the patent belongs to his employer. On the other hand, if he is hired to run a lathe, and invents a new painting process or something else not connected with his work, then the invention and patent belong to him. This is the simple formula on which the law is based but there are many modifications which might apply in individual instances. A good patent attorney's opinion in each specific case should be obtained.

* * *

IS THERE any advantage in keeping a patent application pending as long as possible?—E. S., Quincy, Mass.

Yes there is. Unless actual infringement of the allowed claims is known, it is not wise to hasten unduly the prosecution of an application, for the reason that corrections and amendments which can be made during the prosecution of the application cannot be made after the grant of the patent, except by having it reissued, which is sometimes difficult or impossible to do, is expensive, and is also risky, giving rise, for instance, to what is termed "intervening rights," which may render the patent valueless against the particular person or concern you would want to sue.

* * *

A NEIGHBOR has offered to back me to finance patenting and marketing my invention providing I include his name as co-inventor. Is it all right to do this?—A. D., Albany, N. Y.

No. If your neighbor is not in truth a co-inventor and an unfriendly party learns of the arrangement, the patent can be declared invalid. You can doubtless satisfy your neighbor by giving him a 50% interest in the proceeds made out of the invention. Be on your guard not to assign outright any portion of your title to your patent.

A Soldering Assembly

Receptacle Holds Iron, Solder, Paste and Fluid

By Paul Erwin

ANY one who ever paid $250 for an Oriental rug and $75 for a fancy gate leg mahogany table, and then used the table for parlor soldering, with the rug as catchpan, will be interested in a soldering outfit that permits of soldering in the swellest drawing room in the land, without danger to table, rug or even trousers.

It should be observed that when molten solder falls on a polished table, the drop flattens out and solidifies, and it is possible to lift the resultant wafer off its unbidden resting place. That is exactly what has to be done—lift it. Now, in the process the finish may stick to the under side of the solder wafer, instead of to the table, and this form of obstinate discrimination raises havoc in the most content of families.

If the molten metal drops on a fluffy rug, some of the fluff has to come off with the solder, and the spot may not escape the eye of the real president of the household, no matter how clever you are. And besides these considerations, the solder usually is not free from its cleansing agent, and this cleans joints much better than it does rugs, table tops and trousers. The oily residue may leave a mark that catches the fast eye that roams the household, and soon enough, alas, that terrible scolding ensues.

Saves Curtain Lectures

To do away with all these worries, and still have a fine result, one should have a soldering assembly, such as the one illustrated, which I built in a few hours, and which has saved me many a curtain lecture. I can solder all night, anywhere in the house now, and nothing adverse happens that I can't blame on the baby. The soldering assembly is my Complete Alibi.

This assembly consists of an L-shaped housing, with a right angle metal piece at front so placed that the handle of the soldering iron can rest in the V. The other end of the iron may go into a shield can (such as is used for coils in midget sets) or into an aluminum shaker, as illustrated. The perforated shaker will be of thin gauge aluminum, and for rigidity's sake it is a good plan to cut out the perforated top to near the edge of the screw cover, which can be done with diagonal cutters or tinsmith's shears.

The structure, or L-piece, consists of bottom and two sides, with one large hole and four small holes in each side, somehow suggesting a cubistic conception of Thanksgiving pumpkins.

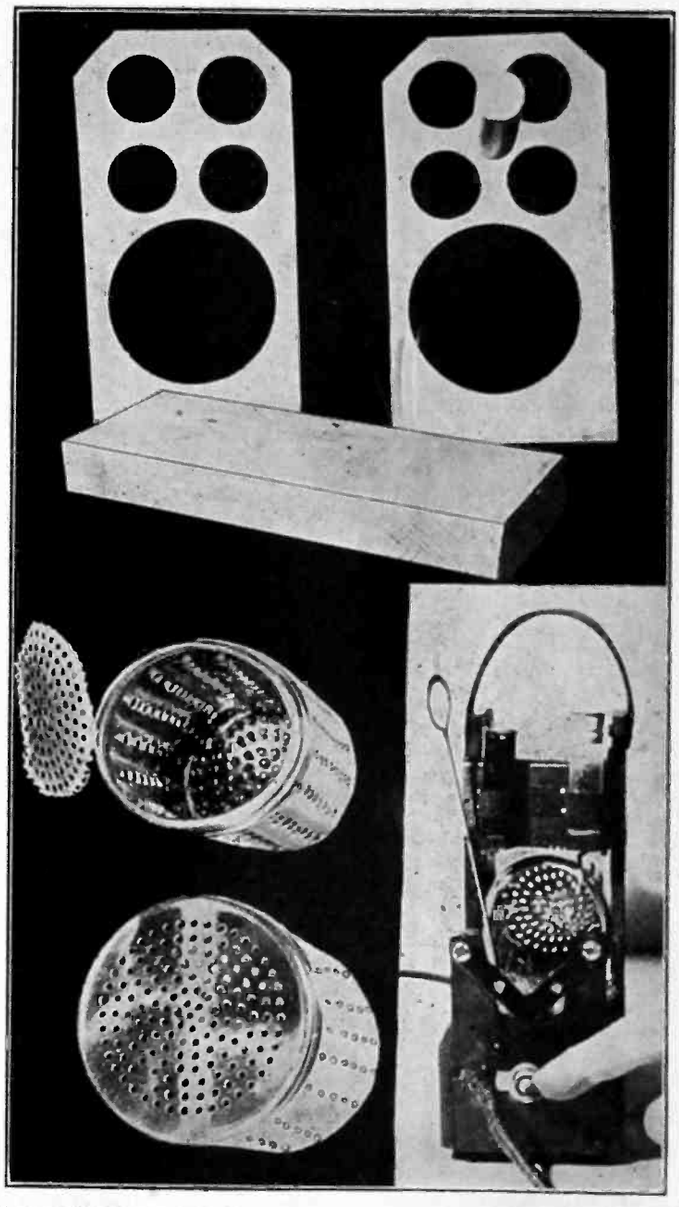
A dowel is used between the two side pieces when they are put together, and this dowel will be the hub for the roll of solder. For facility in removing empty rolls, a hole is drilled all the way through the hub, so that a bolt and nut will tighten the dowel in place. The dowel is small enough in diameter to permit the solder "wheel" to turn.

Between the front metal angle and the open end of the can a brush is seen. This is a coarse one, purchased cheaply in hardware and other stores, and it enables one to clean the iron tip each time, before the iron is used.

Uses Carry-Over Method

I understand perfectly well that the standard recommendation for the use of solder is that the iron should be placed at the joint to be soldered, and the solder then applied to the heated joint, but I'd like to remark as an old-timer in radio that the standard recommendation happens to be the exception. The rule is that the carry-over method is used.

On this point, let me say that cored solder does not permit so strong a hold on the tip, because then friction is less, due to the resin or other substance, and so plain solder may be used, if desired, for otherwise the carry-over would lend a slight peril, in that solder would roll off the tip (like you-know-what off a knife) and then the same old harangues would result.



(Photographs by the author)

How the wood is cut is shown at top. Lower left reveals aluminum shaker with top intact and after cover has been virtually cut off. Lower right shows a-c switch, the V to cradle the iron handle and the elastic bands (who said garters?) holding the two corked bottles.

The following is a list of new members of the Short-Wave Club:

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James Davis, 113 Flora Ave., N. E., Atlanta, Ga.
Edward Garnor, 68 Ferrf Ave., Irvington, N. J.
Felix Arostegui, Mendez Vigo St. No. 116, Mayagüez, Porto Rico
Joseph Esposito, 510 Pequonnock St., Bridgeport, Conn.
Roy C. Anderson, Rt. 1, Box 269, Kingsburg, Calif.
John H. Bever, 137 S. Lakeview Drive, Sebring, Fla.
L. R. Lane, Mesq 23, Vedado, Apt. 404, Habana, Cuba
Nick Gallarico, 1907 So. Cicero Ave., Cicero, Ill.
Glenn Kimmell, P. O. Box 74, Wolf Summit, W. Va.
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C. E. Tolliver, 1607 S. Spring, Springfield, Ill.
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John R. Dunning, R. R. No. 2, Duncarf, N. B. C., Canada
E. B. Banta, 803 N. 11th St., Leavenworth, Kans.
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Short Wave Club

Short Wave Editor, RADIO WORLD, 145 *West 45th St., New York.*

Please enroll me as a member of Radio World's Short Wave Club. This does not commit me to any obligation whatever.

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Separate Power Supply for Tuner System Adap

By Anthony

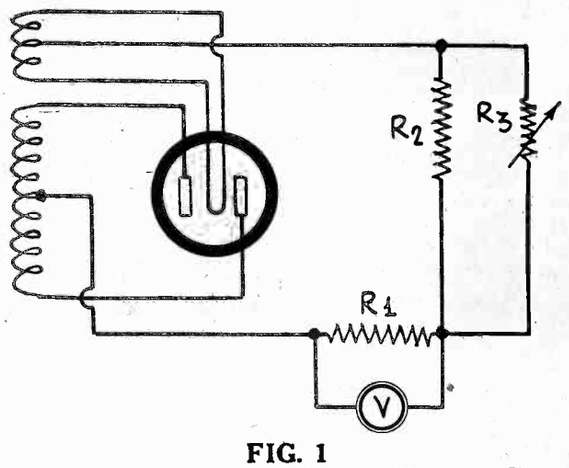


FIG. 1
Effect of current changes illustrated.

[*Last week, issue of March 26th, the author presented a constructional treatment of E. Bunting Moore's latest DX design, a superheterodyne with cross-continent range. The set has tuned in Pacific Coast stations every night for two months in New York City. This week use of a separate power supply for the tuner is discussed.*—EDITOR.]

A GREAT many perfectly good —45 or —50 amplifiers, having their own power supply units, are in existence, and working tuners now to some extent outmoded by expertly developed units such as the Super-Da-Lite-R. Due to the dependence of the Super-Da-Lite-R, as in modern tuners, on a properly designed power unit, there has been a certain amount of difficulty in adapting the new tuner to older amplifiers.

Separation Recommended

As a matter of fact, it is rather poor policy to operate a tuner and an amplifier using —50 tubes from the same power pack. The filter system of the power pack, before coming to the voltage divider, usually has a very appreciable resistance. A pair of —50 tubes properly biased will have a plate current of approximately 110 ma. The current drawn by the tuner and voltage divider rarely will exceed about 37 ma, or 25 per cent. of the total. In short, 75 per cent. of the total current drawn through the filter is taken by the —50 tubes.

Strong Signal Can Overload Output

With a tuner of the Super-Da-Lite-R type it is not at all difficult to overload the power stage on a moderately strong signal (any full powered station within 2,000 miles). As soon as the tubes in the power stage are overloaded at all, their plate current will vary considerably.

Since the voltage drop across the filter is determined by the equation

Voltage drop = Filter resistance times current

and 75 per cent. of the current is that of the —50's, it is readily seen that any change in the —50's is bound to cause large changes in the voltages delivered to the tuner. This variation is at audio frequencies, and affects, in addition to the r-f tubes, also the detector plate, which is the input to the audio amplifier. It will therefore set up an audio frequency regeneration, ruining the quality of the output completely.

A diagrammatic representation of this is given in Fig. 1. R-I represents the filter choke, about 1,000 ohms. The tuner is at R-2, about 12,000 ohms. The power stage, equivalent to 4,000 ohms when constant, is R-3.

Use a Separate Power Source

Since three-fourths of the current flowing through R-1 comes through R-3, it is obvious that a change of any magnitude in R-3 will cause a large variation in the current through R-1, and consequently in the voltage across it. A set up of this kind on a breadboard, using fixed resistors for R-1 and R-2, and a high wattage variable resistor for R-3, will prove a very interesting experiment, and will demonstrate conclusively just what happens in the circuit under the conditions described.

The same effect will result from —50 tubes having slightly differing characteristics even if there be no overload, and it is only in extremely rare cases that two —50 tubes will be purchased having the same *dynamic* (not static) characteristics.

The simplest way of avoiding this difficulty is to provide a separate source of power for the tuner, which can be accomplished simply and at a very little additional expense more than repaid by the greatly improved results.

Some Changes in Circuit

A schematic for the Super Da-Lite-R, including a power supply of adequate capacity, is shown in Fig. 2. The only changes from the original diagram, published last week, are in the elimination of the power stage, and the substitution of L-12 for the 1,000 ohm field coil, and the insertion of R-24. It is still strongly recommended that a 110-volt speaker field coil be used at L-12. This can

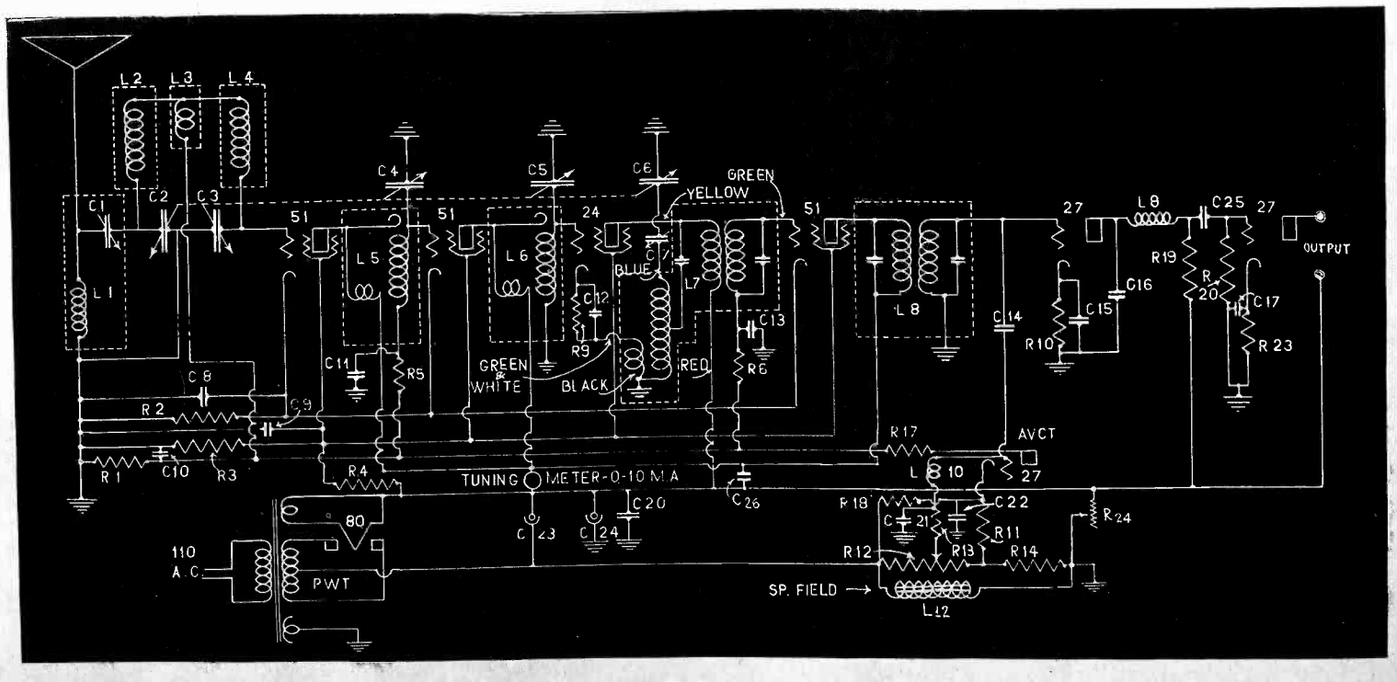


FIG. 2
The cross-continent tuner with one stage of audio. An external power amplifier is recommended by the author for installations where an audio power amplifier already is available.

Improves Results;
ted to Cross-Continent Super

Swale Waring

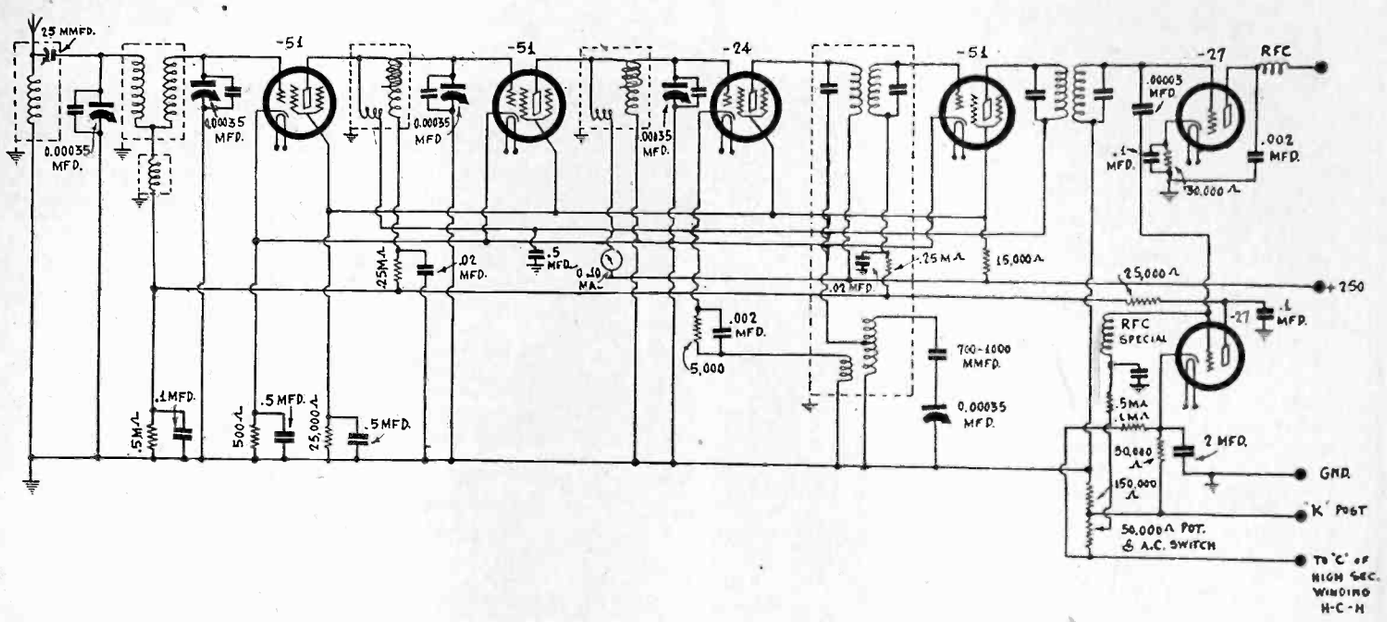


FIG. 3
The tuner without any audio or B supply.

have a resistance anywhere from 1,000 to 2,500 ohms. R-24 is a 5,000 Ohm Type Electrad Truvolt resistor. After hooking the tuner up as shown, put the terminals of a voltmeter at the two ends of L-12 (it does not need to be a high resistance meter, a "B" battery model will suffice) and adjust the slider on the resistor R-24 until the voltmeter shows 110 volts.

The reason for preferring the speaker field at this point is that there should be absolutely no variation in the voltage across this unit at any time, whatever may be happening in the way of strong or weak signals. The only point in the receiver, or rather tuner, where there might be any change in current even on a violent overload will not cause a variation of more than 10 ma, and this will remain constant except when the volumne control is adjusted, so that the field energizing current cannot vary at all with the signal. The bleeder current, through R-24, is large in proportion to the tube drain, making for great stability in overall voltage, with consequent freedom from any possibility of feedback through poor voltage regulation in the power pack.

Better Tone Quality

The power pack for the power amplifier can not be left exactly as it was for the old receiver, and will probably appear to have much better quality than it ever had before, since distortion through a-f regeneration, poor regulation, etc., has been eliminated.

A further reason for the use of a system of this is found in receivers utilizing an automatic volume control, as the Super Da-Lite-R, is in the disturbances caused in this very important tube by variations in the voltage across the field. Let us assume that a strong burst of static, or a strong modulation of the signal, such as a talker who shouts, is received. The power tubes are momentarily overloaded, causing the grids to go positive, and increasing the plate drain. The voltage across the choke rises. This causes the bias on the automatic volume control to increase in proportion, and reduces the bias on the amplifier tubes. This allows the amplification to increase momentarliy, aggravating the overload condition, and making the last of overload much worse.

Big Volume Enjoyed

Of course, if the receiver is operated at low volume, none of these troubles will occur, but it is hardly presumable that anyone who has gone to the expense of procuring a —50 amplifier has done so with the intent of not using more the amount of volume that a. —71 would handle

The big tubes permit large volume without serious distortion.

Standard 5,000 Frequency on New Schedule

Washington.

The Bureau of Standards transmits standard frequencies from its station WWV, Washington, D. C., every Tuesday. The transmissions are on 5,000 kilocycles, and are given continuously from 2 to 4 p. m. and from 10 p. m. to 12 midnight, Eastern Standard Time. (From October, 1931, to March, 1932, inclusive, the evening schedule was two hours earlier.) This service may be used by transmitting stations in adjusting their transmitters to exact frequency, and by the public in calibrating frequency standards and transmitting and receiving apparatus. The transmissions can be heard and utilized by stations equipped for continuous-wave reception throughout the United States, although not with certainty in some places. The accuracy of the frequency is at all times better than 1 cycle (1 in 5,000,000).

From the 5,000 kilocycles any frequency may be checked by the method of harmonics. Information on how to receive and utilize the signals is given in pamphlets obtainable on request addressed to Bureau of Standards, Washington, D. C.

The transmissions consist mainly of continuous, unkeyed carrier frequency, giving a continuous whistle in the phones when received with an oscillatory receiving set. For the first 5 minutes there are transmitted the general call (CQ de WWV) and announcement of the frequency. The frequency and the call letters of the station (WWV) are given every 10 minutes thereafter.

Supplementary experimental transmissions are made at other times. Some of these are made with modulated waves, at various modulation frequencies. Information regarding proposed supplementary transmissions is given by radio during the regular transmissions, and also announced in the press.

The bureau desires to receive reports on the transmissions, especially because radio transmission phenomena change with the season of the year. The data desired are approximate field intensity, fading characteristics, and the suitability of the transmissions for frequency measurements. It is suggested that in reporting on intensities, the following designations be used where field intensity measurement apparatus is not used: (1) Hardly perceptible, unreadable; (2) weak, readable now and then; (3) fairly good, readable with difficulty; (4) good, readable; (5) very good, perfectly readable. A statement as to whether fading is present or not is desired, and if so, its characteristics, such as time between peaks of signal intensity. Statements as to type of receiving set and type of antenna used are also desired. The bureau would also appreciate reports on the use of the transmissions for purposes of frequency measurement of control.

All reports and letters regarding the transmissions should be addressed Bureau of Standards, Washington, D. C.

Picture Diagram of 15-200-Mete Stations the World

By Jo

SUCH good results have been obtained with the two-tube battery operated short-wave receiver described in the February 27th issue, and so many requests received for the publication of the picture diagram, that more details are given herewith, and the full-scale picture diagram printed for the first time. This picture diagram corresponds in every detail with the schematic circuit diagram printed this week on page 17 in answer to a question from a reader.

With this simple circuit, comprising only a detector and a stage of audio, virtually the entire world has been covered, and as many as 87 stations tuned in during one night, so the circuit is a performer. This is no surprise, since the circuit is about 10 years old, and not only has stood the test of time, but has come in for a little improvement because of new tubes.

Circuit for Earphones

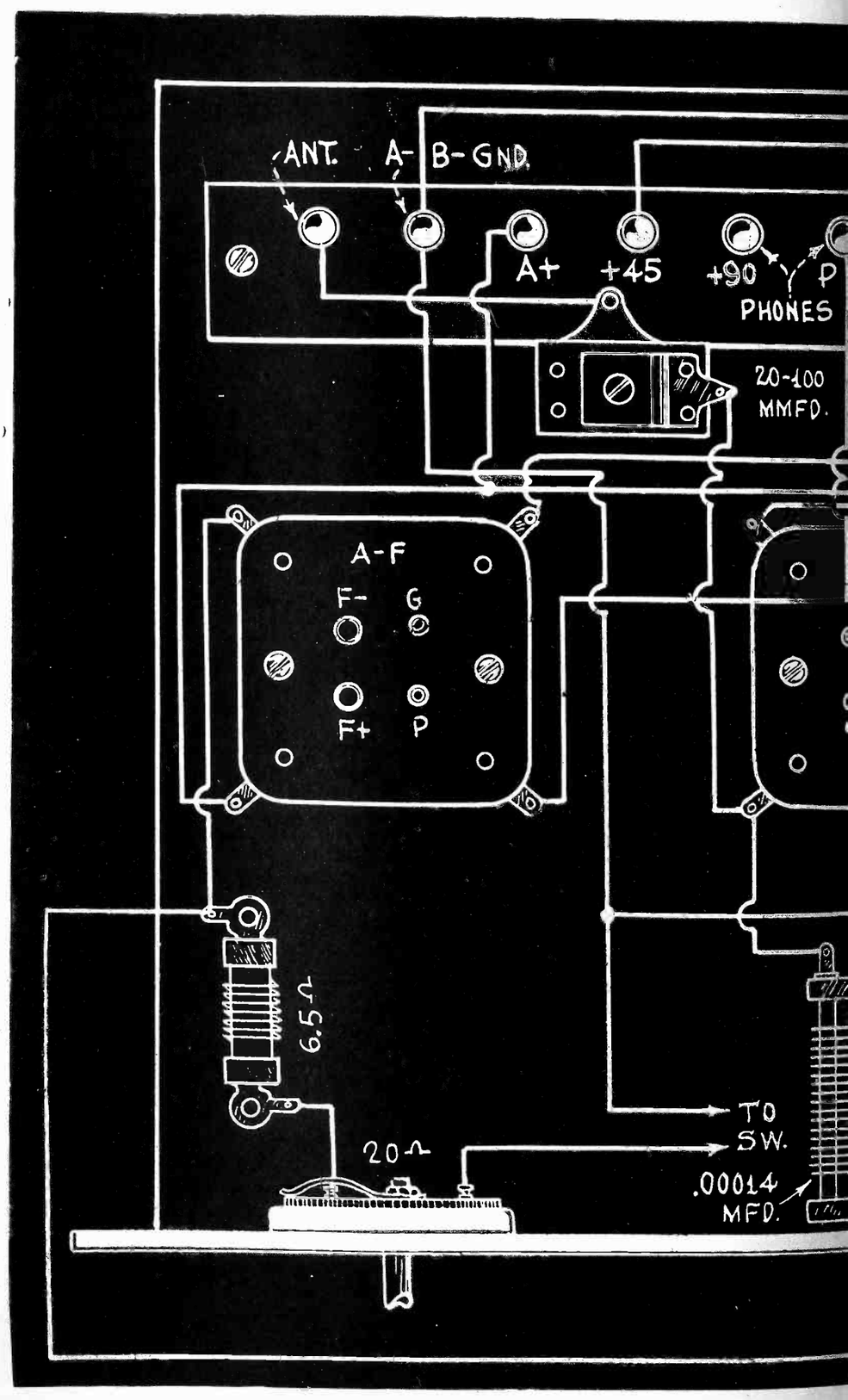
In the diagram the tubes are two 230's, and as these operate at 2 volts on the filament, and draw only 60 ma each in the filament circuit and a total of about 9 ma in the plate circuit, the battery drain is relatively small. Besides, the new tube—if it still can be called new—is a good one for short waves, which applies to the detector, for of course the audio tube handles only audio frequencies. The circuit is for earphone operation, or may be fed to an audio amplifier by those who know the simple methods of doing this. The present purpose, however, is to confine ourselves to the circuit as printed—earphone reception, but earphone reception with a vengeance.

The only trouble that has been experienced has to do with the smallest coil. In any such short-wave outfit the smallest coil will bear investigation, as results depend absolutely on regeneration, and it must be obtained. The way the little set is wired has something to do with it, and therefore resort to the picture diagram will be of extreme help to many, particularly those who are not very familiar with radio construction. It is a circuit that any novice can tackle, particularly as every wire and lead are now clearly shown pictorially, and besides the tuning is not difficult.

More Tickler Turns

As to the smallest coil, if oscillation is not present, as one can determine readily enough by very poor or no results in daylight, then the simple expedient is to add more turns to the tickler and bring the tickler closer to the secondary. It is not absolutely necessary to do both. If more turns are put on, then oscillation should be present.

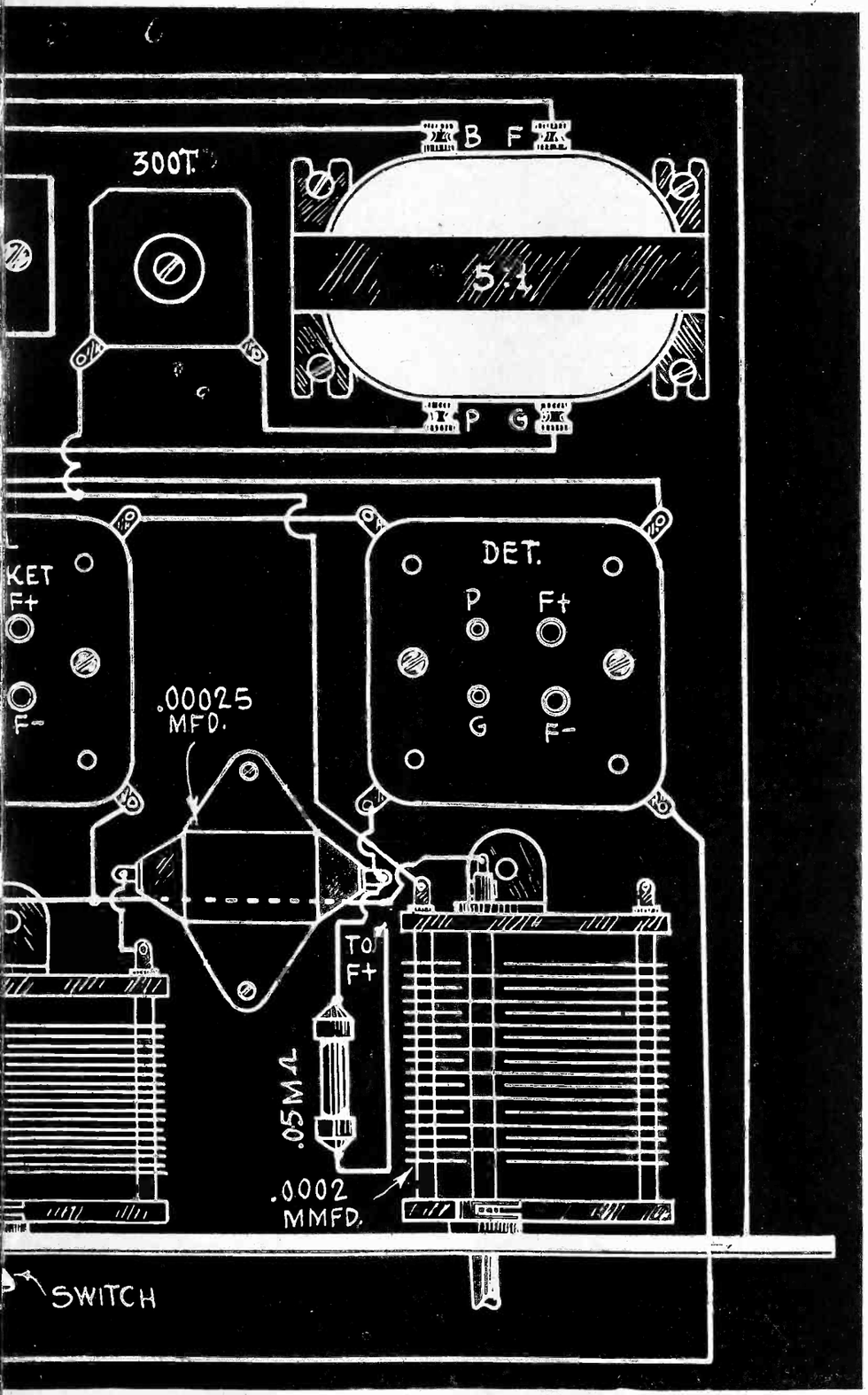
In passing it should be stated that commercial coils were obtainable that maybe had too few turns on this particular winding, but it is an easy matter to make the correction, particularly as any size wire may be used, provided it is insulated, and it may be fine wire. It is also true that the wave



FULL-SCALE PICTURE DIAGRAM OF 15-200-M

Battery Receiver; ver Tuned in with Simple Outfit

Tully



ER RECEIVER FOR BATTERY OPERATION

band conceivably could be covered with only four coils, but the inductance data given in the February 27th issue called for five coils so that no matter how the antenna series condenser was set (it being a 20-100 mmfd. equalizer) there would be abundant overlap and full coverage.

In effect the antenna capacity is in parallel with the tuning condenser, and as the tuning condenser is only 0.00014 mfd., with a natural minimum of 6 mmfd., the antenna capacity adds to that minimum, and so does the capacity due to wiring, tube elements, etc.

Coil-Winding Directions

The less capacity used in the series condenser, which is adjustable with a screwdriver, the lower the minimum and the greater the frequency coverage because the capacity ratio, actual minimum to actual maximum, is larger.

No difficulty in obtaining regeneration has been reported by any one who followed the coil data as previously published, and therefore these data are repeated, so any who desire to wind their own coils may do so, using 1.25 inch tube base forms of the UX type, and meanwhile commercial coils have been changed to include more tickler turns on the smallest coil.

The winding data are as follows for the antenna series condenser set at maximum:

Grid Coil No. Turns, Enamel	*Plate Coil No. Turns, Enamel*	*Range, Meters*
60 of No. 32	32 of No. 32	200 to 118
33 of No. 24	15 of No. 32	118 to 69
20 of No. 18	10 of No. 32	69 to 40
10 of No. 18	10 of No. 32	40 to 24
4 of No. 18	4 of No. 28	24 to 15

It should be remembered that the smallest coil is not for use when there is darkness at the point of reception, but that results are good only in daylight. From soon after dawn until about 3 p.m. good results may be expected.

Polarities of Coils

The coils should be wound as follows, for the circuit diagrams and their terminal designations to apply strictly: Begin winding at the top of the form and connect the beginning to the grid pin. Put on the prescribed secondary and terminate at the F minus pin. Then wind the plate coil, in the same direction, adjoining the secondary, beginning the plate winding near where the grid winding ends, and connect beginning of plate winding to the plate pin. Then the remaining plate coil connection naturally goes to F plus. Polarities will be correct, if diagrams are followed as printed this week. The bases are of the UX type, four pins.

The layout has been made symmetrical, and it works out to advantage also. All the sockets are not placed in the same direction, and it is advisable to stick to the picture diagram to include this diversity.

Readers Offer Solutions of Mystery Wide Wave Coverage with

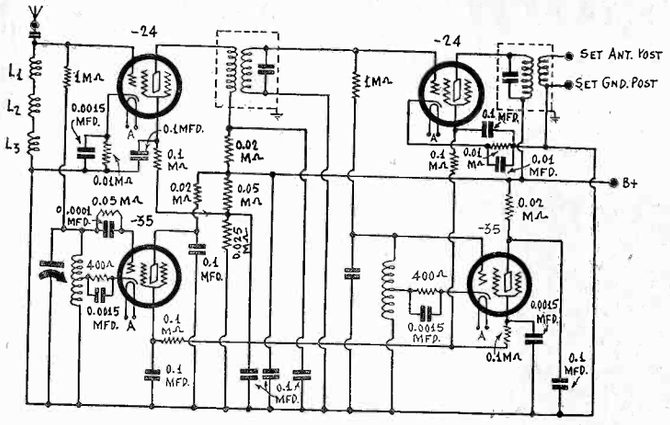


FIG. 1
The mystery circuit applied to a short-wave converter, where a broadcast receiver supplies the second intermediate frequency.

[*TWO articles have been published in these columns, one in the March 12th issue, the other in the March 19th issue, dealing with the mystery circuit. The first showed a superheterodyne, with one intermediate level. The second showed a superheterodyne with two intermediate levels (Fig. 2 this week). Readers were asked to send in their solutions. Some of the replies are printed this week, and comments thereon made by Herman Bernard, co-designer with J. E. Anderson of the mystery circuit. In general, readers have showed excellent penetration. The letters printed herewith, comments thereon, and circuits diagrammed in Figs. 1 and 2, afford sufficient background for the solution of the mystery by readers. Letters should be addressed to Mystery Editor,* RADIO WORLD, 145 *West Forty-fifth Street, New York, N. Y.*—EDITOR.]

A MYSTERY circuit has been printed in these columns, and readers asked to send in their solutions. The circuit comprises an invention and is no mystery therefore to the inventor, but that in some respects it may baffle readers is clear from the answers so far received.

Some of those who have sent in letters are very near to the real solution, and on the basis on what they have revealed, more progress should be made speedily by themselves and by others, particularly as comments are appended herewith to their letters and there is meat in those comments.

Two circuits were previously printed but both embodied the same fundamental idea, one circuit showing two detectors, the other three detectors. The third detector simply represented the demodulation of a lower frequency of amplification, since the previous intermediate frequency was too high for stability with amplification.

Readers have shown an excellent grasp of the fundamental purpose of the system, and the only thing necessary to make the solution tenable is to get really definite as to frequencies.

See what you yourself can think up, and then write your thoughts to Mystery Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

* * *

On the Right Track

ABOUT YOUR three-detector circuit:

First of all, give us more problems to solve. As a matter of fact, the three-detector circuit was not much of a problem, for during the preceding six months you discussed all angles of the subject leading to such a system. You imparted sufficient groundwork information in other circuits, bit by bit, so that any one who had followed your magazine regularly should have "broken" the secret in a minute. But perhaps I am wrong? Well, here goes.

The first detector input by three different r-f chokes in series is to make each choke effective over a certain band of frequencies. For instance, one choke for 550 to 1,500 kc, another choke for 1,500 to 3,500 kc, and the third choke for 3,500 kc up. These frequency values are merely indicative of the basic principle.

The tuning condenser across the first oscillator turns 360 degrees to allow large band coverage with fair spacing of channels.

For the sake of argument let us say that we are using an intermediate frequency of 2,000 kc. Therefore the oscillator could tune from 2,500 kc to 7,000 kc, assuming coverage of the set to be from 500 kc to 5,000 kc. It is possible to design an oscillator to produce this coverage.

The output of the mixer is tuned to 2,000 kc and fed into a second detector, wherein this frequency is mixed with that of another oscillator, which other oscillator generates a fixed frequency. The object is to lower the frequency so that further amplification may be obtained at, say, 175 kc, since amplification at the previous high intermediate frequency is unstable. After the amplification at the lower frequency the signal is fed to the third detector, and then you use audio and have a loudspeaker set for short-wave and broadcast reception.

HUGO W. VON KOPPENFELS
239 South Forty-fourth Street,
Philadelphia, Pa.

Well, Mr. Koppenfels certainly made progress. As the children say when playing blind man's buff, he is getting "hot," so "hot" in fact as to be near the absolute solution. As for the three chokes, he certainly had no trouble deciding why they were used. His frequency distribution was illustrative. When different inductances of chokes are used that way in series, as the frequencies increase the larger chokes cease to be chokes, as such, and act more as condensers, due to the total capacity involved, whereupon the smallest choke finally is left to handle the highest frequency. No switching of chokes is necessary. The effectiveness is automatic. However, Mr. Koppenfels, in using a certain frequency as an example, perhaps did not consider its ramifications in respect to other frequencies. May I give just a hint—a dark one—as if in a game? Since this is the period of the Washington Bicentennial, think of Washington crossing the Delaware. As it is, he made a most excellent showing, and if some of the refinements need a little more elucidation, we believe that he's the man to do the elucidating.

* * *

Object Well Stated

HERE'S A WHACK at your problem from one who does not profess to have an extensive knowledge of radio technique.

My guess is that your circuit represents a one-dial outfit to attain wide wave band coverage with single control. You have a double oscillator, the first perhaps being a 1,600 kc and that frequency passed on to the second 224 and mixed with a frequency from the second oscillator, which of course is a fixed frequency oscillator, it not being necessary to tune it variably.

The three coils in the antenna circuit are for three different bands of frequencies, perhaps about 550 kc, 1,700 kc and above 2,000 kc respectively. I am interested to learn what your second beat frequency is going to be.

From your circuit I guess you are trying for a real one-dial super, perhaps intending to get away from the trouble of trying to make the modulator and oscillator condensers track, which tracking no doubt is a difficult job.

J. C. HURST
Route 4, Dayton, O.

The statement of the object is well put by Mr. Hurst—"wide wave band coverage with single control." He, too, is conscious of the desire to dip deeply into the high frequencies. (Can one dip into heights?) Certainly the second oscillator, fixedly tuned, is to lower the frequency, but there isn't much difference whether 175 kc or thereabouts, or 400 kc or thereabouts, are used. Take 400 kc, if you want. Certainly it would be a pleasure to get away from the tracking problem, although it can not be truthfully said that the tracking problem is a very difficult one. You may have seen the curves on J. E. Anderson's 400 kc automobile super, and if not, here they are again showing that the oscillator and r-f tracked very nicely. The slight differences shown in the curves do not necessarily represent actual differences, but may be due to progressive error in the test oscillator calibration. In practice the tracking has proved fine, since there are no "birdies."

The antenna coil idea was well grasped by Mr. Hurst, too, and it doesn't look as if his knowledge of radio is so limited as he believes. Mr. Hurst sensed the two frequencies of intermediate amplification, and he may assume the second frequency of amplification as stated. Then he should meditate on what the first intermediate frequency was.

* * *

This Man Is Too Wise

YOU CERTAINLY must have something in that circuit with its third detector, or the one where you used only two detectors. I am not able to state exactly the frequencies that must be expressed before a statement can be called a solution, but through the crystal, as I gaze intently, I see the following: one-dial set, heap much frequency coverage, no switching or plugging in, a terrific problem in the mechanics of the dial and the optics of reading it, second detection of a high intermediate frequency, and then either heap much audio, or again some frequency changing (unvaried frequency oscillator) to get r-f amplification at a frequency where it can be had. One of the hints thrown out by the author was that the absence of tuning of the modulator input by a variable condenser was all right, and I'd like some more dope on this. The three antenna chokes

Superheterodyne Circuit; Single Condenser Readily Grasped

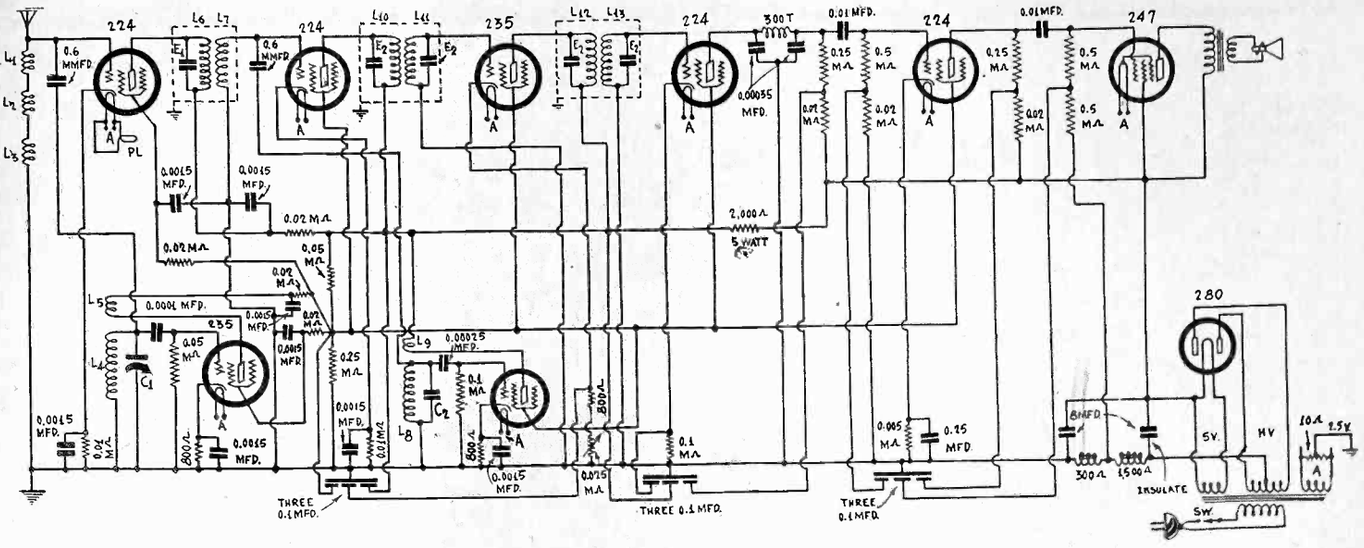


FIG. 2

One representation of the mystery circuit. A dial tunes only C1, and the frequency range for incoming signals is large. There is no amplification at the first (high) intermediate frequency. Another frequency change takes place for amplification at a low intermediate (lower than 450 kc). The fourth tube from left, at top, is the third detector.

constitute tuning, though not with a mechanically variable condenser, still with what amounts to an electrically varied capacity effect. Am I near or far from the facts?

BERTRAM REINITZ
18 East Twenty-first Street,
Brooklyn, N. Y.

Mr. Reinitz knows more about this circuit than he has written. Why isn't he able to select all the frequencies, for the antenna chokes handle very high frequencies and include the broadcast band, so why not take these input frequencies as 20,000 to 550 kc? This is a safe tip to all. The reason it is known that he knows more than he professes is that he mentions something about the dial and its legibility. This topic will have to be passed up, because if too much is said about it there will be no problem remaining. (This is a fast one for the quick boys.) Under some circumstances, a previous tip outlined, it is unforgivable not to tune the input to the modulator, under other circumstances it is quite all right to omit such tuning. The idea embodies in tuning was the use of a variable condenser across a coil. However, as Mr. Reinitz points out, there is tuning indeed where three chokes are effective over three bands, but that wasn't meant in the tip. The idea of the tip was to give the reader an insight into the frequencies to be handled at the input to the first tube. Many have solved that fundamentally. So let the previously stated range of frequencies be taken for granted. "Some more dope" on the reason for the integrity of the first detector (or modulator) without variable condenser tuning can not be given, as that would constitute virtually a complete revelation of the mystery. And, despite the almost uncanny penetration of readers who have offered solutions, it is still a fact that the mystery remains unsolved by readers. Certain situations have been correctly diagnosed, but it is necessary to ascribe frequencies before the total solution can be deemed accomplished. The modulator input frequencies and the second frequency of amplification (take 400 kc) are known, therefore . . . what? More mystery!

* * *

A Well-Considered Solution

IN REGARD to your mystery circuit, I would deduce that it represents an effort to tune all waves with a single control, the oscillator condenser. If this system could be made to operate successfully, it would certainly be a noteworthy development.

The three coils in the antenna input circuit, resonating at different frequencies, seem to indicate that it is an all-wave receiver. If one becomes a capacitative reactance for a given frequency impressed upon it, the next smaller coil will maintain an inductive reactance, so that the current through the coils will always build up an optimum voltage on the first grid, irrespective of frequency.

It appears that you have contemplated a high intermediate frequency, as indicated by the careful filtering in the amplifier shown in the first article, also in the first detector circuits in the second article. It is easy to see that a high intermediate frequency would be necessary to cover a large frequency range with a single coil-condenser combination for the local oscillator, and also to prevent image interference. A little figuring shows that an intermediate frequency of at least 10,000 kc would be required to prevent image interference if the set tuned from 550 kc to 20,000 kc.

Now, an amplifier for frequencies of this order is not only difficult to construct and operate, but it would also have poor selectivity, as so-called 10 kc selectivity is hard to attain above 500 kc. Then, no doubt, these are the reasons for again changing the frequency, evidently to a lower value, as is done in the circuit shown in the second article.

The question remains, can such a vast range of frequencies be practically accommodated in one turn of a dial? It seems to me that the stations would become very crowded, especially those in the broadcast band.

Another drawback with which to contend would be the fact that very slight changes in the oscillator frequency, due to temperature variations and other causes, would be sufficient to detune the set, perhaps to a station 20 or 30 kc from the one originally tuned in! Indeed, if the frequency range that I mentioned above were to be used, I believe it would be impossible to keep any station tuned to resonance for more than a few seconds.

In closing, I would like to say that the solution of the mystery circuit and speculation on its practicability has afforded me much pleasure.

E. M. ANDERSON
18626 Dale Ave.,
Detroit, Mich.

The solution offered by E. M. Anderson is certainly well considered, except for one point, the choice of the intermediate frequency. Its relation to the received frequencies should be studied some more. A high intermediate frequency is contemplated, of course, and the question of practicability revolves about electrical, mechanical and even optical problems. Holding the oscillator frequency constant is a problem in frequency stability that has been solved with crystal control for one frequency and is soluble for variety tuning. An oscillator with a non-reactive plate circuit removes one cause of trouble. Grid circuit stabilization can be applied. Take 10,000 kc, Mr. Anderson's selected intermediate frequency. For a constancy within 10 kc at 20,000 kc oscillator frequency the stability would have to be so good that the frequency would have to be constant to better than 1 part in 2,000. So the circuit is something worth considering, isn't it? Mr. Anderson is advised to theorize on the requirements for a high intermediate frequency. These remarks contain a strong hint.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Answers printed herewith have been mailed to University Members.

Radio University

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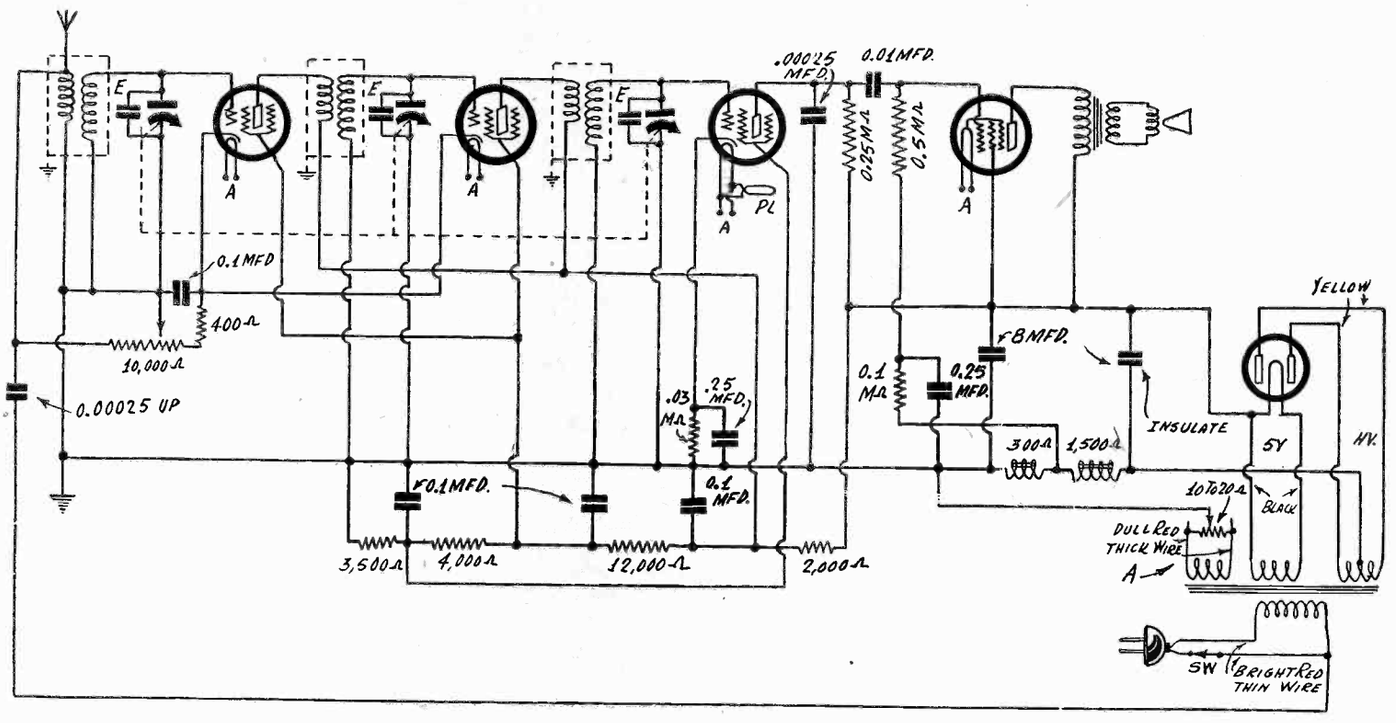

FIG. 997

In this midget the sensitivity may sometimes be improved by omitting the condenser between the antenna post and the primary of the power transformer, or by connecting it to the ground post instead of to the antenna post.

Sensitivity of Midget

I HAVE built a five-tube midget receiver which does not have the sensitivity that I expected. There is a condenser between the antenna post and the primary of the power transformer which is supposed to obviate the need of an antenna. If I use an antenna I get a little more sensitivity but still it is not satisfactory. Do you suppose the condenser referred to is at fault? If your answer is in the affirmative will you kindly explain in what manner the condenser reduces the sensitivity? I would appreciate a circuit of such a receiver with suggestions what to do.—S.T.A., Nashville, Tenn.

You will find a circuit of a five-tube midget in Fig. 997. This has the condenser you refer to. It is quite likely that the condenser has the effect of cutting down the sensitivity, especially if it has a large capacity. The reason for this is that there is a large capacity between either side of the primary of the power transformer and ground so that the antenna is virtually grounded. It may be that one side of the primary is actually grounded. Therefore you should eliminate the condenser in question and if the sensitivity without it is greater, leave it out. The condenser can usually be employed as a ground to better effect. That is, instead of connecting it between the antenna post and the primary it is connected between the ground post and the primary. In that case the ground connection may be omitted, and it is well to make the condenser about 0.1 mfd. Another point, if any condenser is connected to the primary it should be made to the transformer and not to the line. The drawing shown in Fig. 997 is correct in this respect.

* * *

Noisy Volume Control

MY VOLUME CONTROL is a potentiometer in the plate circuit of the detector. The potentiometer is used as plate coupling resistance and the slider on it is connected to the stopping condenser. As I move the slider there is a crackling noise which is very disagreeable. The noise stops as soon as the slider comes to rest and the noise does not interfere with the tone. But just the same, the noise is a nuisance and I should like to get rid of it. What causes the noise and what can I do to remove it?—T. L. H., Yonkers, N. Y.

The trouble is due to the fact that current is flowing in the potentiometer and that the slider changes the resistance by jumps. The connection you describe is not so bad as that in which the slider is connected to the plate, for in that case the current is actually broken as the slider moves. One remedy would be to use a potentiometer in which the slider moves smoothly over the resistance element. A better one is to use the potentiometer as grid leak and connect the slider to the grid.

* * *

Double Switch in Portable

IN YOUR March 19th issue you have a four-tube portable receiver in which you have two switches for turning off the power. Why is it necessary to use the switch in the B minus lead? It seems to me that as soon as the filament current stops the current in the B battery also stops.—J.S.S., Newark, N. J.

No, the current in the B battery will not stop completely when the filament battery is turned off because the bleeder current in the voltage divider would continue to flow. Although this current is very small it would drain the B battery. This could be prevented by omitting the resistance in the voltage divider between ground and the screen of the detector, but the improvement in the circuit caused by the bleeder resistance well warrants the use of the extra switch.

* * *

Design of a Wave Trap

MY RECEIVER is not quite selective enough to eliminate certain high power stations. They cause interference with some of the stations I like to listen to. Will you kindly suggest a wave trap with which I can tune out any interfering station without reducing the sensitivity of the set? I have a tuning condenser of 350 mmfd. which I wish to use.—F.G.W., New York, N. Y.

Wind 93 turns of No. 24 double cotton covered wire on a piece of bakelite tubing 2 inches in diameter. Connect your 350 mmfd. condenser across this winding. Also put on 10 turns of the same wire at one end of the 93-turn winding. Connect the small winding in the antenna circuit and tune the other to the station you wish suppressed.

* * *

Impedance of Parallel Tuned Circuit

IF there is a simple formula for computing the impedance of a parallel tuned circuit will you kindly give it? Is the impedance inductive, capacitive, or resistive? What is the formula for the resonant frequency?—G.W.R., Porchester, N. Y.

The formula is not very simple except at resonance. If the

resistance in the tuned circuit is small, which it must be if there is to be advantage in a tuned circuit, the natural frequency of resonance is the same as that of a series tuned circuit having the same inductance and capacity. It is 0.159 divided by the square root of LC, where L is measured in henries and C in farads. That is the usual formula. The impedance of a parallel tuned circuit depends entirely on the frequency. At resonance it is a pure resistance, for frequencies above resonance it is capacitive, and for frequencies below resonance it is inductive. At resonance the resistance is L/RC, henries, ohms, and farads being the units, and the result is in ohms. It will be noticed that the lower the resistance in the circuit, if assumed to be entirely in the coil, the higher is the resistance of the parallel tuned circuit. Also the higher the ratio L/C is the higher the resistance. We want as high resistance as possible in the parallel tuned circuit and therefore the L/C ratio is made large and the resistance in the coil is made small. As an example, let us take the case where the inductance is 240 microhenries, the capacity is 350 mmfd., and the resistance is 10 ohms, then L/RC equals 68,570 ohms. If we assume that the resistance of the coil remains at 10 ohms when the capacity is 50 mmfd., the value of L/RC becomes 480,000 ohms.

* * *

Time Delay in Automatic Volume Controls

WHAT IS the cause of sluggishness in response in a circuit equipped with an automatic volume control? As I tune from one station to another there appears to be a lag in the response which does not appear when the automatic volume control is not used.—S. T. L., Birmingham, Ala.

This effect is due to the filter in the control. It takes an appreciable time for the by-pass condensers to change the charge and it also takes some time for the choke to respond to the changed current. The cure for this trouble is to use less inductance and smaller by-pass condensers. They must not be made too small, however, for then the control will become too quick in response, so quick that the audio frequencies in the signal will be suppressed.

* * *

Eliminating Hiss

IN MY receiver there is a great deal of hiss which is particularly noticeable when adjusting the sensitivity to receive distant stations. It seems that it does not depend entirely on the presence of a carrier, for even between stations it can be heard. It is, however, stronger when a carrier is present. Can you suggest a remedy for this condition?—F.K.J., Wilmington, Del.

Hiss is due to many things and it becomes noticeable when the amplification is very high. As you say, it is stronger when there is a carrier present. It is also stronger in superheterodynes than in t-r-f sets. One reason that short-wave superheterodynes are not in use much is that the hiss is very strong. It seems that wherever there is oscillation the hiss is much stronger than when there is no oscillation. Hence we may assume that one cause is oscillation. Possibly there is a parasitic oscillation in the circuit which is so high in frequency that it does not interfere with reception except by intensifying the hiss. The hiss is usually attributed to irregularity in the emission of electrons from the cathode and to irregularity of conductivity of wires. Perhaps the best way of attacking the problem in a practical way is to eliminate the high audio frequencies, for the hiss is carried by very high audio frequencies. The use of a sharp band pass filter system in the intermediate frequency amplifier has proved effective in this respect. Of course, any sharp tuning will do the same thing, but a band pass filter cuts out the high and unessential audio frequencies mostly responsible for the hiss and leaves the essential frequencies, so that the quality is not noticeably affected. In case the circuit is not of the superheterodyne type the band pass selectivity could be obtained in the radio frequency tuner. However, you undoubtedly wish to eliminate the hiss in the simplest manner possible. Surely you do not want to build a new set. Well, in that case you can cut out the high audio frequencies after the detector by connecting a condenser of suitable capacity across the line (e. g., grid to ground). The usual tone control does just this.

* * *

Padding Oscillators for High Intermediates

IS IT POSSIBLE to pad an oscillator in a superheterodyne regardless of what the intermediate frequency may be? I know that it will work for frequencies up to 400 kc but how about frequencies of the order of 1,500 kc? I should think there would be great difficulty in padding for such high frequencies.—T.H.F., Detroit, Mich.

Theoretically it is possible to pad for any frequency whatsoever, but practically there may be difficulties. It depends on what the signal frequencies to be received are. If the ratio of the intermediate frequency to the lowest signal frequency is less than unity, there is no trouble. In order to have a superheterodyne it is necessary, for practical reasons, that the intermediate frequency should be lower than the lowest signal frequency to which the circuit is to tune. This condition alone imposes that the ratio of the intermediate frequency to the lowest signal frequency be less than unity.

Close Coupling Between Coils

I HAVE seen on the market a short-wave coil assembly comprising four coils placed around a switch. Are not the coils in this unit too closely coupled so that there will be dead spots in the tuner due to absorption in the unused coils when these coils happen to have resonant frequencies equal to the frequency tuned in?—H.L.L., St. Paul, Minn.

The coil assembly to which you refer has been used in many successful short-wave converters, superheterodynes, and tuned radio frequency sets without any trouble. The coupling is comparatively loose between any two adjacent coils.

* * *

Second Harmonic Superheterodyne

WHAT IS the second harmonic superheterodyne and in what way does it differ from the regular superheterodyne? Would this circuit be suitable for use in short-wave receivers?—T.B.R., New York, N. Y.

The second harmonic super differs from the regular super in only one particular, namely, that the second harmonic of the oscillator frequency is used for mixing with the incoming signal instead of the first harmonic. Since this is the case the range of the oscillator covers much lower frequencies than the oscillator in the ordinary superheterodyne. For example, in an ordinary superheterodyne in which the intermediate frequency is 175 kc and the broadcast band is covered, the oscillator runs from 725 to 1,675 kc. If the second harmonic principle were to be used the oscillator would have to cover the range from 362.5 to 837.5 kc. There might be an advantage in using this principle in a short-wave superheterodyne where the circuit would not oscillate at the higher frequency. For example, we might make a circuit oscillate at 20,000 kc but not at 40,000 kc. We could then use the second harmonic of 20,000 kc for receiving signals of the order of 40,000 kc. This scheme is actually used, not only in receivers but in high frequency transmitters.

* * *

Plug-in Coil Connections

In using tube base plug-in coils for a detector and audio stage, battery operation, 15 to 200 meters, if I use coils as follows, what are the connections: UX plug, upper extreme end of secondary to grid pin; other end of secondary to F minus pin; tickler begun near last-named secondary terminal, to plate pin; end of tickler to F plus pin? Top to bottom, what's what? please show diagram.—A. H. G., Saugerties, N. Y.

The connections, in order you give, would be, top to bottom, grid, grid return, B plus and plate. Note that B plus goes to the plate pin. "B plus" here means low end of plate winding. Actual B plus is reached after two other impedances, as shown in Fig. 998. Also see pages 12 and 13.

* * *

Connection of Pick-up Coil in Supers

WHEN two separate leads are provided for the pick-up coil on the oscillator transformer of a superheterodyne does it make any difference which way these leads are connected in the circuit? In other words, does the pick-up coil have polarity that must be observed?—J.B., Butte, Mont.

While the pick-up coil has polarity in respect to the other windings on the oscillator it makes no difference, as a rule, which way the coil is connected in the circuit. Reversing the leads merely reverses the phase of the oscillator voltage impressed on the detector or mixer tube. But since the signal frequency and the oscillator frequency are different the relative phase of the two changes very rapidly and goes through a complete cycle for each cycle of the difference frequency. There may be slight differences between the two connections due to capacity effects, but which is the better, if there is any difference in this respect, can only be found by trial. For practical purposes there is not enough difference to worry about.

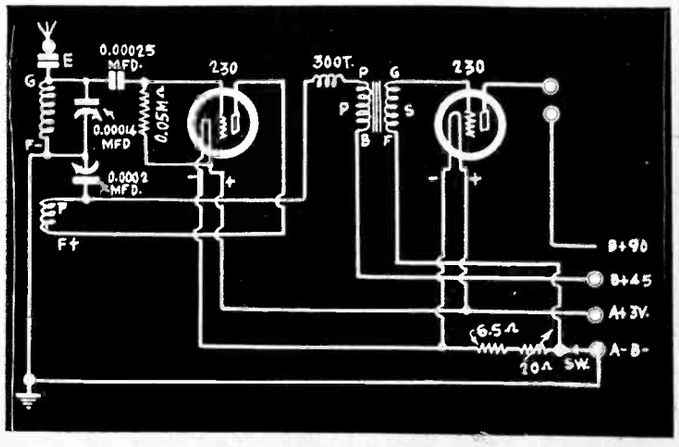

FIG. 998
Circuit of two-tube battery-operated short-wave tuner, 15 to 200 meters, with coil designations marked.

A THOUGHT FOR THE WEEK

CANDIDLY, FOLKS—what do you think of the Myrt and Marge program sponsored by Wrigley over WABC at 7 P. M., EST? How does it strike you as a program of interest and refinement for the average American home?

And what DO you think of Clarence? Let's hear from you!

RADIO WORLD

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Tenth Year

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Will Offer Sets When Television is Practical, Says RCA in Report

James G. Harbord, chairman of the board, and David Sarnoff, president, Radio Corporation of America, in their joint annual report, 1931, said this about television:

"It is believed that television can best be brought into practical application on its own band of radio waves as a service additional to the established system of sound broadcasting.

"Although the development of television is still in the laboratory, marked progress was made in 1931 in its transmission and studio phases. An experimental station was constructed in the tower of the Empire State Building in New York City, from which tests were conducted into the effect on television signals of large buildings and steel frame work in the New York area. Television receiving equipment will be offered to the public when experimentation has demonstrated that a reliable and serviceable system of sight transmission of practical value can be assured.

"While the cost of research has been substantial, sound policy dictates in such a rapidly moving art that the laboratory must be given primary consideration and that no possibility of adapting radio to new utilitarian tasks should be overlooked. Accomplishments of both immediate and potential value identified 1931 as a year of technical progress."

New KHJ Press Agent

Leslie F. Mawhinney is the new publicity director of KHJ, Los Angeles, Calif., succeeding George S. Turner. Mawhinney went to KHJ after four years with the marine news staff of the Los Angeles "Examiner," at San Pedro, California. Prior to joining the "Examiner," he was program director for the now silent KPLA. He began as a seagoing radio operator, later becoming a broadcast engineer, from which post he succeeded to announcing and program work.

Peeking Into Periodicals

Deaf Amateur Now Reads Signals in Neon Lamp

How a neon tube was pressed into merciful service, so that an amateur who had lost his hearing could still carry on communication, was told in the March 19th issue of The N. Y. "Sun," in its weekly radio section. Kenneth Ashley, of Tacoma, Wash., was the amateur. For a while he had to dispense with the pleasure of amateur communication because his haring was gone, but another Tacoma amateur, William Gunston, thought of the neon lamp as registering the pulses optically, and after the method was perfected Ashley was able to participate in two-way communications as in other days. It took some time to get the hang of reading the lamp.

* * *

Voices of Celebrities Appraised; Special Accents Called Drawbacks

Personality as expressed in voice is susceptible to some degree of measurement. In the radio section of the New York "Times," March 20th, a section edited by Orrin E. Dunlap, Jr., is an interview with John Carlile, the Columbia Broadcasting System's production director. Some celebrities are assayed by Mr. Carlile. A condensation of the conclusions follows:

Mrs. Charles A. Lindbergh: one of the best radio voices; pronunciation not tied down to any one locality.

Governor Franklin D. Roosevelt: pleasant, clear, with intense sincerity registered.

Alfred E. Smith: so closely related to his own personality that it would not do for any one by but Mr. Smith.

Mayor James J. Walker: colorful and versatile.

Premier Ramsay MacDonald: full of expression and carrying deep emotion.

President Hoover: typical engineer; uninteresting voice.

Premier Mussolini: a voice that paints his forceful character most thoroughly; utterly self-confident; "the voice of the century."

Lady Astor: because of her career her voice has lost its femininity.

Leopold Stokowski: interesting and compelling, but would not do for an announcer because of foreign accent.

* * *

Continental Stations Use Records Sung in English

A letter from Mark Potter, Leeds, England, throws interesting light on what the Continental European radio programs largely amount to. "As most of the Continental stations make plentiful use of records," he writes in The Friendly Forum, a column conducted by Alice M. Whiteman in "Radio Log and Lore" (Kirkland, Wash.), "you can hear the same dance tunes (generally sung in English) from Norway to Poland and Spain to Jugo-Slavia as you turn the tuning knob, and can hear the announcer say "Nun kommt ein fox trot, 'On a Cold and Frosty Morning.' The poorer we become, the more we spend on radio, for it is the cheapest form of entertainment in hard times." The letter, from which the foregoing is just a brief quotation, is printed in full on page 6 of the March issue of this world-wide-log-map monthly.

New Incorporations

Transcontinental Broadcasting System, New York, N. Y., advertising by radio—Atty., H. Kalman, 42 Broadway, New York, N. Y.

Colin B. Kennedy Corp. of New York, New York, N. Y., radio business.—Atty., H. G. Kosch, 383 Madison Ave., New York, N. Y.

Curtis Energy Radio Corp., New York, N. Y.—Attys., Siegmeister & Rayfield, 26 Court St., Brooklyn, N. Y.

Wapi Broadcasting Co., Wilmington, Del., radio broadcasting.—Attys., Corporation Trust Co., Wilmington, Del.

Maynard J. Columbe, Plattsburg, N. Y., radios.—Attys., Boire & Kehoe, Plattsburg, N. Y.

Cosmic Products Corp., Wilmington, Del., radios, radio supplies.—Attys., Corporation Fiscal Co., Wilmington, Del.

Sheffield Radio Laboratory, Mount Vernon, N. Y., electric communication.—Filer's name not given.

American Broadcasting System, New York City.—Attys., Grossman & Combs, 521 5th Ave., New York, N. Y.

Edison Refrigerator Co., New York, N. Y.—Atty., M. Eldridge, 130 West 42nd St., New York, N. Y.

Warren Commercial Radiator Sales Co., New York, N. Y.—Attys., Bonynge & Barber, 115 Broadway, New York, N. Y.

Fox Electric Supply Co., Syracuse, N. Y.—Attys., Levy, Shullman & Murray, Syracuse, N. Y.

L. & L. Electric Manufacturing Corp., Brooklyn, N. Y., electrical generators.—Atty., S. Rothstein, 51 Chambers St., New York, N. Y.

Pirate Electric Corp., Brooklyn, N. Y.—Atty., A. J. Smith, 217 Greene Ave., Brooklyn, N. Y.

Gruen Electric Co., Atlantic City, N. J., electrical appliances.—Atty., Philip Monheit, Atlantic City, N. J.

Surrender of Authority

Gurney Refrigerator Co., Wisconsin

Designations

Pan-American Broadcasting System, Delaware, 80,000 shares no par.

Changes in Names

Radio Cabinet Corporation of America to Cabinet Corporation of America, New York, N. Y.

Corporation Reports

Acme Wire Company and subsidiaries—Year ended Dec. 31: Net loss after inventory adjustments, depreciation and other charges, $198,797, against $219,380 in 1930.

Steinite Radio Company—Nine months ended June 30, 1931: Net loss after depreciation and other charges, $104,389, compared with deficit of $1,246,377 for year ended Sept. 30, 1930. Company has changed fiscal year to end June 30 instead of Sept. 30.

Weston Electric Instrument Corporation—Year ended Dec. 31: Net profit after depreciation and Federal taxes, $122,264, equivalent, after class A dividends, to 32 cents a share on $164,000 common shares, against $615,075, equivalent, under participating provisions, to $4.08 a share on 37,409 class A shares and $3.08 a share on 150,000 common shares.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

Iver C. Noste, Hardware and General Merchandise, Mound City, So. Dak.
R. F. Jones, 356 Pitt Ave., Sebastopol, Calif.
Philip T. Kremer, Somerton, Ohio
Richard's Service, 242 Pacific St., Brooklyn, N. Y.
George P. Blackburn, Judge Sixth District Court, Paris, Texas
G. C. Wilkinson (replacements and new sets), 304 North 6th Street, Temple, Texas
S. A. Dyer, Ripley, Tenn.
K. Allwyn Lief, 665 W. 160th St., New York, N. Y.
Francis Orcutt, 127 South Ave., Penn Yan, N. Y.
Nick Constantine, 276 Sherman Ave., New York, N. Y.
Russell Johnson (short wave transmitters and receivers) 2919 Whitney Ave., Detroit, Mich.
Cap. Haga, Troutdale, Virginia
J. C. Penn, P. O. Box 185, Greenville, Miss.
Geo. R. Taylor, 1305 E. Market St., Indianapolis, Ind.
C. A. Reed, O. K. Garage, Hosford, Fla.
Marinus, Donze, R. R. 10, Holland, Mich.
A. L. Bartram, c/o Motor Inn, Chilan, Wash.
Ronald Inahuku, 1013 Honolulu Hotel, Honolulu, T. H.
Geo. W. Adams, 1043 Washington Ave., Lorain, Ohio
L. G. Lemon, 46 Pleasant St., S. Manchester, Conn.
Clarence Shirk, 1062 French St., Meadville, Penna.
Hugh W. Anderson, Eyre St., Fort George, Belize, B. H.
Wm. Boone, 818 Grace St., Wilmington, N. C.
J. S. Sausser, 226 North St., Harrisburg, Pa.

STATION SPARKS

By Alice Remsen

Spring

FOR SWIFT'S GARDEN PARTY

(WJZ, Sundays, 3:30 p.m.)

Spring in the meadows!
Spring in the air!
Primroses peeping out everywhere.
Lark soaring high
In the ambient sky;
Green little buds, tender and shy,
Appear on the trees at the river nearby.
Slender young birches
Are bending and swaying,
Gracefully swaying,
To the sweet tune that the breezes are playing.
Spring in the meadow!
Spring in the air!
The youth of the year is everywhere!
—A. R.

* * *

It was on the first day of Spring that I listened to Swift's Garden Party and enjoyed the delightful singing of Dennis King, and the equally delightful piano accompaniment of Josef Bonime. It was a joy not to be missed. For garden lovers, the advice given by the Master Gardener, who is tuned in from Chicago, is very valuable and interesting. This half-hour period is well worth your listening time with its artists like Dennis King, Mario Chamlee and Josef Bonime.

* * *

Sam Lanin, the able Conductor of the Pillsbury Pageant heard at 9:00 p.m. on Fridays over WABC, has a new program over the same station at 10:30 p.m. Sundays. It's called the Eugene International Revue. An excellent fifteen minutes of music and song. Each program features a different country, using its music and a native singer.

* * *

Jack Fulton, Paul Whiteman's crooning Prince of Jazz, recently celebrated his eighth anniversary with the rotund Paul, while Mike Pingitore, considered in many circles the greatest living banjoist, is enjoying his fourteenth year with the noted director this month. Pingitore is a member of the original Whiteman band that made American musical history by being the first to play jazz.

* * *

Charlie Kinney, well known in radio circles through his activities as scout for the Victor Recording Co., is now in business for himself as a personal representative for outstanding radio artists. Charlie is a swell fellow. He's a great judge of material, possesses plenty of initiative without undue aggressiveness, and has a very friendly personality. With his many fine business contacts he should make good in his new field of activity. Here's lots of luck to him.

* * *

Jack Arthur and Jean King may now be heard three times a week over WOR in a new series of programs, sponsored by the McCutcheon Company. The programs will include songs by Jack, piano selections by Jean and a general dialogue between the two. Jean King has a very fine musical background and plenty of stage experience. This is her first introduction to radio. On the other hand, Jack Arthur is very well known to radio audiences, being a daily feature on WOR, playing the part of Johnny Hart in the Big Time sketches on WEAF, and the baritone lead in WOR's "Footlight Echoes," besides various other programs on different stations. Jack also had lots of stage experience before entering radio. These two artists are a good combination. Tune in on them, Mondays, Wednesdays and Fridays at 6:45 p.m. WOR.

* * *

Jack Denny, whose orchestra has been playing at the Mount Royal Hotel in Montreal for the past five years, is now raising his baton in the Empire Room of the Hotel Waldorf-Astoria. His music may be heard through NBC channels. He can be heard over the Columbia airwaves, also, with Belle Baker and Mann Holiner in the Ever-ready program on Sundays at 9:00 p.m.

* * *

Leslie Howard, well known actor of the English and American stages, is now the featured artist of the Yardley program, on WJZ, Sundays at 2:00 p.m. He replaces Beatrice Herford, the international monologist, who had previously been featured on the half-hour since its inception.

* * *

It is quite a treat to watch Max Smolen rehearsing the Bourjois "Evening in Paris" orchestra. He really works and uses his baton so vigorously that he needs no other exercise. Max starts in fully clothed, but after a while he commences to shed. First he'll loosen his tie, then the collar, and then he takes off his coat. He has a beautiful little lock of hair, which insists upon gracefully falling over his forehead in a Napoleonesque manner. This annoys Max very much, and he grasps the offending hair and pushes it behind his ear; to no avail, for down it comes again on the very next beat of the baton. Max thoroughly enjoys his work, and puts his whole heart and soul into it. He knows how to handle his men and gets the very best out of them. The result justifies his hard work, for he has one of the best orchestras of its kind on the air.

* * *

Sidelights

BILLY JONES is a boxing fan . . . MILDRED BAILEY is a sister of Al Rinker, one of Whiteman's original Rhythm Boys . . . JACK FULTON was the captain of his high school basket ball team . . . Illinois is responsible for a great many radio artists: ALICE JOY hails from Streator, ANDY of Amos 'n' Andy and EM of Clara, Lou and Em, are from Peoria, JIMMY MELTON, GENE AND GLENN, FRANK LAFORGE and LEE SIMS all hail from Illinois . . . EDDIE EAST and RALPH DUMKE, the Sisters of the Skillet, are both college graduates. They are not even brothers and don't own a skillet . . . IDA BAILEY ALLEN'S new cook book is selling big. Over 20,000 copies were sold the first month following publication. . . SHERMAN PAXTON LAWTON, M.A. has written a book called Radio Speech. It contains a great deal of valuable information on speaking and writing for the radio . . . RUTH ETTING was signed for the Chesterfield program without giving an audition . . . ERNIE GOLDEN is one of the best golfers in the radio musical field; he is also an expert at billiards . . . FRANK LUTHER recently missed his first broadcast in five years—influenza was the reason . . . ED WHITNEY, who plays Captain Jimmy Norton in "Harbor Lights," is no sailor and never will be; he gets seasick just looking at the steamship ads in newspapers.

Biographical Brevities

ABOUT JUNE PURSELL

June Pursell, who recently signed a long-term contract with the National Broadcasting Company, was born in Indianapolis, and spent her life in Indiana until eight years ago, when she went to Los Angeles for a visit. Instead of returning to Indiana, Miss Pursell suddenly found herself embarked on a radio and a vocal career.

This is how it happened: Miss Pursell had never received a vocal lesson, but always loved to sing. While visiting in Hollywood she sang one night at a club. It was something of a dare. A boy at a nearby table was carrying a ukulele. Miss Pursell borowed it, and then played and sang for two hours and a half. Unknown to the singer, Station KNX was broadcasting the program, and that's how it all started.

As a matter of fact, hundreds of telegrams and telephone calls poured in while Miss Pursell was singing, and officials of Station KNX were so impressed with the voice of the young singer that they urged her to keep on singing and offered her work. This sort of bowled her over, but she was delighted and went right to work, staying with KMX for seven years. In between radio engagements she became popular with Pacific Coast vaudeville audiences. She made a whole year's tour of the Keith-Orpheum Circuit and also sang in pictures.

Miss Pursell won a Pacific Coast radio popularity contest in 1930 and went to Hawaii as a prize winner. She has made many phonograph records and on the Coast has built up an enviable reputation as an unusual ballad singer. Friends urged Miss Pursell to come East. She did so and was engaged by the National Broadcasting Company after her first audition. She is five feet, four inches tall, weighs 125 lbs., and is one of radio's most attractive singers. She has platinum blonde hair and blue eyes. Her mother, Mrs. Della Pursell, came from California to be present at Miss Pursell's debut.

* * *

ANSWERS TO CORRESPONDENTS

LOIS MEILUN, Albany, California: Write to Brentano's, 1 W. 47th St., New York, for information on Rudy Vallee's Autobiography. Yes; some radio announcers give out their photographs. Write to them in care of the studios.

R.C., Rochester, N. Y.: Since answering your inquiry recently about the hookup of "Evening in Paris" have discovered that it is a coast-to-coast broadcast and besides those before mentioned it goes through the following stations also: KLZ, Denver; KDYL, Salt Lake City; WGST, Atlanta; WDSU, New Orleans; KRLD, Dallas; WCCO, Minneapolis; KFJF, Oklahoma City; WLAC, Nashville; KHJ, Los Angeles; KOIN, Portland; KFRC, San Francisco; KOL, Seattle; and KFPY, Spokane. Thirty-five stations in all, including short-wave.

LEONARD C. JOHNSON, Chicago, Ill.: Am sorry I do not know the whereabouts of Mrs. F. H. Meyers, who used to sing over Station WLW under the name of Harriet Wellen, but if she reads this she may get in touch with you through me.

MARY YATES, Brooklyn, N. Y.: The young couple who dance at George Olsen's Montmartre Club are a vaudeville team named Julie Johnson and George Murphy. Yes, they are very clever. You may listen to George Olsen's Orchestra over WABC on Tuesdays, at 11:45 p.m., and Thursdays and Fridays at 11:30.

* * *

(If you care to know something of your favorite radio artists, drop a card to the conductor of this page. Address, Miss Alice Remsen, care RADIO WORLD, *145 W. 45th St., New York City.)*

AMENDMENTS TO RADIO LAW TONED DOWN

Washington.

The Senate Committee on Interstate Commerce amended the bill for alteration of the radio law, so that the prohibition against lotteries will not be so severe as voted by the House, but will conform in general to the provisions of the postal law on the same subject. Also, the House provision that no alien may serve on the board of directors of a corporation under penalty of forfeiture of any radio license held by the corporation was toned down.

The bill passed by the House was found to be too drastic, and even Senator White, of Maine, opposed one of the provisions, regarding alien directors, although he had introduced in the Senate the exact duplicate of the House bill, and believed the Federal Radio Commission was behind the entirety.

20% of Directors May Be Aliens

At present not more than 20 per cent. of the stockholders of a radio-licensed corporation may be aliens, and the Senate committee amended the bill to make the same 20 per cent. allowance in favor of alien directors.

A few aliens are directors of the International Telephone & Telegraph Corporation, and if the bill were enacted as originally intended, this company would be ruled out of the communication field in which its only competitor is the Radio Corporation of America's subsidiaries. Hence it was claimed the change had to be made to prevent a monopoly.

The rewritten provision of the bill regarding lotteries states that no person may broadcast from any station for which a license is required by any Federal law any information concerning any lottery, gift enterprise or similar scheme, offering prizes dependent wholly or in part on luck, lot or chance. Penalties are provided for violations.

Bill Ordered Approved as Amended

The bill as amended in these two particulars, and in some minor matters, was ordered approved by the Senate Committee, and will be reported to the Senate for a vote. Then the bill will have to go back to the House.

Wholesale Radio Moves; New Facilities Unique

Wholesale Radio Service Company, for several years at 38 Vesey Street, has moved to much larger quarters at 100 Sixth Avenue, New York City, now occupying two floors, total 45,000 square feet. This is the fourth move to larger quarters made by this long-established company.

At present there are 125 persons on the payroll, the volume of business is larger than ever, and the new facilities are great enough to take care of a considerable increase. Besides the usual facilities for carrying stock, shipping and administration, there are demonstration booths, a separate loudspeaker comparison room and an auditorium with stage and screen so that sixty persons can be given an illustrated lecture. Instructions to service men and others on their problems will be given in the auditorium.

A "continuous radio show" is to be instituted, whereby manufacturers' latest products will be on exhibition.

Brown Confirmed As Board Member

Washington.

Thad H. Brown, of Ohio, recently general counsel of the Federal Radio Commission, and four years ago one of Herbert Hoover's campaign managers, was confirmed by the Senate to be a member of the Federal Radio Commission, succeeding Ira Robinson, resigned.

Only one Senator spoke against the confirmation of President Hoover's appointee. Senator Couzens (Rep.), of Michigan, former Mayor of Detroit, and who made a great fortune out of ownership of Ford stock, questioned whether Mr. Brown would be a fit member of the Commission, because of his political activities. Senator Couzens raised no objection on the ground of Mr. Brown's general fitness, but he feared that political influence might persuade him on matters that came before the Commission for decision.

Other Senators spoke in Mr. Brown's behalf. Senator Dill (Dem.), of the State of Washington, said that important organization changes had been effected by Mr. Brown since his appointment as general counsel of the Commission.

The confirmation of Mr. Brown makes the Commission membership complete. There are five members, one for each of the zones created under the radio law.

FEUD RENEWED BY WMCA-WNYC

Washington.

WNYC, the municipal sation in New York City, which has been at loggerheads with WMCA, which operates on the same frequency, 570 kc, has been recommended for extension of allotted time on the air, from the present 24 to a prospective 84 hours a week. After a hearing Ellis A. Yost, Commissioner examiner, made the recommendation.

Paul D. P. Spearman, appearing for WMCA and also for WPCH, objected to the recommendation.

"The examiner erred," said Mr. Spearman, "in his failure to find that the responsible head of WNYC has no particular training or qualification that would fit him to control and direct the activities of a radio broadcasting station."

The "responsible head" is the Commissioner of Plant and Structures, Albert Goldman.

Mr. Spearman wants the full Commission to hold a hearing on the case.

WPCH, 810 kc, another New York station, is owned by WMCA. It was suggested by WMCA that WNYC be assigned to 810 kc and that WPCH share time with WMCA on 570 kc.

Counsel for New York City asked full time on 570 kc for WNYC.

KOLSTER ADDS 100 EMPLOYEES

Production of Kolster International radio receiving sets has been speeded up. More than 100 employees have been added to the force at 360 Thomas Street, Newark, N. J.

Dr. Frederick Kolster is cooperating with C. E. Brigham, chief engineer of Kolster Radio, Inc., and with L. M. Clement, lately of the Westinghouse Electric and Manufacturing Company's radio engineering department, and now chief engineer of the radio department of the International Communications Laboratories in the engineering.

VISION PERMIT DENIED WMCA; HOGAN UPHELD

Washington.

The Baird Television Corporation, of England, which has offices in this country at 145 West Forty-fifth Street, New York City, was refused permission to operate a television transmitter in conjunction with WMCA, New York City, on the ground that it is a foreign corporation and that the real reason for seeking the license was to commercialize the Baird system, rather than conduct a program of research on an experimental basis.

The Federal Radio Commission, in refusing to make the grant to the applicant, the Knickerbocker Broadcasting Company, New York, overrode the recommendations of Ralph L. Walker, examiner, who held the hearing on behalf of the Commission.

Opposed by Radio Pictures

The refusal to issue the permit was due largely to the opposition voiced by Radio Pictures, Inc., New York, which operates a television station of which John V. L. Hogan is the guiding genius. Radio Pictures claimed that granting the construction permit, which is the certificate preliminary to a license, would not be in the public interest.

The Commission pointed out that granting the application would constitute a violation of section 12 of the Radio Act of 1927, as all members of the Board of Directors, and the controlling voters among the stockholders, were aliens.

The Baird Corporation in reality would be the operator, and not the Knickerbocker Corporation that owns WMCA, the Board held.

Gave Good Demonstration

The Baird system is the one invented by John Logie Baird, of England, who is not to be confused with Hollis Baird, the American television expert, who is chief engineer of the Shortwave and Television Corporation, Boston.

John Logie Baird's system was first demonstrated in this country several years ago and results were among the best ever produced here.

180-Line Pictures Favored by Peck

William Hoyt Peck, optical expert, announced that he is experimenting with 180-line images, projected at the rate of 24 frames per second.

Mr. Peck says that images of a size greater than home movies can be obtained when the transmitters triple the number of lines now generally used. This will be equivalent to giving nine times as much detail.

The system which Mr. Peck is demonstrating utilizes a novel method of scanning, in which corrected reflecting lenses transmit the light from the crater tube to the screen. A new process is used in making the lenses, so that they may be produced as nearly optically perfect as those used in the finest cameras or telescopes, though costing little to manufacture. The lens itself is of a new design.

They have worked out so well in television scanning that Mr. Peck plans to produce them for photographical and astronomical work as well.

A-C SET PATENT FOUND INVALID; "NO INVENTION"

Philadelphia.

A decision dismissing the complaint of the Dubilier Condenser Corporation and others against Radio Corporation of America, for infringement of the Lowell and Dunmore patents concerning the use of rectified alternating current for direct current potentials in a receiver, was announced by the United States Circuit Court of Appeals for the Third District. The court heard an appeal from the District Court, where the plaintiff had won, but unanimously upset the decision of the lower court and declared the patent claims invalid.

The finding was that there had been no patent at all, even though a paper purporting to be a patent had been issued by the Patent Office, for Lowell and Dunmore, the court found, had done no more than to combine into a unit receiver methods and principles that had been well known.

All Well Known To Prior Art

A leading claim of the so-called patent dealt with the tapping of the a-c main in the usual manner, with accompanying rectifier, filter and other circuits to enable energizing of the receiver with direct current, replacing batteries. The system was applied to a three-section type receiver, comprising radio frequency amplifier, detector and audio frequency amplifier.

Judge Wooley wrote the opinion in which the court held that the r-f amplifier, detector and a-f amplifier systems were all well known to the art prior to the issue of the so-called patent, even unto the special claim of patentability of the process of eliminating hum when a-c was used for set operation. The invention, according to the Dubilier Corporation, consisted of the means of hum elimination when a-c was substituted for d-c as the source.

No Invention, Court Holds

Hum-elimination by this means, the court stated, was admittedly old, and Lowell and Dunmore "simply used it as Heising had taught them by his patent in 1916 in the light of the White patent of the same year."

The only thing new, said the court, was the separate connection of an old hum eliminator with old type tubes in an old-type receiving set of the three-section type, and even the value of this new or separate connection was reduced by the fact that such a hum eliminator had been used in radio frequency stages long before.

Then the court held there had been no invention in simply piecing together the methods previously known and that the patentees applied "in a natural and orderly way the prior knowledge of the art, without making an inventive advance."

Another point concerned the application of a positive potential to the plate, and at the same time a negative potential to the grid for negative bias of audio tubes. The court found that Dunmore was not the first to use such a system. Again, it was found that no invention had been made by Dunmore.

TELEVISION COMPANY LICENSED

Canadian Television, Ltd., Montreal, Canada, has been licensed under the patent applications of the Jenkins Television Corporation of Passaic, N. J.

Republican Convention to Have 12 Microphones, Record for Single Event

Washington.

Technical arrangements for broadcasting the Republican National Convention in Chicago in June have been completed at conferences between representatives of Republican National Committee and the National Broadcasting Company.

Radio facilities will be vastly improved this year as compared with the facilities used in the convention at Kansas City four years ago. Parabolic microphones, recently introduced into radio, will enable engineers to pick up voices of speakers seated among the various delegations. These microphones are directional, and as soon as a speaker arises among the delegations, the microphone will be turned on him. These microphones also will be used for crowd noises.

Announcers and others who will report the convention for radio will have places in special booths behind and above the speakers' platform. These booths command a view of the stage and the entire Chicago arena. In addition, sound-proof booths will be erected directly below the speakers' platform. These will be used for speakers addressing the radio audience only. Twelve separate microphones, the greatest number ever used in a single broadcast, will be utilied.

AUTO-SENDER NEW INVENTION

Paris.

Jacques Detruiseux demonstrated an automatic radio transmitter to representatives of several departments of the French Government. The new device is so arranged that it can be operated either automatically or by any person able to read. A trained wireless operator is therefore not necessary.

The apparatus is operated by means of dials on which the alphabet and various radio signals are printed. To transmit, the operator, whether human or mechanical, turns a dial so that the index is opposite the letter of the alphabet or the radio signal to be transmitted, and the desired signal is sent out. Therefore any one who is able to read the letters and signals printed on the dial is able to spell out any message required. By a prearranged sequence of turning the dial a machine can do the same thing.

The transmitter is so small that it can be installed in places where ordinary transmitters cannot be used advantageously. It may, for example, be mounted in life boats where it may be operated by any one in the boat. It can also be installed on a ship and started when it is necessary to abandon that ship. The automatic sending feature will obviate leaving a radio operator on the ship to the last minute, as once the device has been started it will continue to send out distress signals until the boat goes under. Again, it may be installed in airplanes where it can be operated by any one whether he be trained in radio transmission or not. This will prove a boon to many aviators who are forced down at sea or in desolate places on land.

Stations by Frequencies

Frequency list, broadcasting stations, call, owner, location, power, wavelength. United States, Canada, Cuba, Mexico and Newfoundland. In March 26th issue RADIO WORLD. *Send* 15c for a copy to RADIO WORLD, 145 West 45th Street, New York, N. Y.—Advt.

MICROPHONES STUDIED FOR USE IN SENATE

Washington.

Radio engineers and representatives of broadcasting companies have told the Senate Committee on Rules that it is quite practical to broadcast the proceedings on the Senate floor throughout the United States. They had conducted tests in the Senate chamber on the feasibility of installing microphones and presented a number of plans. One plan proposes that each Senator be provided with a lapel microphone, with a 30-foot cord to enable him to move about in a circle of 60-feet diameter while addressing the Senate. Objection was raised to this method on the ground that it would hamper the speakers' freedom thus to be tothered.

Another plan was to install several electrodynamic microphones near Senators' desks. These would be portable and could be installed in a short time when an important debate was to be broadcast.

Tests Conducted

Still another plan proposed the suspension of not less than thirteen microphones from the ceiling, to be arranged so that they could be raised and lowered as occasion demanded. A fourth plan proposed the installation of an equal number of microphones near central desks. A fifth plan proposes a system of directional microphones installed in the walls and concealed from view. And a sixth plan suggested a combination of the elements of the other plans.

Representatives of both the National Broadcasting Company and the Columbia System had conducted tests and made suggestions. It was brought out that the acoustic properties of the Senate chamber were very poor and that they would have to be improved to make broadcasting of the proceedings successful.

The new ventilating system also made too much noise and that would have to be remedied.

The cost of the installation was estimated in various sums from $7,500 to $30,000, depending on the plan adopted and the treatment of the acoustic and noise problems.

Representatives of both broadcasting systems offered to broadcast the proceedings without charge, provided the Government paid for the installation of the necessary equipment.

One committee problem was to decide what to broadcast. Senator Howell, of Nebraska, proposed that proceedings be broadcast every day from 1 p.m. until the Senate adjourned for the day. This, he explained, would take in all speeches and debates.

Station Changes

Changes in the list of stations by frequencies, made since the publication of the list in last week's issue (March 26th) follow:

630 kc, WOS, Jefferson City, Mo. Change owner to Missouri State Marketing Bureau.

1010 kc, KGGF, new location, Coffeyville, Kans. (Instead of South Coffeyville, Okla.)

1120 kc, KRKD, new location, Los Angeles, Calif. (Instead of Inglewood, Calif.)

1360 kc, WCSC, Charlotte, N. C. Change ownership to South Carolina B'dc'g Co., Inc.

1420 kc, KGKX, Sandpoint, Idaho. Change owner to Sandpoint B'dc'g Co.

NEW LISTS OF SET AND TUBE RCA LICENSEES

A revised list of the licensed radio set manufacturers, and also the first complete list of licensed tube manufacturers, have been issued by the Radio Corporation of America as follows:

RECEIVING SET LICENSEES

All American Mohawk Corp., 4201 Belmont Ave., Chicago, Ill. (Chicago Off.). Mr. E. Farny, President—Rudolph Wurlitzer Mfg. Co., No. Tonawanda, N. Y. (Factory).

F. A. D. Andrea, Inc., 24 Orchard St., Long Island City N. Y. Mr. F. A D. Andrea, President.

Atwater Kent Mfg. Co., 4700 Wissahickon Ave., Philadelphia, Pa. Mr. A. Atwater Kent, President.

Audiola Radio Co., 430 So. Green Street, Chicago, Illinois. Mr. M. Frankel, President.

Balkeit Radio Company, North Chicago, Illinois. Mr. I. J. Mendels, General Manager.

Bremer Tully Mfg. Co., Brunswick Radio Corp., 120 W. 42nd St., N. Y. City. Mr. R. W. Jackson, Vice-President.

Colonial Radio Corporation, 254 Rano Street Buffalo, N. Y. Mr. W. S. Symington, President.

Crosley Radio Corporation, The, Cincinnati, Ohio. Mr. Powell Crosley, Jr., President.

Freed Television and Radio Corporation, 22-19 Wilbur Ave., Long Island City, N. Y. Mr. Arthur Freed, President.

Gilfillan Bros., Inc., 1815 Venice Blvd, Los Angeles, Calif. Mr. S. W. Gilfillan, President.

A. H. Grebe & Co., Inc., 70-72 Van Wyck Blvd., Richmond Hill, N. Y. Mr. A. H. Grebe, President.

Grigsby-Grunow Company, 5801 Dickens Avenue, Chicago, Illinois. Mr. B. J. Grigsby, President.

Gulbransen Company, 816 N. Kedzie Avenue, Chicago, Illinois. Mr. G. M. Gardner, Vice-President.

Howard Radio Company, South Haven, Michigan. Mr. T. J. Sullivan, President.

Colin B. Kennedy Corporation, 212 W. Ewing Street, South Bend, Indiana. Mr. Colin B. Kennedy, President.

Kolster Radio, Inc., 200 Mt. Pleasant Avenue, Newark, N. J. Mr. Franklin Hutchinson, President.

Lang Radio Corporation, 767 E. 132nd Street, New York, N. Y. Mr. F. W. Lang, President.

Ozarka, Inc., 1257 Fullerton Avenue, Chicago, Illinois. Mr. J. Natheson Bell, President.

Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa. Mr. J. M. Skinner, President.

Pierce-Airo, Inc., 510-518 Sixth Avenue, New York, N. Y. Mr. David Wald, President.

Pilot Radio & Tube Corp., Lawrence, Mass. Mr. I. Goldberg, President.

Radio Products Corporation, 3900 No. Claremont Avenue, Chicago, Ill. Mr. Frank A. Urwan, President.

Silver-Marshall, Inc., 6401-6451 W. 65th Street, Chicago, Illinois. Mr. McMurdo Silver, President.

The Simplex Radio Company, Sandusky, Ohio. Mr. H. Maibohm, President.

Sparks-Withington Company, Jackson, Michigan. Capt. Wm. Sparks, President.

Steinite Radio Company, 8440 So. Chicago Avenue, Chicago, Illinois. Mr. Lester Abelson, Vice-President.

Stewart-Warner Corporation, 1826 Diversey Pkway., Chicago, Illinois. Mr. C. B. Smith, President.

Story & Clark Radio Corp., 173-75 No. Michigan Avenue, Chicago, Illinois. Mr. F. F. Story, President.

Stromberg-Carlson Tel. Mfg. Co., 100 Carlson Road, Rochester, N. Y. Mr. W. Roy McCanne, President.

Transformer Corp. of America, 2309 So. Keeler Avenue, Chicago, Illinois. Mr. Ross Siragusa, President.

Trav-ler Radio & Television Corporation, 1818 Washington Avenue., St. Louis, Mo. Mr. H. J. Wrape, President.

United Air Cleaner Corp., 9705 Cottage Grove Avenue, Chicago, Illinois. Mr. J. T. Beatty, President.

United American Bosch Corporation, 3664 Main Street, Springfield, Mass. Mr. A. T. Murray, President.

United States Radio & Television Corp., 333 No. Michigan Avenue, Chicago, Illinois. 3301 So. Adams Street, Marion, Indiana (Factory). Mr. J. Clarke Coit, President.

Ware Manufacturing Corp., 480 Lexington Avenue, New York City. Mr. Paul Ware, President.

Zenith Radio Corporation, 3620 Iron Street, Chicago, Illinois. Mr. E. F. McDonald, President.

TUBE LICENSEES

Allan Mfg. & Electrical Corporation, Lawrence, Mass. Mr. I. Goldberg, President.

Arcturus Radio Tube Co., 720 Frelinghuysen Avenue, Newark, N. J. Mr. C. H. Braselton, President.

Cable Radio Tube Corporation, 84-90 N. 9th Street, Brooklyn, N. Y. Mr. J. J. Steinharter, President.

CeCo Manufacturing Co., Inc., 1200 Eddy Street, Providence, R. I. Mr. Ernest Kauer, President.

Century Lamp & Tube Co. (formerly Matchless Electric Co.), 1500 No. Ogden Avenue, Chicago, Illinois. Mr. A. Mecklenburger, Secretary.

Champion Radio Works, Inc., Danvers, Mass. Mr. F. W. Marsh, President.

DeForest Radio Company, Manhattan Avenue & Factory Street, Passaic, N. J. Mr. L. S. Gordon, President.

Diamond Vacuum Products Co., 4049 Diversey Avenue, Chicago, Illinois. Mr. N. R. Armstrong, President.

Duovac Radio Tube Corporation, 380 Furman Street, Brooklyn, New York. Mr. Nathan Goldman, President.

Gold Seal Mfg. Co., Inc., 5 Central Avenue, East Newark, N. J., Mr. W. E. Duff, President.

Hygrade-Sylvania Corporation, Salem Mass., and Emporium, Pa. Mr. B. G. Erskine, President, at Emporium, and Mr. E. J. Poor, General Mgr., at Salem, Mass.

Johnsonburg Radio Corporation, Johnsonburg, Pa. Mr. J. D. Lindsay, President.

Ken-Rad Corporation, The, Owensboro, Kentucky. Mr. Roy Burlew, Vice-President.

National Union Radio Corporation, 400 Madison Avenue, New York, N. Y. Mr. S. Muldowney.

Raytheon Production Corporation, Newton, Mass. Mr. L. K. Marshall, President.

Republic Radio Tube, Inc., 76 Coit Street, Irvington, N. J. Mr. W. S. Tait, President.

F. A. Schiller, Inc., 500 Chancellor Avenue, Irvington, N. J. Mr. F. A. Schiller, President.

Triad Manufacturing Co., Inc., Pawtucket, R. I. Mr. George Coby, President.

Tung-Sol Radio Tubes, Inc., 95 Eighth Avenue, Newark, N. J. Mr. H. W. Harper, President

Tradiograms

By J. Murray Barron

Alfred A. Gherardi announces the removal of the Radio Technical Company to 80 Fifth Ave., N. Y. City.

* * *

Hammarlund Mfg. Co., 424 West 33rd St., N. Y. City, has developed a new Isolantite socket made in two types, subpanel and base mounting. There is also the Hammarlund Isolantite coil form. The combination makes an excellent one for short-wave work.

* * *

J. M. Kuhlik, sales manager of Miles Reproducer Co., 26 East 22nd St., N. Y. City, has some new display literature for the dealer. Bulletins E, K and L give complete listing of microphones, amplifiers, intercommunicating systems, mike stands and public address systems.

* * *

Radio Training Schools, Inc., are now located at 799 Boylston St., Boston, Mass.

* * *

Thor's Radio Basement Store, 167 Greenwich St., N. Y. City., is doing good business. Besides an upstairs store with two attractive window displays there is the meeting-place downstairs, where the experimenter and service man may hunt around the display stands and find practically anything and everything in radio parts.

* * *

S. S. White Dental Mfg. Co., Industrial Division, 152 W 42nd St., N. Y. City, has a complete line of moulded resistors for the manufacturer. There is some literature, but strictly for manufacturers. The company also manufactures flexible cable and remote control in radio.

* * *

Hari-Mac Radio Stores, Inc., have moved to 1109 Sixth Ave., N. Y. City. The new place is more than twice as large, hence a larger stock with greater variety will be carried. Messrs. Harry Schmerling and R. P. Macklin are the proprietors.

RCA PREFERRED DIVIDEND

At the meeting of the Board of Directors of the Radio Corporation of America the regular quarterly dividend of 1¾% (87½c per share) was declared on the "A" preferred stock. The dividend is payable on April 15th, 1932, to holders of record April 1st.

INDEPENDENTS DEMAND TRIAL OF TRUST CASE

Washington.

In answering the Senate, that passed a resolution requesting information on the status of the monopoly suit filed against Radio Corporation of America and associates in 1928, Attorney General Mitchell imparted some information that had not been made public before. In the statements issued by the Government and RCA the fact that certain concessions were being made was revealed, but the Attorney General shed new light on the reduction of royalties, known to the trade but not to the general public.

These reductions were as follows:

The previous minimum annual royalty charged to licensed set manufacturers, amounting to $100,000, was reduced to $10,000, and the percentage of royalty reduced from 7½ to 5. The same new terms apply to tube licensees. Royalty on export manufacture has been reduced.

Some foreign exclusive traffic contracts have been made less stringent. Dissolution of the inter-relation of ownership between General Motors Corporation and RCA is in progress, as has been known, and other changes are to be made, including the possible institution of an open patent pool, but, said Mr. Mitchell, some independents that now have patent suits against the RCA and associates are opposed to the entry of a consent decree and termination of the case, and insist the Government's case proceed to trial and judgment.

He commended the defendants for a cooperative spirit toward the Government.

Pentode Adapter

A small-sized adapter in its familiar mould is marketed by Alden Manufacturing Company, 715-RW Center Street, Brockton, Mass., for utilizing a 247 tube in place of a 245. The adapter is inserted in the tube socket and the tube in the adapter. In push-pull two adapters are to be used, one in each output socket. The adapter has a UX base and provides at top a UY socket for the 247 tube.

TRIPLE-PURPOSE TUBE

Arcturus announces the Wunderlich tube for full-wave grid detection, automatic volume control, and a stage of audio-frequency amplification without adding to the cost of radio receiver, nor requiring major mechanical changes.

It is claimed that the tube has four times the detector power output of the triode.

SUNDRY SUGGESTIONS FOR WEEK COMMENCING APRIL 3, 1932

April	3:	Footlight Echoes.....WOR	10:30 p.m.
April	4:	Evening in Paris.....WABC	9:30 p.m.
April	5:	True Story Hour.....WEAF	8:30 p.m.
April	6:	Big Time.....WEAF	8:00 p.m.
April	7:	Golden Blossoms.....WJZ	8:30 p.m.
April	8:	Jack and Jean.....WOR	6:45 p.m.
April	9:	Little Symphony.....WOR	8:00 p.m.

BLUEPRINTS OF STAR CIRCUITS

8-TUBE AUTO SET

Sensitivity of 10 microvolts per meter characterizes the 8-tube auto receiver designed by J. E. Anderson, technical editor of Radio World, and therefore stations come in with only six feet of wire for aerial, and without ground. Most cars will afford greater aerial pickup, and besides the car chassis will be used as ground, so with this receiver you will get *results*. The blueprint for construction of this set covers all details, including directions for cars with negative A or positive A grounded. The circuit features are: (1) high sensitivity; (2), tunes through powerful locals and gets DX stations, 10 kc either side; (3), latest tubes, two 239 pentode r-f, two 236 screen grid, two 237 and two 238; push-pull pentodes, all of 6-volt automotive series; (4), remote tuning and volume control on steering post, plus automatic volume control due to low screen voltage on first detector; (5), running board aerial. The best car set we've published. This circuit was selected as the most highly prized after tests made on several and is an outstanding design by a recognized authority. Send for Blueprint 631, @ 50c

SHORT-WAVE CONVERTER

If you want to build a short-wave converter that costs only a very few dollars, yet gives good results, furnishing all its own power from 110 volts a-c, and uses no plug-in coils, you can do so from Blueprint 630. Price.....25c

5-TUBE AC, T-R-F

Five-tube a-c receivers, using variable mu r-f, power detector, pentode output and 280 rectifier, are not all alike by any means. Forty circuits were carefully tested and one selected as far superior to the others. This prized circuit was the 627, and if you built it, you will always be glad you followed our authentic Blueprint, No. 627. This is the best 5-tube a-c t-r-f broadcast circuit we have ever published. Price 25c

A-C ALL-WAVE SET

An all-wave set is admittedly what many persons want, and we have a circuit that gives excellent broadcast results, and is pretty good (not great) on short waves. No plug-in coils used. Cost of parts is low. Send for Blueprint, No. 628-B, @.....25c.

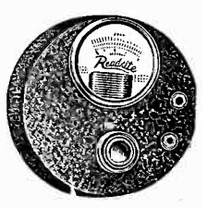
In preparation, an 8-tube broadcast superheterodyne for 110v d-c. Write for particulars.

RADIO WORLD, 145 West 45th Street, New York, N. Y.

THREE-IN-ONE TESTER *FREE!*

EVERYBODY who does any radio work whatsoever, whether for fun or for pay or for both, needs a continuity tester, so he can discover opens or shorts when testing.

A mere continuity tester is all right, but—



Often it is desired to determine the resistance value of a unit, to determine if it is correct, or to measure a low voltage, and then a continuity tester that is also a direct-reading ohmmeter and a DC voltmeter comes in triply handy.

So here is the combination of all three:

A 0-4½-volt DC voltmeter, a 0-10,000-ohm ohmmeter and a continuity tester. A rheostat is built in for correct zero resistance adjustment or maximum voltage adjustment. The unit contains a three-cell flashlight battery. Supplied with two 5-foot-long wire leads with tip plugs. Case is 4-inch diameter baked enamel. Weight, 1 lb Sent you with an order for one year's subscription for RADIO WORLD (52 weeks) at the regular rate of $6. Order Cat. PR-500. Use Coupon below.

Radio World, 145 W. 45th Street, New York, N. Y

Enclosed please find $6 for one year's subscription for Radio World (one copy a week, 52 issues). Send Cat. PR-500 as premium.

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- ☐ $3 for six months, 26 issues.
- ☐ $1.50 for three months, 13 issues.

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SOLDERING IRON F R E E !

Works on 110-120 volts, AC or DC; power, 50 watts. A serviceable iron, with copper tip, 5 ft. cable and male plug. Send $1.50 for 13 weeks' subscription for Radio World and get these free! Please state if you are renewing existing subscription.

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145 West 45th St. N. Y. City

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TRANSFORMERS, (Radio Power) rewound; specials made. Supreme Radio Laboratory, Dept. W, 16 Fulton Ave., Rochester, N. Y.

RADIO TUBE RACK with aluminum brackets, holds 14 tubes, $1.50. Rack for 8 tubes, $1.00. Pioneer Radio Laboratories, Port Jervis, N. Y.

MIDGET RECEIVER, A. C., complete, $13.95. Send for literature. Autocrat Radio Co., 3855 N. Hamilton Ave., Chicago, Ill.

"AMATEUR MOVIE CRAFT," by James R. Cameron. A book dealing with the making and showing of 16 m/m pictures and equipment necessary for same. Paper cover, $1.00; Cloth, $1.50. Radio World, 145 W. 45th St., New York, N. Y.

EBY antenna-ground binding post assembly for all circuits. Ground post automatically grounded on sets using metal chasses. Assemblies, 30c. each. Guaranty Radio Goods Co., 143 West 45th St., New York, N. Y.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

THE FORD MODEL—"A" Car and Model "AA" Truck — Construction, Operation and Repair — Revised New Edition. Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

"THE MODERN GASOLINE AUTOMOBILE," by Victor W. Page, M.S.A.E. New Revised and Up-to-date Edition. A whole library of information now complete in one large octavo volume of 1,146 (6 x 9) pages—1,000 engravings. Bound in flexible scarlet fabrikoid. Price $5.00. Radio World, 145 W. 45th St., New York, N. Y.

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using 11 super Akra-Ohm Resistors and a Weston A.C. and D.C. Type 301 Universal Meter—will do the job of 22 separate meters.

Send now for Bulletin 150-G which contains a complete diagram of this circuit and full information on its construction.

Actual working drawing and construction diagrams supplied with the Type 600 Resistor Kit.

Shallcross Mfg. Company
ELECTRICAL SPECIALTIES
700 PARKER AVENUE
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BRACH RELAY—List price $4.50; our price 99c. Guaranty Radio Goods Co., 143 W. 45th St., N. Y. C.

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Our large staff of expert instructors are at your service. You get many benefits. Among them, our quarter century radio experience, our association with radio's largest research laboratory, our cooperation with NBC and CBS, and many large radio manufacturers. Yet tuition here is no higher than ordinary schools.

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While others grumble, you can be working for the future! So don't put off getting the facts for another day! Mail the coupon below for our latest general catalog and complete information. Be sure and check the branch of radio you like best, so we can give you special details on it.

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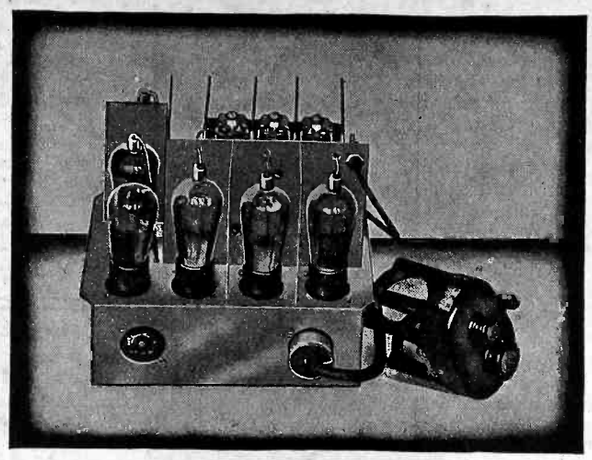
Anderson's Auto Set, No. 631

In an automobile set what you need and must have is **SENSITIVITY.** You read about high-powered home receivers having a sensitivity of 10 microvolts per meter. Here is an 8-tube auto set, chassis 7 x 11½ x 2¾ inches, that has just such sensitivity. It brings in DX through 50,000 watt locals 10 kc. removed. Did you ever hear of that before in an auto set? Volume is high, without distortion. Push-pull pentode output. This circuit was designed and engineered by J. E. Anderson and is by far the best auto set we've ever heard. Variable mu, pentode r-f tubes.

Complete kit of parts, including remote tuning control, running board aerial, speaker, battery box, everything but tubes which are: two 236, two 237, two 238 and two 239 (automotive 6-volt series). Order Cat. JE-631 @.....$50.00

Set of tubes for car receiver (Cat. 630-TUK), @.....$11.80



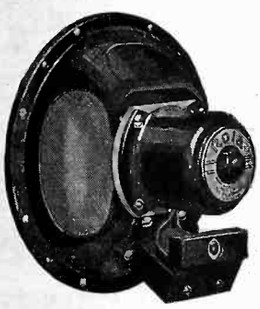
INTERMEDIATE FREQUENCY TRANSFORMERS

FOR short wave superheterodyne work 1,600 kc. is the popular intermediate frequency, because you can tune to below 9 meters without interlocking of modulator and oscillator circuits, due to the high intermediate frequency. Our 1,600 kc. shielded transformers have large diameter wire, loose coupling for selectivity and stability, and Hammarlund's new superheterodyne condensers built in, accessible to a screwdriver. Both plate and grid circuits are tuned. Shield is 2½ inch diameter, 2⅞ inches high. For variable mu tubes. Order Cat. FF-1600 @.....$1.65

Doubly tuned fixed-frequency transformer, 1 to 1 ratio, 175 kilocycles. Band pass filter characteristic. Hammarlund 20-100 mfd. equalizers across primary and secondary accessible. Aluminum shield (must be grounded) 2¼ inches diameter, 2½ inches high, removable bottom. For variable mu tubes. Order Cat. FF-175 @.....$1.50

Same as directly above, for 400 kc. Order Cat. FF-400 @.....$1.50

ROLA DYNAMIC SPEAKERS



Series F, Rola dynamic speakers for single pentode output, with 1,800 ohm field coil tapped at 300 ohms. Field coil may be used as B supply choke, with 300 ohm section for 247 bias, if field is put in negative rectifier leg. Output transformer built in. 7" cone. Cat. RO-18 @ $4.50

Same as above, except that cone diameter is 10.5 inches. Cat. RO-18-10 @ $5.85

Same as above, except that cone diameter is 12 inches. Cat. RO-18-12 @ $6.95

Magnavox dynamic 6-inch cone for automobile sets, 6 volt field to be connected to car's storage battery. Speaker fits on fireboard under the instrument board. Shielded cable is supplied with each speaker. Cat. MG-AU @.....$4.95

BROADCAST COILS WITH 80-METER TAP

The shielded 80-550 meter coils have a side lug (shown at left) and four identified lugs at bottom. The side lug is for grid return. The ground symbol lug is the 80-meter tap. P and B go to antenna and ground or plate and B plus. For oscillation B goes to plate and P to B plus.

TAPPED coils are proving very popular, as they make for economy of room and also afford good results. The Roland coils are obtainable for broadcast coverage, 200 to 550 meters, with tap for going down to 80 meters, so television, airplane talks, amateur and other interesting transmission may be heard. An insulated three-deck two-tap long switch is needed for front panel band shifting. See illustration at right. These coils are wound on 1⅛ inch diameter and are attached at the factory to aluminum screw bases, with four identified lugs protruding at bottom and a fifth lug at side. An aluminum cover (not illustrated) screws over the base.

The primary is wound over the secondary, with insulating fabric between, and the inductance is kept exactly equal for all coils by keeping the axial length of the winding identical, as well as the number of turns. Therefore at top (what looks like a separate winding), a space is "spun," as well as at bottom, to insure such identical inductance.

For 80-550 meters, for use with 0.00035 mfd. three gang, order Cat. M-35-C (three coils, three shields at this price) @ $2.45

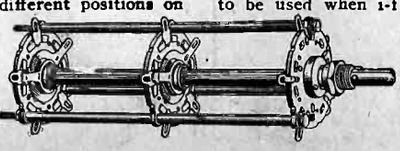
For 0.0005 mfd. order Cat. M-05-C @ $2.45

175 kc tuning unit: 3-gang condenser, trimmers, r-f and modulator coil, and special oscillator coil with 700-1000 mmfd. padding condenser and 0.6 mmfd. grid-to-grid coupling condenser. Padding directions supplied, (Cat. 175-TU) @ $6.03

LONG SWITCHES

Three decks, four different positions on each deck. Cat. LSW-4-3 @ $2.95

Three decks, two different positions on each deck (used in 627 circuit). Cat. LSW-2-3 @ $2.65



SUPER CONDENSERS

Fine padding condenser, 700-1,000 mmfd. to be used when i-f is 175 kc. Cat. PC-710 @..$ .50

Coupling condenser, oscillator grid to modulator grid, 0.6 mmfd., no pickup winding needed. Cat. C-6T @ .....$ .18

Battery Set 15 to 200 Meters

A SHORT-WAVE receiver, using two 230 (2-volt) tubes, requiring 3 volts filament battery source and 90 volts of B battery. The circuit is detector and one transformer coupled audio stage. This "detector and one step" has been standard for ten years. With this circuit reception the world over has been enjoyed and the elated users number into the teeming thousands. Ranges 15 to 200 meters, using five plug-in coils. Old-timers know this circuit well. Persons who have had no experience with short-waves will find this a most appropriate circuit for a thrilling beginning. The circuit can be wired in 1½ hours.

PARTS REQUIRED: 5 plug-in coils, $1.50; Hammarlund 0.00014 mfd. tuning cond., $1.20; Hammarlund 0.0002 tuning cond., $1.35; three UX sockets, 30c; audio trans., 70c; 50,000 ohm leak, 10c; 300 turn honeycomb, 30c; 0.00025 mfd., clips, 15c; 6.5 ohm limiting resistor for filament circuit, 15c; 20-ohm rheostat, 40c; 20-100 mmfd. equalizer, 20c; battery switch, 20c; 6 bind. posts, 30c; bind. post strip, 10c; vernier dial, 50c; two knobs, 10c; 7 x 10 bakelite panel, $1.25; 7 x 10 baseboard, 25c.

Designed by Jack Tully.

Complete parts, with blueprint, less tubes, (Cat. SW-DAF), @ $9.10

Two 230 tubes @ total of.....$1.92

Precision Parts

800 TURN HONEYCOMB coil, total diameter 1¼ inches; will tune to 175 kc. with 0.0001 mfd. (or 20-100 mmfd equalizer). Cat. HC-800 @.....$ .50

300 TURN HONEYCOMB coil, same style, tunes to 400 kc. with 0.0001 mfd. Also may be used without condenser as antenna input coil, screen and plate choking, or two used inductively coupled for evening the amplification of t-r-f sets, in untuned stage feeding detector. Cat. HC-300 (each) @.....$ .30

50 TURN HONEYCOMB coil, ¼ millihenry, for all short wave purposes. Cat. HC-50 @.....$ .25

1 WATT PIGTAIL RESISTORS, all resistance values. Mention Cat. PGTR and state resistance in ohms thereafter. Price .....$ .15

5 WATT 2,250 OHM resistor to drop maximum B to B plus 180 volts for plates of r-f tubes in any t-r-f set. Cat. 5-W-2 @.....$ .45

POTENTIOMETERS: 400 ohms at 27c; 5,000 ohms @ 95c; 25,000 ohms @ $1.25; 50,000 ohms @ $1.25; 100,000 ohms @ $1.25; 500,000 ohms @ $1.25.

POTENTIOMETER with a-c switch attached, 10,000 ohms, for variable mu grid bias as volume control. Cat. POT-5-SW @ $1.55

WALNUT FINISH, EITHER DORSET OR STANTON CABINET for midget sets, cut for 7-inch cone. Cat. MDCB @ $4.90

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Shielded. Cat. DJA-35 @.....$1.95

KELFORD 30 henry choke; stands up to 100 ma; in black shield case. Cat. KEL-30 @.....$1.75

KELFORD 15 henry B supply choke; 60 ma; unshielded. Cat. KEL-15 @.....$ .95

2.5 VOLT center tapped fil. trans., 8 amperes (will stand up to five heater tubes, when voltage is 2.25 v). Cat. FLT @ $1.62

HAMMARLUND 0.0002 mfd. variable condenser, junior midline; rotation is within 2-inch diameter; for short waves. Cat. H-20 @.....$1.35

HAMMARLUND 60 mmfd. manual trimming condenser. Cat. H-60 @.....$ .79

HAMMARLUND 20-100 MMFD. EQUALIZERS: adjusting screw works in a threaded brass stud, so excess force cannot damage the unit. Cat. 3-EQ-100 (price is for three) .....$ .60

CHASSIS for midget, fits in Roland cabinet; chassis is 13½ inches wide, 7½ inches front to back; flaps front and back 3 inches high; drilled for sockets and speaker plug and for volume control and switch at front. Cat. 5-TCH @ $1.75

CHASSIS for 6 tube midget. Cat. 6-TCH @.....$1.75

TWO GANG 0.00035 MFD. straight frequency line condenser, brass plates; long ¼ inch shaft; nickeled frame. Cat. DJA-35 @.....$1.95

THREE 0.1 MFD. condensers in one shield case; black lead is common; three red leads go interchangeably to destination; mounting screw built in. Cat. 31 @...$ .57

MIDGET POWER TRANSFORMER, for five-tube set, to handle three heater tubes, one 247 and one 280. Cat. MPT-5 @ $3.15

MIDGET POWER TRANSFORMER for six-tube set, to handle four heater tubes, one 247 and one 280. Cat. MPT-6 @ $3.55

8 MFD. WET ELECTROLYTIC condenser, for inverted mounting; washer and extra lug provides insulation from chassis for circuits with B choke in negative leg. Cat. LCT-8 @ .....$ .62

TELEVISION KIT, 80-100 meters, using two stages 235-r-f, 224 power detector, 224 first a-f, 247 output, 280 rectifier. R-f coils have right-angle honeycomb chokes with 4-turn pickup windings. Designed by Edwin Stannard. Dorset cabinet and Rola speaker included. 110 v., 50-60 c. Order Cat. TK @ $18.95