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THE MIDGET

A 3-Tube Set in a Sewing Cabinet

By Herbert E. Hayden

RADIO WORLD
Title Reg. U.S. Pat. Off.
155-176
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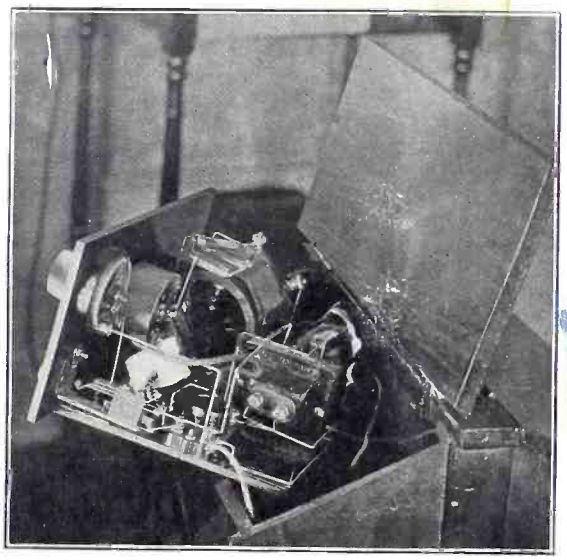

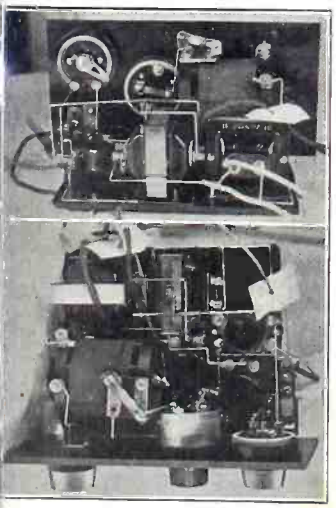

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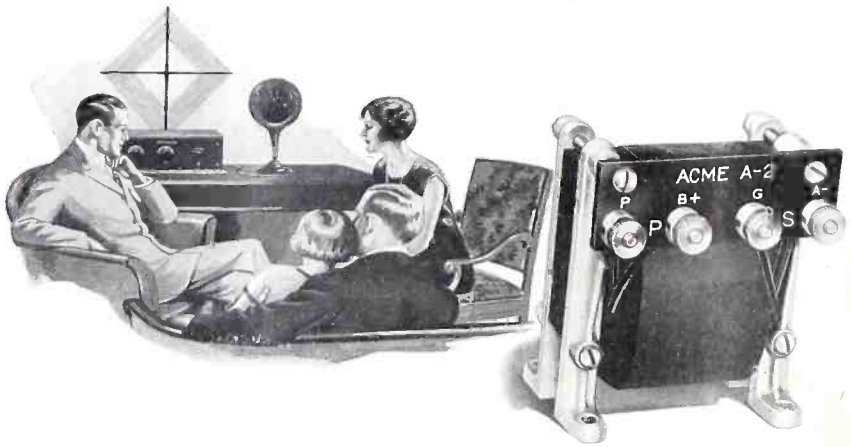
THE cabinet used to house the set and all batteries is shown directly above. At left are side and top views of set. The larger upper photo shows set being placed in cabinet.

THE MIDGET SET installed in a sewing cabinet, Priscilla model. The view shows the completed set as it looks in the home. Two lids, one for front, one for back, facilitate operation of the set and attention to the batteries. The whole outfit is self-contained. The cabinet is of handsome appearance and looks very attractive even amid exquisite parlor furniture. (Hayden.)

THE EVOLUTION REFLEX

By CAPTAIN PETER V. O'ROURKE

Loud and clear entertainment *all summer*



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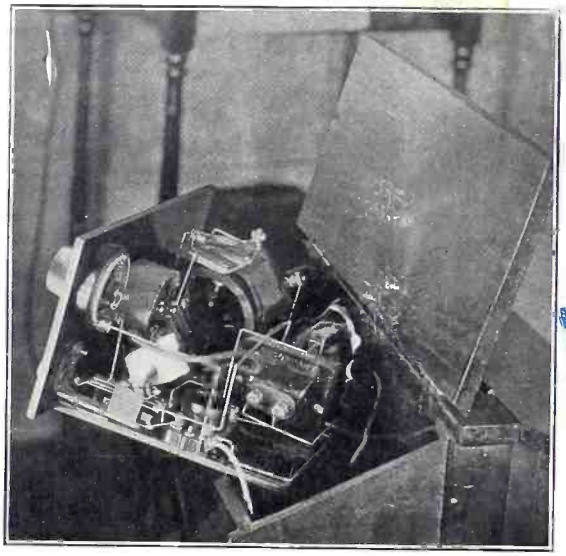

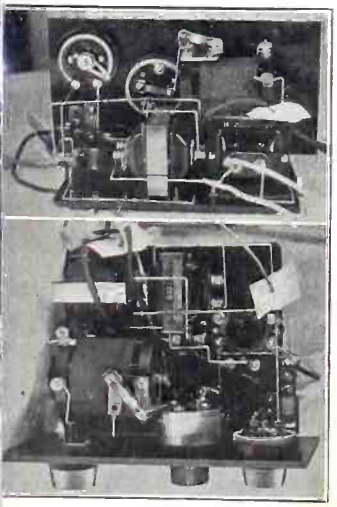

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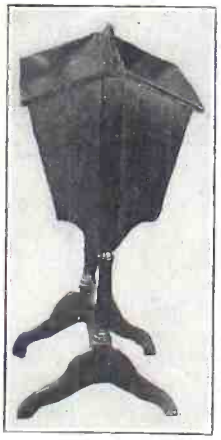

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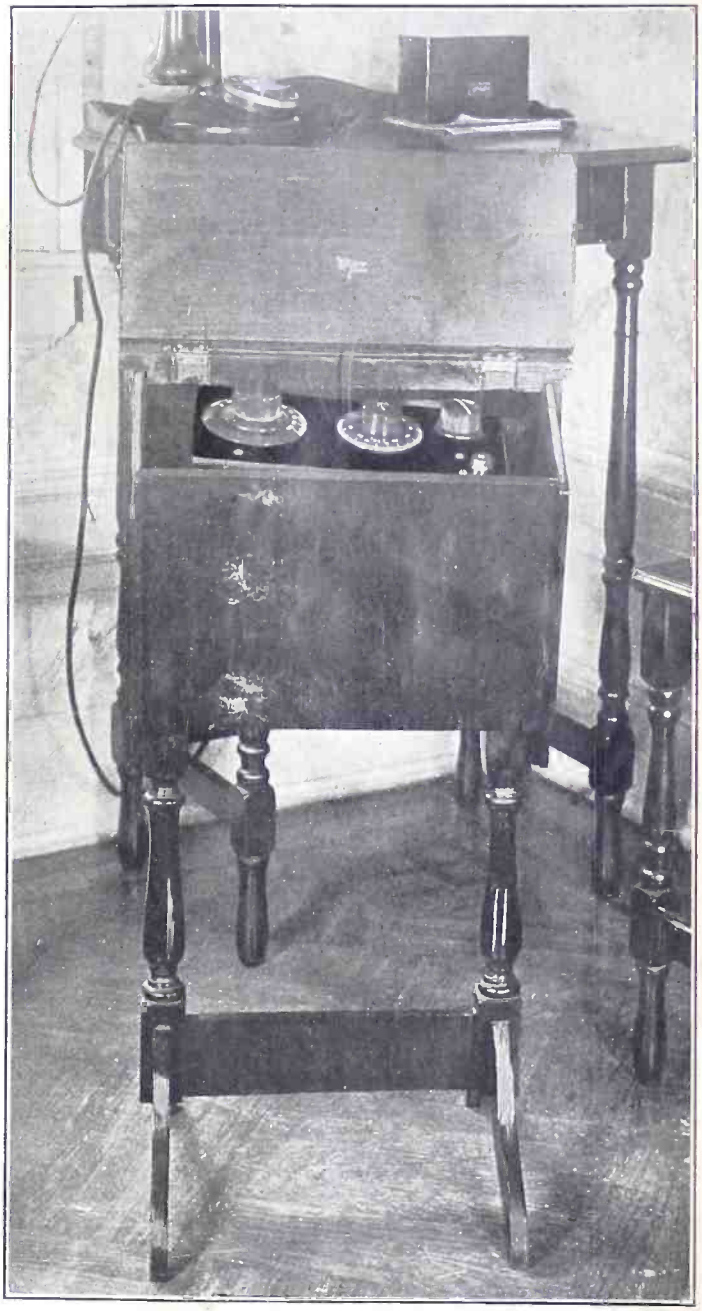

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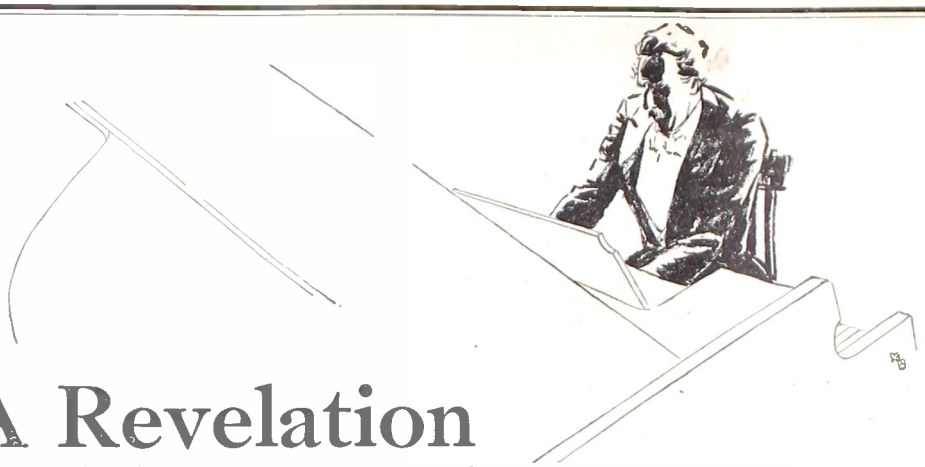

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RADIO WORLD

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The Evolution Reflex Set

By Capt. P. V. O'Rourke

THE reflex originated as a 1-tube set. Then two tubes were reflexed, then more. But the order of reflexing remained consecutive until David Grimes contributed the inverse duplex. Another name for that would be the reverse reflex. It represented the evolution of the reflex to its present standard. It had no primates as antecedents, however, hence the inverse duplex is, in that sense, fundamental and is legal even in Tennessee.

CAPT. PETER V. O'ROURKE

Although the diagram may look complicated to the novice, it is essentially simple. So is anything that you understand. Therefore, let us come to an understanding of how this set works.

The 2-tube model is employed (Fig. 1), but that represents the principle as well as any other. There are two stages of radio-frequency amplification. The first is in tube No. 1, the second in tube No. 2. That may be called the obverse order. No other order is possible with such an RF hookup. A coil combination (L5L6) couples the output of tube No. 2 to the crystal detector. Now, to continue on the obverse line of conduct, the current, rectified by the crystal, would be introduced into the first tube (No. 1) for the first stage of audio, then in the second, for the final audio stage. By that process the tubes would handle RF and AF in the same order. Foreclosed from any change in the order of the RF, let us see what can be done with the AF. Well, the second radio amplifier tube (No. 2) may be used for the first audio stage and the first RF tube (No. 1) may be used for the second audio stage. This is the reverse or inverse method.

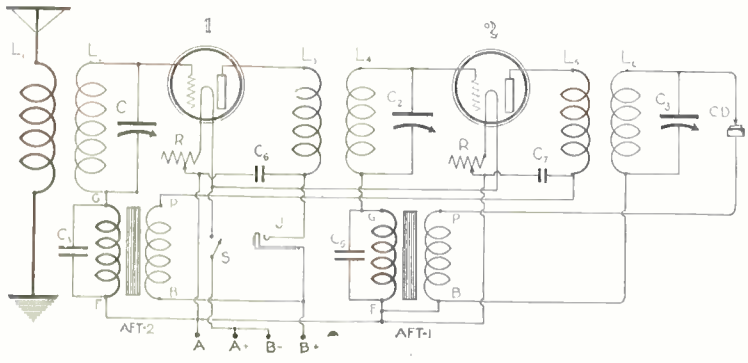
What is the advantage?

You will note that transformer-coupled audio-frequency amplification is used. This is by far the most voluminous method of audio amplification. It is often stronger than the tubes will justify; not so in this set (Fig. 1) particularly, because a crystal detector is used. Nevertheless under any and all circumstances the final audio load (on the second AF tube) may be several hundred times as great as the load on the first audio tube. On the radio side there is a comparable disparity or inequality of load, although the difference is not so marked. Hence if we take an RF tube with the heavier load and pile on top of that the heavier audio load, all on the one tube, that would constitute what might be termed an injustice to that tube. Distortion might result, likewise difficulty in controlling the tube for both radio and audio service of such an exacting nature. Therefore, split up the load, so that the heaviest AF burden is imposed on the tube to which are committed the lighter RF tasks. This attempt at equalization is the underlying idea of the Grimes system. While not accomplishing in practice the exact division, contemplated in theory, it does result in an advantageous division of the labors and represents a worth-while contribution to the evolution of the reflex. There is no monkey business about that.

With the order of performance in mind it becomes easier to read the diagram understandingly. Tracing the course of the electromotive force, we gain an even clearer comprehension of the workings of the set.

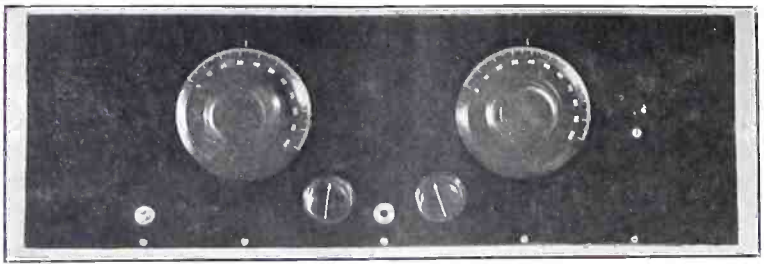
When emf. is impressed on the aperiodic primary L1, by the antenna system, it is transferred by mutual induction to

LISTENING to the Evolution Reflex. (Underwood & Underwood).



THE ELECTRICAL WIRING of the Evolution Reflex (Fig. 1), embodying the inverse system of reflexing invented by David Grimes. The main problem is the control of oscillations. Separate rheostats must be used, as shown. Usually the first tube (No. 1) is burned low and the other rheostat is turned rather high. The coils must not be accidentally coupled, hence had better be mounted at right angles

How to Overcome Oscillations



PANEL VIEW of the set.

LIST OF PARTS

Three radio frequency transformers (L1L2, L3L4, L5L6).
Three .0005 variable condensers (or one of these and one double condenser) C1, C2, C3.
Two .0001 mfd. fixed condensers, C4, C5.
Two .001 mfd. fixed condensers, C6, C7.
Two audio-frequency transformers (AFT1, AFT2).
One crystal detector.
Two sockets.
Two 20-ohm rheostats (R).
Three 4" dials with pointers (two if double condenser is used).
One A battery switch, S.
One 7x18" panel.
One single-circuit jack, J.
Accessories: Aerial, leadin wire, ground clamp, lighting arrester, cabinet, speaker, two 45-volt B batteries, A battery, two tubes (storage battery type preferred); one jack plug; wire for internal set connections; terminal strip; screws, nuts, miscellaneous hardware.

the secondary L2. The current is thus impressed upon the grid of tube No. 1, to which L2 is metallically connected. L3 picks up the energy as amplified by tube No. 1 and transfers it to L4, which impresses it upon tube No. 2. The output of tube No. 2, still radio current, is through L5, which energizes L6. One terminal of L6 is joined to one side of the crystal detector. (This is the side nearer the plate connection of L5, to keep high potentials together). The crystal breaks up the oscillatory current (radio) and allows only a direct pulsating current to flow. This act of changing the nature of the wave from a complete cycle with positive and negative directional flow, into a unidirectional flow of much lower frequency, constitutes in reality the elimination of the carrier wave, yet the preservation of the frequencies that the human ear can hear. Hence when some device that responds to these impulses is introduced (such as a pair of phones at extreme right of CD and rotor of C3) one can hear the program of the station to which the set is tuned.

But in this set we use no listening post at the crystal output, since we desire only speaker operation.

Therefore we take this direct pulsating current (as distinguished from the high-frequency alternating current that is radio) and impress it on the grid of the tube No. 2. This is done by connecting the crystal output to the primary (PB) of AFT1, the secondary of AFT1 being joined to the terminal of L4 that would have gone direct to A minus. In this way the secondary (GF) of AFT1 is connected metallically to the grid, through L4. Also notice that the battery terminal (grid return) of L4 is accomplished through the secondary of AFT1. A by-pass condenser, C5, facilitates the return of the radio component to battery.

Now we have the first audio stage output from the plate of tube No. 2, and this goes to the primary of AFT2, the completion of the circuit being to B+, about 90 volts. The secondary of AFT2 is connected to the grid of tube No. 1 by the same method used regarding AFT1. Hence we have our final audio output from the plate of tube No. 1. This lead comprises the primary L3 of the first interstage radio coupler. The radio current is sidetracked from the audio course by C6, a by-pass condenser. A jack, J, is used for speaker connections.

The signals, both as radio and as audio, have thus led us a merry chase. But the ending is a happy one. With two tubes you can not build a speaker set unless you resort to reflexing and use a crystal detector. Attempts to combine tube detection with AF in the same tube (i. e., a reflexed detector tube) are interesting but not altogether substantial. For satisfaction the tube would have to operate simultaneously at two different bends of its characteristic curve, and that simply isn't being done even in the best tube circles.

The set would have three controls. But these may be reduced to two by employing a double condenser for C2C3. This instrument is really two condensers. There are two separate stators, but a common rotor. Hence one motion tunes two stages.

The condensers should be .0005 mfd., so as not to require coils too large in physical size. A double condenser would be rated as .001 mfd., the sum of the two respective sections of .0005 mfd. each.

The coils may be 65-turn honeycomb or duolateral coils (75-turn commercial type with 10 turns taken off and the terminal resealed with wax). These would be the secondaries. The primaries would comprise 20 turns of any convenient wire, No. 24 to No. 18 on a small vaseline bottle, the winding being removed and tied inside the HC. Thus you have L1L2, L3L4 and L5L6.

Spider-web coils may be used. The primary would be wound first, consisting of 10 turns, the secondary next, comprising 47 turns. Use No. 22 SCC wire. The form is 5½" outside diameter; hub about 2½" diameter.

A solenoid would be wound thus: Using No. 24 DSC wire on a 3½" tubing, 4" high, wind 10 turns for the primary, leave ¼" space, and wind 43 turns for the secondary.

All three RFT are wound alike.

The set doesn't seem to require any particular kind of tube. If UV201A, C301A or DV2 are used, the rheostats R would be 20 ohms each. If different ratio transformers are used put the higher ratio in the first stage (AFT1).

The common connection of the F and B posts of AFT1 (which, by the way, does not short circuit the windings) is correct. S is a battery switch. The by-pass condensers C4 and C5 are .0001 mfd., but if larger capacities are on hand you may use them. C6 and C7 are .001 mfd. each.

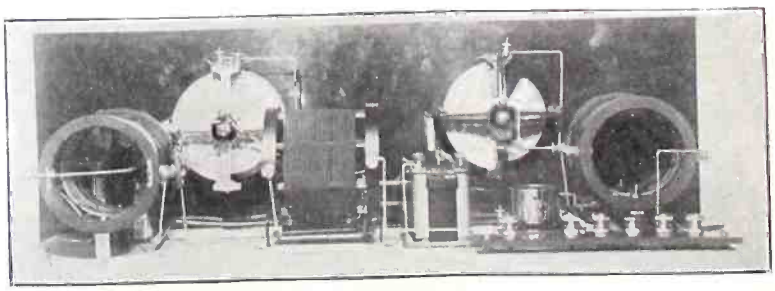
The set is sensitive and selective, but the distant stations will not be heard with great volume. Much depends on the type of crystal used. Galena is often very good. In the set as shown the RUF crystal was used, however. This is good for volume.

If oscillations occur, that is, whistles in the lower waves, even inability to tune in the lower waves, because the whistle will not down, some method of balancing the first RF tube (No. 1) will have to be introduced. A grid leak connected from the grid of this tube to A+ usually will accomplish this. A midget condenser connected between grid of that tube and plate of the same tube is another way. Its setting is varied until the lower waves can be tuned in quietly.

If the primaries of the RFT are connected out of phase the danger of oscillation will be reduced, although it is ever a possible problem to solve where two RF stages are used. This method of primary connection is to have opposite potentials nearer together. One illustration will explain all three cases: Connect one end of L1 to aerial, the other end of L1 to ground. Aerial is high potential; ground is low. Hence the grid, which is high, connects to that terminal of L2 nearer the ground terminal of L1. Plate is high potential, B+ and A— low potential. Keep unlike potentials together in this instance. The opposite rule applies under other conditions.

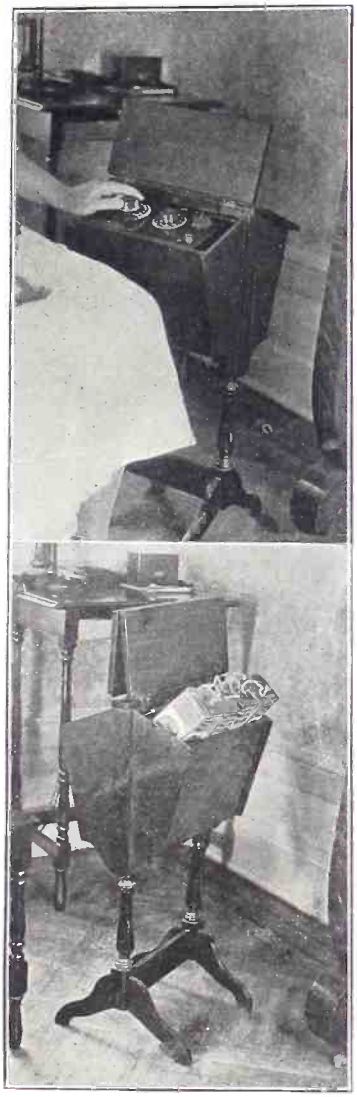
Another way of reducing the tendency to oscillate is to connect grid returns to filament minus, instead of A battery minus. This lead would be from F post of AFT to F— on socket.

In tuning the set the dial at left may read a couple of degrees "off," but (in a 3-control set) the two others should synchronize. If a double condenser is used for C2C3, then the secondaries L4 and L6 must be watched. One of these two secondaries will have a few more turns on it than the other. A station is tuned in and turns moved from the larger coil.



THE ASSEMBLY VIEW of the Evolution Reflex.

The Midget 3-Tube Set



THE relative size of the cabinet is shown; also the utilization of a half-section as the battery container. (Hayden)

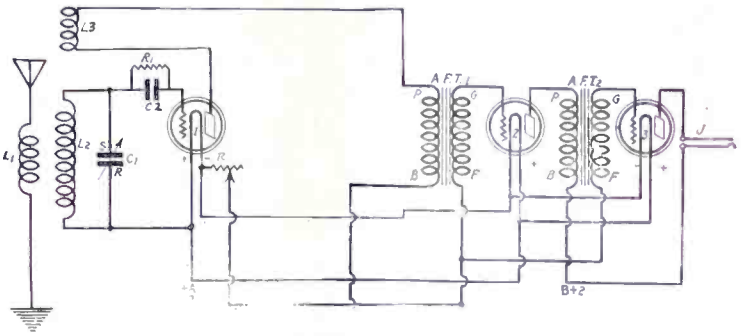
By Herbert E. Hayden

Photographs by the Author

PROBABLY the smallest 3-circuit tuner that you can build, including two stages of transformer-coupled audio-frequency amplification, is the one shown on the front cover and also herewith. The panel is 4½" high and 9" long, the total depth of the completed set being 6¼". Therefore if one is handy at making a cabinet, 4½ x 9 x 6¼" will house a set that produces great volume on the speaker.

HERBERT E. HAYDEN

Instead of doing this, however, I utilized a Priscilla model sewing cabinet that my wife had around the house. This is purchasable in almost any department store for a few dollars, about the same price that one would pay for a radio cabinet. Here, however, there is room to house the batteries on one side and the set on the other, thereby achieving a complete self-containment, the net result being an attractive and handy radio instrument that falls into the now popular "furniture class."



THE wiring diagram of the Midget 3-Tube Set. L1L2L3 is the baby 3-circuit tuner. C1 is the small .0005 mfd. variable condenser. Note that R, which is a 10-ohm rheostat, controls all the tubes. R, which is the grid leak, may be variable, for some tubes function better with a higher or lower resistance in the grid circuit, than as mentioned in the text. A varable grid leak also saves time and money, for with a number of grid leaks, having different values, it is really difficult as well as expensive to have so many grid leaks, to get the exact one for the tube. AFT1 and AFT2 are the audio-frequency transformers, both of which are the low ratio type. There is only 1 jack, which is of the single circuit type. Two individual B batteries may be used, so as to stop any radio-frequency current from feeding back to the set and thereby making the set unstable as to the controlling of oscillations. C2 is the .00025 grid condenser.

Circuit is Attractive

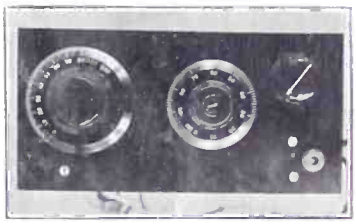
Regarding the circuit, it is the standby that has brought so much joy to thousands of listeners who chose it either from considerations of service alone, or service combined with economy, since it is impossible to get any greater service from three tubes than by the diagram shown.

The space conservation is due largely to the coil and condenser combination. The stator form on which the windings L1 and L2 are put measures 2½" in diameter x 2½" high. This is the surface measurement, that is, at least so much room must be provided, if the windings are to be safely accommodated. The actual Bruno Junior coil used provided just that much room, although the insulating rings, ⅜" thick, accounted for the extra height of ¾" and extended the space diameter at top and bottom by ¼". The coil is solenoid in construction. The tickler is of the same kind of winding. Quartzite rods inserted in the rings support the windings, but the measurements may be followed out with the regular run of tubings. If cardboard is used it is well to immerse it in molten beeswax, to make it moisture-proof.

Winding the Coils

The primary L1 consists of 10 turns, begun at one end of the tubing. The wire used for primary and secondary is No. 24 silk over cotton, but if that isn't easily procurable, use No. 22 single cotton covered. The secondary, L2, is wound next, being begun where L1 was terminated. Therefore no space is left between the two windings, which are not metallically connected, by the way. The secondary has 53 turns. Thus four terminals are produced so far, beginning and end of primary and of secondary. These are brought to binding posts on the form, or direct to set. If a puncturable form is used. pierce the form to thread the terminals through and thus they will be held together.

The tickler form is 1½" diameter, 1¼" high. The wire used here is No. 26 single silk covered, 38 turns being applied, 19 on each side of where the rotor shaft protrudes.



THE Panel Layout

LIST OF PARTS

One Junior sized 3-circuit tuning coil, L1L2L3.
One small-sized .0005 mfd. variable condenser, C1.
One 10-ohm rheostat, R.
Three sockets for UV199 tubes.
One 3" dial and one 2½" dial.
One single-circuit jack, J.
One .00025 mfd. fixed grid condenser, C2.
One 2-megohm fixed grid leak, R1.
Two audio-frequency transformers, AFT1, AFT2.
One 4½x9" panel.
One 7x6" baseboard.
Accessories: Six 10" lengths of stranded battery cable, different colors; one cabinet; 100 ft. aerial wire, 50 ft. No. 14 insulated leadin wire, ground clamp, two brass right angles, two 45-volt B batteries, hhree 4½-volt C batteries for use in parallel connection as A battery; phone plug; speaker; nuts, screws, hardware; two dial pointers optional, or panel may be touched with drill for indicating purposes.

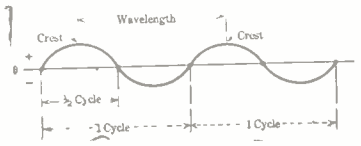
The variable condenser is the tiny sized double-range type made by the Connecticut Telephone & Telegraph Co., and it has three posts, marked A, B and G. As the range we desire is a .0005 mfd. maximum, connect the A and B posts, that common lead going to one side of the grid condenser C2. The remaining open connection, G, goes to A plus. The condenser may be wired the other way round, with G to grid and the common AB lead to A plus, but space was saved by using the method outlined.

Uses Small Tubes

The set is designed for the UV199 or C299 tubes. three of such special sockets

(*Continued on page 29*)

Getting Started in Radio



THE WAVE TRAIN consists of an endless series of cycles, two of which are represented above. Only the carrier wave (a pure continuous wave) is shown. Starting at zero the wave rises to maximum in one direction (arbitrarily called positive), falls back to zero, dips below the zero line to maximum negative and returns to zero. This is one cycle or 360 degrees. The wavelength is measured from crest to crest. This diagram represents no particular wavelength or frequency, and is merely symbolic. (Fig. 2).

THE RADIO PRIMER

By Herman Bernard

Associate, Institute of Radio Engineers

THE objective of the man, woman or child who has become interested in radio hookups is to build a set, one that will work well. Later on there will develop a thirst for technical knowledge and to satisfy this considerable studying must be done. But the primary consideration, that of building a set, requires little study. Even a person who knows nothing at all about radio can build a set that will give satisfaction. The underlying reasons for making certain wired and other connections may be ignored. There is a growing incentive to fathom these mysteries, one finds after starting on radio construction. Then, months or years later, when expert knowledge is acquired, one still finds mysteries in the art, and that perpetuates the lure. For instance, with all the present-day knowledge of radio, who can make so bold as to rise with the explanation of just why and how a crystal detects?

HERMAN BERNARD

Crystal Sets Not Serviceable

Mention of the crystal recalls the fact that beginners in other days favored this hookup as the starting point. Two years ago a crystal set was good enough for the reception of programs from local stations. But now there are so many stations on the air that for general use the crystal set is not practical. Radio engineers, even as this is being written, are attempting to design a selective crystal set, but as yet no solution has been announced.

Today the beginner had better not attempt to build a crystal set, not because he will not receive signals, but because he may receive too many at once. Two or more stations will be heard at the same time. That is known as broad tuning. It is the opposite to selectivity, which is that quality in a receiver which makes it possible to receive only one station to the exclusion of all others.

What Is a Crystal Set?

The crystal set, as referred to here, means one that employs only a crystal for rectification or detection, no tubes being used at all. If tubes are employed ahead of the crystal they function as radio frequency amplifiers, that is, they increase the sensitivity and selectivity of the circuit, which makes the hookup a tube set, although a crystal is the rectifier. The correct term to describe the function of the crystal is "rectification," since it changes the alternating high-frequency current into direct pulsating current. However, "detection" is the term most commonly applied to this operation, although in a strict sense the detection occurs only in the phones, because it is here that the signals are rendered audible.

The crystal rectifies with great purity and clarity, much more so than the tube, which may be due to some extent to the selectivity with which the tube is necessarily taxed. Selectivity may be pressed beyond the point of undistorted reception With the crystal this is hard to do, because of the resistance the mineral imparts to the circuit. Selectivity is a function of resistance, since it amounts only to the reduction of resistance. At its peak, selectivity represents the elimination of all resistance, except the direct current resistance of the wires and associated parts in the set. That goal is theoretical, since at the high frequencies (rapid alternation of current) in radio reception all objects containing metal, and most particularly the coils themselves, offer resistance. Usually the higher the frequency the greater the resistance.

Frequency And Wavelength

In reading articles on how to build sets one often encounters the terms kilocycle and wavelength. Much confusion will result unless these terms are understood.

Kilocycle means 1,000 cycles. A cycle is one complete alternation of current flow. Thus a radio wave will be represented as the letter "S" written horizontally, with a horizontal line running through the center. The first half of the cycle, at left, top of the horizontal line, is positive, the rest, or lower bend, negative. Starting from the left, at zero, the wave rises to its greatest point, known as maximum amplitude, and then returns to zero and makes the negative dip, returning to zero again, to begin all over again. The wave, however, is usually measured from crest to crest, with the same result. The number of variations in polarity (reversal of flow) is almost incredibly rapid in radio. For instance, at 600 meters, the upper limit of the broadcast range of wavelengths, the number of cycles, or reversals per second, is 500,000 (500 kilocycles). Yet this is the lowest number in the broadcast belt, for as the wavelength decreases the frequency increases. The lower limit, 200 meters, represents 1,500,000 cycles per second (1,500 kilocycles).

Therefore, the higher the frequency the lower the wavelength and the lower the frequency the higher the wavelength. Low frequency must not be confused with low wavelength.

For simplicity's sake the cycles are designated in units of 1,000, called kilocycles. Fractions of a kilocycle may be ignored, because they represent too small a difference in actual practice to require attention. The Bureau of Standards prefers the kilocycle rating to the wavelength designation, but meters seem to suit the public.

Now why does the higher wavelength represent the lower frequency, and vice-versa?

A Visualization of a Cycle

Imagine a clock with the hour hand removed. The minute hand, starting from the point representing the even hour, will make one complete revolution of the face of the clock in one hour. The positive side of the revolution will be represented by the half-cycle from the point of the even hour to the point representing half-past that hour. The negative part of the revolution will be the remaining half, the hand back at zero. The speed is constant. The comparison serves to impress on the student what one cycle represents. But the number of cycles per hour is always the same. In radio the number differs under varying circumstances

Now, suppose a man is firing a revolver Every second he pulls the trigger once Let us say the speed of the bullet is 300 feet a second. That speed will remain constant. The frequency at which he fires the revolver may be expressed as unity, one cycle per second. Suppose he fires one bullet every half second The following happens:

(1) The distance between bullets, instead of being 300 feet, is 150 feet, or one-half.

(2) The frequency is twice what it was, or two instead of one.

Therefore the greater the frequency, or the faster he fires the revolver, the shorter the distance between bullets. If he fired one bullet every third of a second the distance between bullets would be 100 feet, while the frequency would be three.

So whenever you read about a higher frequency think of the man firing the revolver faster, or when you hear of lower frequency think of the man firing at shorter intervals. Consider the distance between bullets as the wavelength. Then you can not get mixed up. The saying, "the greater the frequency, the lower the wavelength," then will mean something to you.

The Formulas

In radio, the equivalent of the speed of the bullet, 300 feet per second, is the speed at which the waves travel. This is uniform and is the same as the speed of light, about 186,000 miles per second. That is equal to 300,000,000 meters a second.

Hence

$$f = \frac{300,000,000}{\lambda}$$

Where f represents frequency in cycles, 300,000,000 is the constant speed of the wave in meters and λ (the Greek letter lambda) is the wavelength in meters. Applying the formula to 600 meters

$$f = \frac{300,000,000}{600} = 500,000 \text{ cycles} = 500 \text{ kilocycles.}$$

Knowing the frequency, the wavelength may be determined by the formula

$$\lambda = \frac{300,000,000}{f}$$

Hence:

$$\lambda = \frac{300,000,000}{500,000} = 600 \text{ meters.}$$

It is easier to remember the formulas when one specially notes that the 300,000,000 is always on top, at right of the sign "=".

The figure 300,000 is used in actual practice, instead of 300,000,000, so that the answer is directly obtained in kilocycles. In the second formula the denominator is then expressed in kilocycles (500).

The wavelengths are different for the different stations, except where two or more are on the same wave, when they

How to Build Your First Set

share time on the air. The separation between channels is 10 kilocycles. The stations, therefore, must have a means of regulating at the source the wavelength on which they send out their programs. This consists of a generator of high-frequency current (radio waves). By proper adjustment of inductance and capacity, along the same lines as the adjustment is made in a receiver, the generation is effected at a given frequency. Upon this radio current, known as the carrier wave, the audible frequencies are impressed. The function is called modulation. The singer before the microphone causes variations of vocal frequency in the carbon or other element of the microphone, this pulsation is carried by a short wire to the transmitter, and the amplified voice or music is mixed with the radio current. The result is a radio current of the original frequency as generated at the station, and also companion frequencies. Thus not only one wave is sent out by the station—the original wave or carrier—but there is an accompanying envelope of frequencies, known as the side bands. The wave that does go out, which is spoken of generally as the wavelength of the station, say 300 meters (1,000 kilocycles) is therefore not the only wave, but there are waves very close to it that accompany the carrier.

They All Become Radio

These side bands are the result of the sum and difference of the audible frequencies and the carrier wave. Even though the wavelength of the carrier is always the same, the actual output is of varying frequency, due to modulation. A realization of that fact will explain why it is inadvisable to have a set that is 100 per cent selective, for then only the carrier wave might be heard, and the side bands, or the very sounds you want to hear, excluded. The carrier and side bands all are radio waves. The audible frequencies lose their identity as such, only radio waves resulting, although the restoration process takes place in the receiver.

As 100 per cent selectivity is purely theoretical, the next consideration is not to have a set that chokes off any of the side bands, for that would cause distortion. Yet one must have a set capable of tuning out undesired stations and permitting the reception of only the program from the station that is the favored one of the moment. This is the happy compromise reached by the most popular receivers of the day. They pass side bands of 5,000 cycles or so.

The varying wavelengths, due to modulation, are of such minute difference in frequency as sent out by a given station transmitting a program that the difference can not affect the dial setting. If you tune in the carrier wave you tune in all that goes with it.

It must be obvious, therefore, that the sole purpose of the receiver is to get rid of the carrier wave.

Aside from an understanding of this much fundamental knowledge of radio wave generation, transmission and reception, it is necessary to be able to read diagrams. Very little study will make one quite proficient in this. Prior to the attainment of that knowledge one usually favors diagrams shown in picture form, rather than those drawn schematically, hence for the present we will abide by the picture diagram.

The First Set

The set selected as the one to build first is known as the 3-circuit tuner. That, like many another radio appellation, is a misnomer, since there are not three circuits. The original circuit, known as the single-circuit tuner, and now out of date because of its broadness of tuning and its fierce radiation or "squealing", had two of the "circuits" comprised in the 3-circuit tuner, since the arithmetic is wrong somewhere. However, one had better accept radio terminology as it is, since the expressions are deeply embedded in the science, and no amount of courageous revolt against misnomers is likely to succeed. The nearest approach to success in the reform direction was to attempt to popularize the use of "radiocast" instead of "broadcast," but even this can not be said to have succeeded yet.

Now, to build the 3-circuit tuner you will have to get together the parts listed. They are few and simple. You will be sure to have a set that is selective enough for your needs, unless you live almost on top of some broadcasting station. There is no sure remedy for cutting out such a station. Proximate residents of that sort are out of luck, for the present, except that they may gain selectivity by omitting the ground wire connection when desiring to try to tune out the powerful neighbor.

The 3-circuit tuner is the most popular and most efficient 1-tube set there is. The fundamental circuit may appear in various forms, but it is always the same circuit, remember, and the results will always be about the same under the same conditions.

Picture Diagram of a 1-Tube DX Circuit

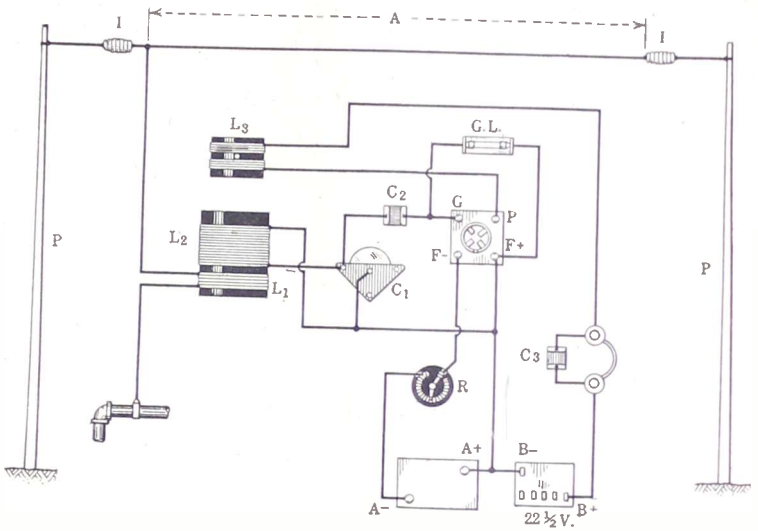


FIG. 1. the wiring diagram of the 3-circuit tuner, in picture form for the novice. Constructional directions are given in the text. What action takes place in a set like this? Read Herman Bernard's explanation.

The Aerial

The picture diagram (Fig. 1), shows the aerial strung between two insulators (I) and between two poles (P). It is well to have these poles on the roof, as high as possible, but in most cases it will be inconvenient to have the poles more than 10 or 12 feet high. If one lives in the country a rope may be attached to the limb of a tree, and should be long enough to keep the insulator well beyond any of the foliage. The other end of that insulator would be attached to one end of the aerial wire. The other insulator might be on the roof or above a window.

LIST OF PARTS

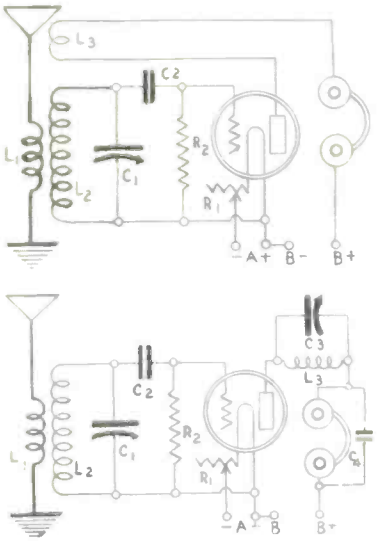
One 3-circuit tubing coil, L1L2L3 (or tubing and wire to make it).
One .0005 mfd. variable condenser, C1.
One .00025 mfd. grid condenser, C2.
One 7x2" panel.
One .001 mfd. fixed condenser, C3.
Two 4" dials with pointers.
One 6-Ohm rheostat.
One socket.
One 2-megohm grid leak, GL (with mount unless grid condenser has clips).
Two Fahnestock clips for phones.
Accessories: No. 18 DCC wire for internal set wiring; aerial wire, leadin wire, two insulators, ground clamp, lightning arrestor (directions for use found in package); one 1½-volt dry cell, one 22½-volt B battery; aerial masts; phones, cabinet; optional terminal strip and SC jack and plug.

The length of the aerial itself is not of vital importance, but 65 feet is a good length. The ground may be a metal rod driven into moist earth or be a cold water pipe connection in the house. The wire therefrom to the set is part of the aerial system. In determining the length of the aerial, therefore, count the ground lead. If this is 35 feet, then you have a 100-foot aerial. The beginner will find the antenna problem so interesting that he will soon become fairly well versed in it and will improve his aerial system as he gains in experience. For the sole purpose of getting reception from the first set he makes he need not be too particular about the aerial.

The wire from the aerial to the antenna post of the set is called the lead-in and is represented as X in Fig. 1.

We will assume that the novice desires to make a set as inexpensively as possible. He may use cardboard tubing for the coils, if they are to be home-made. Two forms are required, one 3½" wide and 4" long, known as the stator, since it is not to be rotated, and the other, 2½"

Reception Theory Explained



THE SAME circuit as in Fig. 1 is represented on top in schematic form. The lower circuit uses capacity feedback, as distinguished from the inductive variety.

in diameter (or a little less), and about 2¼" high (the rotor). He will buy ½ lb. of No. 22 single cotton covered wire. On the stator form (the larger one) he will drill a ¼" hole, 1½" from the top of the form, and also another hole of the same size at the same relative point in the rear, that is, diametrically opposite the other puncture. In the center of the smaller form he will do likewise. A ¼" brass, bakelite or hard rubber shaft, or even wooden dowel stick, is to be inserted through these holes, and the smaller form made to rotate within the larger by turning the shaft. A dial will be affixed to the shaft, outside the panel, to facilitate this movement.

The beginner can improvise his own method of introducing hardware to accomplish this result. More than likely he will use a commercial coil. If so he should get one that tunes in the band of wavelengths with the capacity of variable condenser he will use. Most commercial tuners, as the coils are called, are made with a certain number of turns of a particular kind of wire, to be used in conjunction with a .0005 mfd. variable condenser, normally 23 plates. The capacity of the condenser is rated in microfarads (mfd.) and is spoken either as "triple-o-five" or "three-o-five."

Data on Coil Winding

To wind the coil, first apply the aperiodic primary, L1, beginning near the end of the stator form opposite the one near which the ¼" hole was drilled. A suggestion of the position is given in Fig. 1. Two parallel pinholes or 3/32" or other small drill holes are made, so that the wire may be threaded through these, for purposes of anchorage. The anchor holes are ¼" apart. Thread enough wire to afford an excess of 6", for use later in making connections in the set. Wind 12 turns of wire, leave 6" excess, cut the wire, and thread it through two holes similar to the ones you made before. The secondary, L2, is begun ¼" away from the end of the primary, or nearer, but is not connected to it. The number of turns here is 43. The same 6" excess is left in both cases (beginning and end of secondary) and the same terminal facilities are provided.

The tickler L3 consists of 26 turns, 13 on each side of the center shafthole of the rotor.

Panel Data

On a 7x12" panel draw a horizontal line. From the left measure off 3" and from the right of the panel also 3" and here drill ¼" holes. The one on the left is for the condenser dial, the one at the right for the rotary coil or tickler. If a home-made coil is used, nuts and screws should be provided for mounting the stator to the panel, two holes being drilled through top and bottom of stator and corresponding panel points, so as not to interfere with the wire on the coil. The condenser has screwholes and mounting screws. Also a template, or exact measurement chart for drilling, is usually provided by the condenser manufacturer. Follow this. Countersink screwholes, so that the screwheads will not scrape against the dials.

The rheostat is mounted with center shaft hole drilled 2" from the bottom and 6" from either side of the panel. If a jack is used it should be of the single-circuit kind and mounted about 1" from the right of the panel, 2" above the bottom. Otherwise clips may be used, one at the end of L3, the other for B+. These may be put on the panel.

A baseboard, 7x10" or 7x11" will be needed. On this the socket is mounted. The filament posts of the socket (each marked F, or F+ and F—) should be on a line with and toward the panel, although the tube should be 4" back of the panel, or a little more.

The coil as shown in Fig. 1 is not exactly like commercial models, for in these the tickler may be mounted near the aperiodic primary. Disregard these differences. The tickler as shown in Fig. 1 is merely illustrative and does not show actual position, since in fact it is within the stator. The wiring is made clearer by the manner of treatment in Fig. 1.

Tubes and Batteries

In this set we will use the WD11, WD12, C11 or C12 tube. The 12 type uses a standard socket, 11 type a special socket. Both types work equally efficiently. Each requires a 1½-volt No. 6 dry cell to light the tube. The B battery has a voltage of 22½. The rheostat R is 6 ohms.

To wire the set, follow these directions:

Connect the ground to the extreme end or outside terminal of the aperiodic primary L1, the aerial to the inside terminal (as in Fig. 1). The end of the secondary that is nearer the aerial connection to the primary is connected (a) to the stator plates of C1, the variable condenser, .0005 mfd., and (b) to one side of the grid condenser C2. The other side of the grid condenser is connected direct to grid of the tube, represented by the G post of the socket. Some grid condensers may be screwed right on the socket binding post. The remaining end of L2 is joined (a) to the rotor plates of C1 and (b) to A plus. This positive pole of the dry cell is the one in the center. The grid leak (GL) goes from grid post of socket to F+ (i. e., A+). The tickler coil L3 is connected with one terminal to the plate of the tube, represented by the P post of the socket, and the other terminal of L3 to one of the phone tips (or clip). The other phone tip (or clip) goes to B plus 22½ volts. Across the phones is connected a .001 mfd. fixed condenser, C3. One side of this condenser goes to the end of the tickler coil (not the lead thereof that goes to plate), and the other side of C3 to B plus 22½ volts. This is a by-pass condenser. If clips are used, the connection is from clip to clip.

The A battery wiring, which many perform first, consists of connecting A minus (the post on the circumference of the dry cell) to one side of the rheostat and the other side of the rheostat to the F minus post of the socket, which, if not marked F minus, will be the left-hand F post, as you look at the socket with the two F posts in left-to-right line in front of you. F plus is exactly the same as A plus, since no rheostat interrupts the positive A lead from battery to socket. The voltage at F minus (socket post) is less than at A minus (battery post), due to the resistance of the rheostat R. Join the A plus post to the F plus post of the socket. Turn up the rheostat. If the tube lights, then connect A plus to B minus. That completes the wiring.

A doubt may arise as to the grid leak connection. If GC has clips, the leak may be mounted on the condenser.

Tuning the Set

In tuning the set it will be found that the dial actuating the variable condenser governs wavelength, that is, brings in the stations, and that the tickler dial controls volume. In some cases of weak signals they will not be heard, although the correct condenser setting is obtained, until the tickler dial is rotated to the proper position. The tickler always should be so placed when tuning in a station that little feedback takes place. When the voice or music is faintly heard the regeneration should be increased, by turning the tickler dial, until sufficient volume is obtained. Do not let the set "spill over," a condition which is accompanied by squawks and squealing and which causes radiation, an annoyance to persons listening to other sets. The method of using excessive regeneration, then turning the condenser dial until a whistle is heard, is known as tuning in by the whistle. That should not be the general practice, but for reception of distant stations it is virtually impossible to tune in with such a set in any other manner.

What Regeneration Does

The regeneration referred to simply means the return of the radio current from the plate of the tube to the grid circuit. This is accomplished by the tickler. The return of the current is by induction, that is, the transfer of radio energy through air from one coil not metallically connected to another. Each coil has what is known as a field when radio current is impressed on it, and the field of the tickler is communicated to the field of the secondary. This process lessens the effective resistance of the circuit, affording the desired selectivity.

The Theory of the Set

As for the theory of operation, the radio waves strike the aerial and are directed to the aperiodic primary, which receives all the broadcast wavelengths almost impartially. The energy is transferred by induction to the secondary, across which is the variable condenser, which, by rotation, is put at a setting that will bring in only the desired station, to the exclusion of the others. In other words, the variable condenser is the only tuning element. By rotation the plates are more or less in mesh with the stator plates, thus varying the effective capacity and causing the condenser to discharge at a lesser or greater speed. This timing of the charge and discharge of the condenser with the frequency of

(Continued on page 24)

2-Year-Old Wins DX Stake

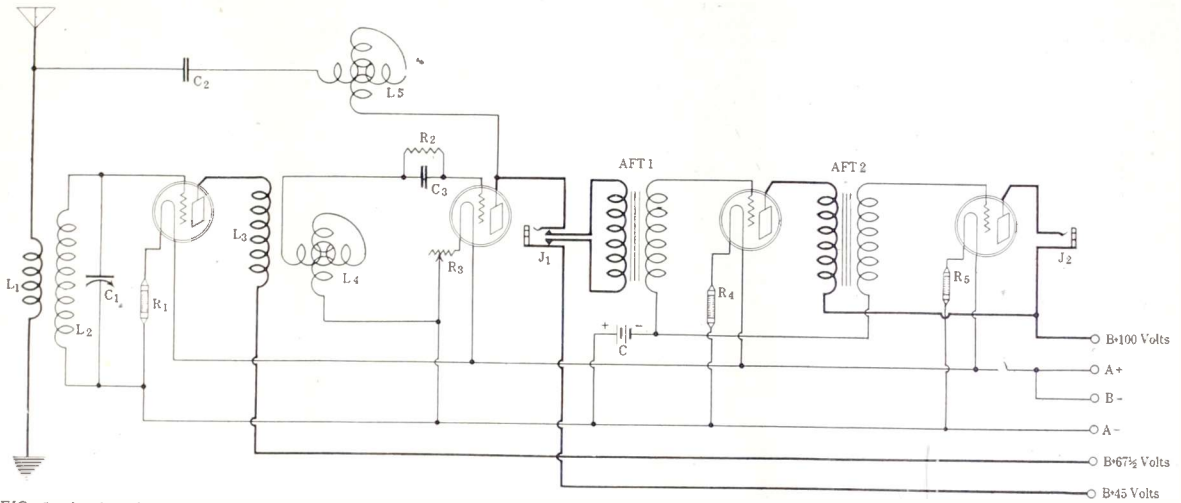


FIG. 5, showing the electrical diagram of an extremely selective and voluminous receiver. Note that in the A+ lead at the extreme right is interrupted by a switch. This should be a switch for the purpose of cutting off the filament currents.

By Lewis Winner

Associate, Institute of Radio Engineers

ABOUT two years ago a friend came to my house and said, "Lew, I want to get a radio and I want you to build the set."

LEWIS WINNER

"But you once told me that you would never have a radio in your house," I reminded.

"Ah, that is where the whole secret lies," he replied. "The set that you built for Kramer changed my mind. Boy, oh, boy, that is the set."

"But there is nothing new in it," I parried. "It is a simple hookup."

"That is just it. I don't want to spend much money, but still I want to have a set where the music or whatever is coming through the loud speaker is to be listened to with comfort."

Now you will be wondering what makes me want to talk about a set which is two years old. During that time neither my friend nor I has seen a set which can beat it for volume and distance. Many people have come up to my home and asked me if the receiver is a new circuit. I reply that this set is two years old and they look at me, as if to say, "Stop your kidding; in those days there were no such animals." And that's that.

What the Set Is

The receiver employs four tubes, a step of tuned radio frequency amplification without regeneration, which is the safest form of radio frequency to use, a regenerative detector, and two steps of audio frequency amplification. There are three controls. The plate of the detector tube is electromagnetically coupled back to the grid, by means of the variometer. I find that the variometer in the plate circuit is one of the most efficient ways to obtain regeneration.

What is Regeneration?

Fans very freely use the word regeneration. What does this term mean? In a regenerative type of receiver the tube is easily made to give off oscillations, if the arrangement is such that the least little change in the grid voltage alters the plate current to such an extent that the voltage in the grid circuit is much greater than originally. More power is in the plate than is actually used in other sets. In order to accomplish the gain a great many circuits have been devised. Of course, in all these the plate in some manner was coupled back to the grid. This is done in such a way that there is given to the grid a small amount of power, the extra power being used in the coupling circuits. This is in the form of continuous oscillations. The frequency here varies from 1 cycle per second to 11,000,000 cycles per second.

This action is commonly known as feedback action. There are only three fundamental ways of obtaining this action: direct coupling, inductive coupling and the electrostatic coupling. The one thing that is absolutely necessary, to have continuous oscillations, is that the induced grid voltage has to alter the plate current through a height which is capable of supplying the coupling circuits enough power to keep the exact same voltage in the grid circuit.

The Illustrations

This point is well illustrated in Fig. 1. If the mutual inductance of L2 and L3 is increased beyond a definite point, the throbbing plate current which is flowing through the coil L3 manufactures enough power through the coils L2L3 to keep an oscillating current through the capacity circuit L1L3C1. This alters the grid voltage to produce the changes in the plate current. We therefore learn from the foregoing that the fundamental frequency of the L1L2C1 or grid circuit is equal to the frequency by which the changes of current and voltage occur throughout the complete system.

Fig. 2, shows another method of getting the tube to generate oscillations. This circuit is very useful when you wish to generate a large amount of current. As you will note in the diagram the main oscillatory circuit is in the filament-plate circuit, and in the coil between the filament and the grid. A very peculiar action takes place here. The grid circuit is like the slide valve in an engine, where the piston moves to and fro. The flow of alternating current from the plate to the filament is like a resistance. This value depends upon the voltage of the grid. This resistance will increase and decrease in direct ratio to the voltage of the grid, which is alternating. This puts an alternating electromotive force on the oscillatory circuit in series with this resistance.

Fig. 3 illustrates how the plate and grid circuits are coupled electrostatically. The variable condenser C1 does all the coupling. In this circuit the frequency is determined mainly by the inductances L1L2 and the capacity (condenser), C1.

Fig. 4. shows the famous De Forest Ultraudion Circuit. The main control of the making of oscillations is C3, the .0005 variable condenser.

The receiver in which the detector tube has its plate coupled back to the grid in any of the methods mentioned is one of the best receivers today.

This data was given to show why regeneration was employed in the detector tube in this set.

Theory of Phone Operation

While we are on the theoretical side of radio, it is well to discuss the head-telephones about which little is said at any time.

The head telephones, commonly known as earphones, headphones and receivers, are a very important part of any set in which loud signals are desired. They are also very useful when listening in for distance. A great many of the so-called speakers employ nothing more than a telephone which is hermatically or otherwise sealed in the base. Some type of horn is then inserted in the throat of the telephone. Sometimes this telephone is called a "loud speaker unit." There are only a half dozen loud speakers which one can really call loud speakers and that are worth mentioning. These really give more volume.

Now as to electrical phenomena which happen during the operation of the earphones. The phone is made of an iron diaphragm and an electromagnet with a cone, which is permanent magnetized. One will note that the pole pieces are placed close to the diaphragm. This is to reduce the magnetic leakage to as near zero as possible. It was stated that the pole pieces are magnetized by the permanent magnet. Due to this the diaphragm is drawn to the magnet. Let us suppose that a direct current is flowing through the coils of the electromagnet. The magnetism made here helps the magnetism given off by the permanent magnet. The diaphragm is drawn close to the magnet If we reverse the current flow through

'My 1923 Set Best,' Says Winner

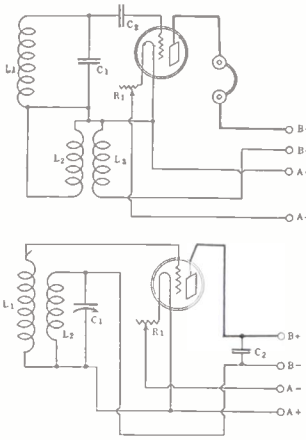


FIG. 1 (top), a diagram of the circuit which shows that the natural frequency of the grid circuit equals the frequency by which the changes of current occur throughout the system. L1 is a 34-turn coil on a 3½" tubing, 4" high. (Use No. 22 DCC wire for all coils.) L2L3 are wound on the same tubing (3½" in diameter). L2 has 10 turns and L3 has 35 turns. C1 is a .0005 mfd. condenser. C2 is a .00025 mfd. condenser. Use a UV201A tube with 45 volts on the plate. Fig. 2 (bottom), a more powerful method of obtaining local oscillations from the tube. L1L2 are both wound on the same tubing, which is 4" in diameter, 5" high. L1 contains 37 turns, leave no space and for L2 36 turns. Use No. 24 DCC wire. C1 is a .0005 mfd. variable condenser. C2 is a .001 mfd. condenser.

the coils, the total amount of magnetic lines of force made by the current opposes those lines of force generated by the permanent magnet. The pull on the diaphragm is reduced thereby. It is evident that a current which changes in amplitude causes the diaphragm to follow these variations. Sound waves are then given off.

More theory, but interesting to know: The signal is now rectified in the vacuum tube. The resulting action makes audio-frequency currents in the primary of the audio-frequency transformer. By induction these currents are transferred to the secondary of the AFT. The electromotive force which results therefrom is put on the grid. A variation equal to the grid variation takes place in the plate current of the second tube. This results in an increase in signal strength.

The above is better understood if the vacuum tube itself is taken into consideration. If the temperature of the filament is adjusted to a certain point the grid voltage adjusted and the electromotive force impressed upon the plate, a definite point will be found. If at this point an alternating electromotive force is given to both the grid and filament minus leads the grid voltage will rise and fall around some definite value. This will cause the current in the plate circuit to rise and fall in exactly the same manner. We therefore can say that an alternating electromotive force of increased amplitude can be drawn from the plate circuit, the power required to accomplish this is derived from the B battery.

All the coils can be made at home although it is advisable to purchase the variometers L4, L5 as they are difficult to build. L1L2 is the first RFT. C2 is a .0005 mfd. fixed mica condenser. C is a .0005 mfd. variable air condenser. R1 is a 20-ohm rheostat for controlling the filament temperature which is not critical. R2 is a 2 to 5 megohms, depending upon the characteristic of the tube employed. C3 is a .00025 grid condenser. R4 and R5 are Amperites, both types to be according to tube used. The audio-frequency transformers should be matched and of a low ratio (3 to 1). J1 is a double circuit jack. J2 is a single-circuit jack. UV201A tubes may be used throughout. A 7x18" cabinet with panel to fit will house all the above instruments very conveniently.

Get a form which is 3½" diameter. Now ½" from the edge wind 10 turns of No. 22 DCC wire (L). Terminate, leaving about a 5" lead for connecting purposes. Leave no space and wind 45 turns for the secondary L2, (same kind of wire). Leave both terminals (beginning and end of winding) out for connecting purposes (about 5" in length). This form is 5" in height. L4L5 are both commercial variometers (Amrad type advisable). L3 is a 10-turn primary winding, wound on a 3½" diameter form, 2" high, with No. 22 DCC wire. L3 is placed in inductive relation to the stator of the variometer L4. Do not by any means put any holding material on these coils.

Pay special attention to drilling the holes for the two variometers.

5" from the left-hand side of the panel and 3½" from the top and the bottom drill a hole 3/16" in diameter for the rotor of the first variometer L3. Now 5½" from this hole and 3½" from the top and the bottom drill another hole for the other variometer, the size being 3/16" in diameter. Also, 5½" from this hole and 3½" from the top and the bottom drill a hole, the diameter to be determined by the size of the shaft of variable condenser that you purchase. Be sure to place the two variometers next to each other. Just 2⅛" from the bottom and 2¾" from the center of the two large holes, beginning from the left-hand side of the panel, drill a hole for the detector rheostat. ⅞" from the bottom and in the same line as the extreme left-hand dial bottom, drill a hole for the double-circuit jack. The diameter of this hole is usually about ¾". The other jack hole is placed at the extreme right-hand side of the panel, directly underneath the extreme right-hand dial.

If you think that you cannot build this set in so small a space, do not do so because I say so. There are many folk who are very handy or who have a knack of placing parts so that there is not the least bit of jamming, while others just can't do it. The only thing that is to be looked out for is the placing of the two variometers, that is they should be placed near to each other (no more than 3" apart).

I personally like a small panel as it makes a very neat job when finished. L1L2 is placed directly in back of the variable condenser C1. It should be at right angles to the two variometer stators and the variometer coupling coil L3. C2 is placed directly on the antenna terminal strip. The grid condenser and leak as usual is placed very close to the grid binding post of the socket. The audio-frequency transformers are placed at right angles, so as to prevent inter-magnetic leakage. Some audio transformers are shielded and need not be placed at right angles as there is no leakage. This leakage is one of the great causes of distortion. Before placing any of the instruments on the baseboard test every piece of apparatus for a complete or an open circuit. This is done with a 1½-volt A battery and a pair of phones, which are connected in series. This will prevent any worry on the builder's part after he has completely constructed the set.

Push up all the prongs of the sockets, insert the tubes and see if the terminals of the tubes touch the prongs of the socket. Tighten all the binding posts on the terminal strip. This should be placed

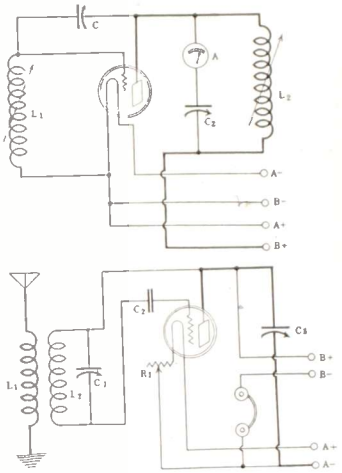


FIG. 3 (top), electrical diagram of the electrostatic coupling method of the grid and plate, to obtain local oscillations from the electron tube. L1 is a 35-turn coil on a 3" tubing (No. 22 DCC wire). L2 is the same as L1. C1 and C2 are both .0005 mfd. variable condensers. A is a milliammeter. Fig. 4 (bottom) is the Ultra Audion. L1 is a 10-turn primary on a 3½" tubing, 4" high. Use No. 22 DCC wire for all coils. L2 has 46 turns on the same tubing. C2, the grid condenser, has a capacity of .00025 mfd. C1 is a .0005 mfd. variable condenser. C3 is another .0005 mfd. variable condenser. R1 is a 6-ohm rheostat.

directly on the baseboard and in back of the variometers.

Bring the end of L1 to the ground and the beginning of this coil to the antenna post on the terminal strip. One terminal of the fixed condenser C2 goes to the antenna post. The other post goes to the stator of the plate variometer L5. The rotor of this condenser goes to the plate post of the detector socket, which in turn goes to the top terminal of the double-circuit jack. The beginning of the coil L2 goes to the stator plates of the variable condenser C1 and the rotor plate of this condenser goes to the end of this coil. The beginning of this coil also goes to the grid post of the RF tube. The end of this coil goes to the filament minus of the RF tube. The beginning of L4 goes to the plate post of this same socket, while the end of this coil goes to the B plus. One terminal of the Amperite goes to the negative post of the socket while the other post of the Amperite goes to the negative A on the terminal strip. The positive post of the socket goes to the positive A battery post on the terminal strip. The stator of the second variometer L4 goes to the grid resistance and condenser, while the other terminals of the condenser and leak go to the grid post of the socket.

The rotor of the variometer L4 goes to the negative A or to the resistance of the rheostat. The arm of the rheostat goes to the negative post on the socket. The other filament terminal of this socket goes to the positive A. The second terminal from the top of the double circuit jack goes to the P post on the AFT. The third terminal goes to the B plus post on the AFT, and the last terminal goes to detector B plus. This concludes the wiring of the first two tubes, which consists of one step of tuned RF and regenerative detector. The G post on the first AFT goes to the grid post on the socket. The F minus of the transformer goes to the F minus of the other AFT. The plate of this tube goes to the plate post of the second AFT. The B plus of this transformer goes to the B plus ampli-

(*Concluded on page* 23)

A Home-Made Galvanometer

The Story in Photos

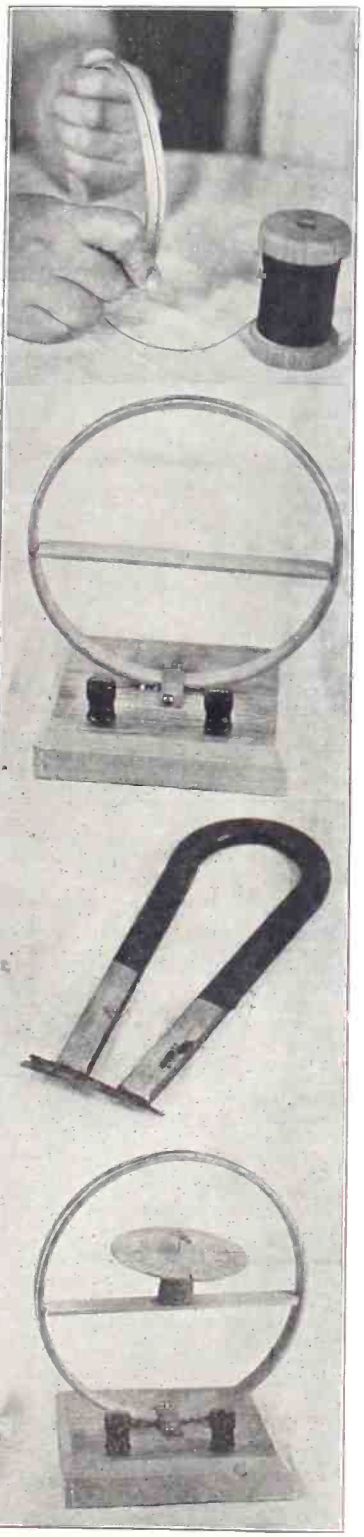


FIG. 1 (top) winding the wire on the hoop, Fig. 2, the cross-piece and base in position. Fig. 4 (third from top) magnetizing the needle. Fig. 5, the completed instrument.

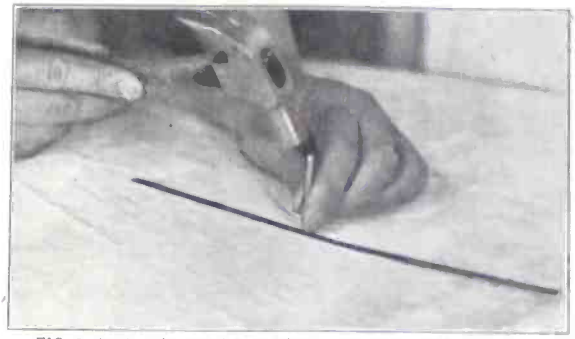


FIG. 3, denting the metal from which a magnetic needle is to be made.

By Herbert Erwin

Photographs by the Author.

GALVANOMETERS consist essentially of a magnetic needle suspended within a coil of wire, and free to swing over the face of a graduated dial. A galvanometer is really the mother of your voltmeter or ammeter. In the making of galvanometers two special coils of wire are wound around the magnetic needle. These coils are known as the "short" and "long" coils. The short coil gavanometer consists of a few turns of heavy wire. The long type is wound with a large number of turns of fine wire. Thus with a given current the total magnetizing force which deflects the needle is very much the same, but with a short coil it is produced by a large current circulating around a few turns, instead of a small current circulating around thousands of turns.

What the Result Is

The short coil being of low resistance is used to measure the current (amperes), and the long coil with the high resistance is used for measuring the pressure (voltage). Hence they are ammeter and voltmeter, respectively.

The principal forms of galvanometers are:

1. Astatic.
2. Tangent.
3. Sine.
4. Differential.
5. Ballistic.
6. D'Arsonval.

These, according to their construction are divided into two general classes:

1. A movable magnet pointer and stationary coil.
2. A stationary magnet pointer and movable coil.

If a little compass is placed on a table and a wire held above it carrying current from a battery the needle will turn in one direction, and if the wire is held UNDER the compass the needle will be deflected in the opposite direction. The earth's magnetism naturally holds the compass needle North and South.

Effect of the Field

The magnetic field encircling the wire being at right angles to the needle (when the wire itself is parallel therewith) the field operates to the turn the needle from its normal position, North and South, so as to set it partially East and West. However because the earth's magnetism does exert some force tending to hold the needle North and South, it is evident that no matter how strong the current it can never succeed in turning the needle entirely East and West.

In the making of our simple form of galvanometer, the most important part will probably be the field coil which surrounds the magnetic needle. This is easily accomplished by winding 6 turns of No. 20 DSC magnet wire on the center of a 6" embroidery hoop. Fasten both ends of the wire securely (Fig. 1) and leave about 6" for connections to binding posts. In building this instrument we are going to wind just one coil.

Constructional Data

Mount the ring with its winding on a little square wood base. Fix two little binding posts and connect the wires securely.

Now fasten a little stick of wood about 1" wide right across the center of the ring or hoop (Fig. 2).

The magnetic needle can be obtained either by buying the needle as part of a 10c compass, by making it. (Figs. 3 and 4).

Get a piece of steel spring about ⅛" wide and make a little dent in the center of a piece about 1¼" long. This dent is used as a bearing, as the needle is supported on a pin point. After this, the needle is cut to the shape of an arrow and is magnetized by drawing it back and forth slowly across the poles of a permanent magnet. Do this for a few minutes and a magnetic needle results.

To complete the instrument, a small cork is glued on the little wooden stick across the center of the hoop, and in the center. An ordinary pin is pushed in this cork with the sharp point upwards. Then a little circle of thin cardboard about 2½" in diameter is placed so that the pin sticks up through the middle of it. Finally the needle is placed on the pin point. (Fig. 5).

If an old dry battery is connected to the binding posts, the needle immediately will be deflected, and if a strong new dry cell is used, the current will send the needle spinning.

By using a source of known amperage the maximum setting of the needle can be dialed 100 and the divisions marked off accordingly.

NO NEW STATIONS IN A WEEK SETS A RECORD FOR 1925

No stations were licensed by the Department of Commerce during a recent week. This establishes a precedent for this year. One of the reasons is that the supply of wavelengths is practically exhausted.

TWO STATIONLESS STATES

Two states are without broadcasting stations. They are Wyoming and Nevada. Until recently there were two stations in Wyoming, but they were deleted.

Interference By Induction

Why Receivers Pick Up Noises From Electric Power Company Plants and Lines That Use Frequencies Much Lower Than Those of the Broadcast Belt of Wavelengths — The Three Factors That Make For Satisfactory Reception . . —"Man Has Not Yet Found a Satisfactory Method of Controlling the Static Level."

[Prof. C. M. Jansky has made a special study of man-made interference. He is chairman of the Twin City Radio Interference Committee, chairman of the technical committee of the Northwest Radio Trade Association and consulting engineer of WCCO, Minneapolis-St. Paul.]

By Prof. C. M. Jansky, Jr.

In charge of Radio Instruction at the University of Minnesota

INDUCTIVE radio interference may be defined as interference to radio reception resulting from the operation by man of other devices, using or attended by electrical phenomena.

Radio communication is carried on by the aid of electro-magnetic waves. Electro-magnetic waves are generated by high-frequency alternating currents. For the purposes of radio transmission high-frequency alternating currents are produced in the familiar antenna system seen at any broadcasting station. A fixed relationship exists between the frequencies of the alternating currents in the radiating system, and the wavelengths of the electro-magnetic disturbance produced. Since electro-magnetic waves are identical with light waves, and therefore travel with the velocity of light, this relationship is: Wavelength in meters equals 299,000,000 divided by the frequency in cycles per second.

The wavelengths used for broadcasting range approximately from 200 to 600 meters, that is, the frequencies used to produce these waves range from 1,500,000 cycles per second down to 500,000 cycles per second.

Since the frequencies used by electric power companies and by electrical communication companies are much lower than those used by radio communication, it might seem at first thought that the operation of other electric equipment could not possibly produce wavelengths within the broadcasting range. This would be true were it not for the production of other frequencies in electrical systems by the interruption or disturbance of those systems from one cause or another. Such interruptions or disturbances may cause the generation of high frequencies, which may be radiated as electro-magnetic waves at the point of generation, or may be carried as electric currents along the adjacent wiring and radiated from other points on the system. Sometimes the effect of the disturbance may be accentuated by the fact that the distributed capacitance and inductance of the wiring may be such that oscillatory currents having natural frequencies within the broadcasting band exist and damped sine waves may be produced at these frequencies. The difference between radiation and induction, or the question whether or not there is a difference between them, will not be discussed here. The effect in the receiving set is the same.

Many assume that if electrical devices or systems produce interference to radio reception such devices or systems are not operating properly. While this may be true in many cases there are in common use today many electrical devices the normal operation of which will cause tremendous inductive radio interference. An excellent example is the synchronous motor-driven high-voltage rectifier used with X-ray tubes. The sparking discharge produced in this device will interfere with radio reception at points within a radius of several miles, although the operation of the rectifier may be entirely satisfactory from an electrical and medical standpoint. The above, is of course, an extreme example.

The immediate problem of the sources of inductive radio interference is the co-ordination of effort in the determination of what in specific cases is causing interference and its elimination or minimization after the source has been found. In Canada every receiving set owner must pay a license fee of $2 per year. Because of this fact the Canadian Government feels under obligation to study and eliminate radio interference wherever posible. Accordingly the Canadian Radio Service has interference squads continually at work. In our own country some attention has been paid to the elimination of interference by our Radio Supervisors. However, the Department of Commerce has been criticized by some even for the small amount of work done on this problem, on the grounds that the Radio Act of 1912 under which Radio communication is regulated does not provide for the licensing of receiving sets, and therefore the Department should not concern itself with anything which does not directly effect transmitting sets.

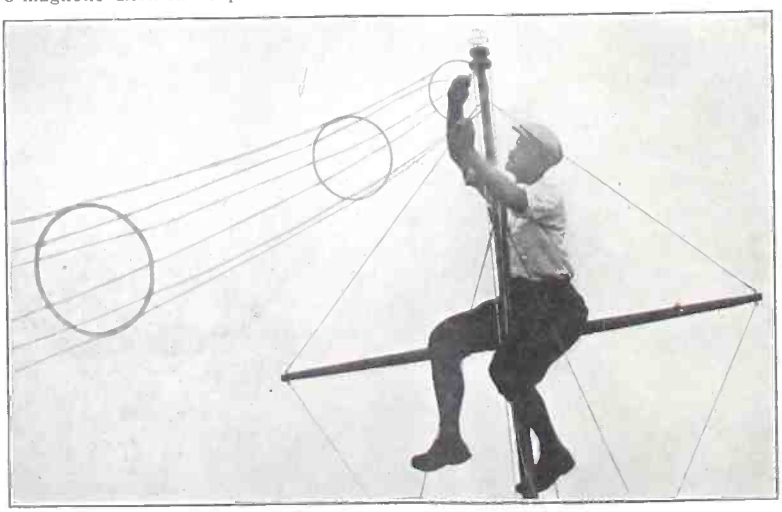
It is an interesting fact, worthy of special emphasis, that more study of the problem of inductive radio interference and its elimination has been done by the privately-owned electrical public utilities, individually and collectively, than by any other agency. This fact is greatly to the credit of our public utilities and is added proof of their desire to give satisfactory efficient service to the public. However, the public utilities cannot and should not assume the entire burden of eliminating interference.

I firmly believe that satisfactory results cannot be obtained without the co-operative aid of all those involved. This problem concerns the power companies, telephone and telegraph companies, electric railway companies, electrical and radio dealers and jobbers, transmitting radio amateurs, and last but not least, broadcast listeners themselves.

Factors of Satisfactory Reception

Neglecting radio interference, there are three factors which determine whether or not reception from a given radio broadcasting station can be made satisfactory at a given location. These factors are: The intensity of the received signal, the intensity of static, or atmospherics, and the intensity of inductive interference. In discussing these factors, the terms "signal level," "static level" and "interference level" may be applied to the average conditions existing at a given location during a given period of time. With modern efficient amplifying receiving equipment it is not the actual levels of these three factors which are important, but their relative values. A signal from a broadcasting station can easily be amplified to satisfactory intensity, providing the ratio of the signal level to the static and interference levels is sufficiently high. If this ratio is not sufficiently high satisfactory reception cannot be obtained.

During the summer months the static level is usually much higher than the inductive interference level, and consequently it is static which limits the reception of distant stations. Man has not yet found a satisfactory method of controlling the static level. During the winter months the static level drops almost to zero, and consequently it is the interference level which limits reception. It is therefore but natural that we should hear more about inductive interference in the winter than in the summer time.



ONE of the most convenient forms of antennas on board ship or for super-power work is the cage antenna, shown above. In this type of aerial the high-frequency current which is flowing along the wires is inclined to crowd toward the wires which are outside. By outside wires is meant the lead-in wires. In some types of antenna the lead-in is taken from the center, but here it is taken from the extreme end, leaving one free end at the opposite post. These wires have to carry more than their share of current. This is known as the edge effect. This increases the resistance of the aerial. This is done away with by putting all the outside wires (running parallel with the pole) at one end. This type of antenna has low resistance. Richard Wagner is seen fixing the cage antenna aboard the cruiser MUI. (Fotograms).

THE KEY TO THE AIR

KEY

Abbreviations: EST, Eastern Standard Time; CST, Central Standard Time; MST, Mountain Standard Time; PST, Pacific Standard Time; DS, Daylight Saving Time.

How to tune in a desired distant station at just the right time—Choose your station from the list published herewith. See what time division the station is under (EST, CST, etc.); then consult the table below. Add to or subtract, as directed from the time as given on the PROGRAM. The result will be the same BY YOUR CLOCK that you should tune in, unless daylight saving time intervenes, as explained below.—The table:

If you are in	*And want a station in*	*Subtract*	*Add*
EST	CST	..	1 hr.
EST	MST	..	2 hrs.
EST	PST	..	3 hrs.
CST	EST	1 hr	..
CST	MST	..	1 hr.
CST	PST	..	2 hrs.
MST	EST	2 hrs.	..
MST	CST	1 hr.	..
MST	PST	..	1 hr.
PST	EST	3 hrs.	..
PST	CST	2 hrs.	..
PST	DST	1 hr.	..

If you are under DST and the station you want is under that time, too, or if both are under ST, the above table will hold.

If you are under DST, and the station operates under ST, add one hour to the table result.

If the station uses DST, and you are under ST, subtract one hour from the table result.

FRIDAY, AUGUST 7

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 1:05 PM; 8 to 12 PM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 to 10 PM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—7:30 PM to 11:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 10.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 to 1:30 PM; 4:30 to 5:30; 6:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 to 7 PM; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45 11 to 12; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 8 to 11.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7:45; 2 PM to 3:15; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—9 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 11.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15; 8 to 11.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8:30 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 5; 7 to 11; 12 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—7 PM to 9; 11 to 12; 12:30 to 1:30; 4:30 to 5:30; 6:30 to 9:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 8:45 to 10:05; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:50; 6 to 7.
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 10:30.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 1 AM.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15; 1:30 PM to 2:30.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 4:45; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1; 1; 5:45 to 7:10; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 12.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
WPAK, Fargo, N. D., 263 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 8:30; 10 to 12.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.

With
IRVING HOFFMAN
at

WRC

Washington, D. C.

WILLIAM M. SWEETS, STUDIO MANAGER AND ANNOUNCER OF WASHINGTON BALL GAMES

ELLSWORTH E. TOMPKINS, ANNOUNCER AT STATION W.R.C.

GEORGE F. ROSS POPULAR PIANIST AND ANNOUNCER AT WRC.

ELEANOR GLYNN, STAFF ARTIST AND ACCOMPLISHED PIANIST.

FREDERICK WILLIAM WILE, WHO TALKS ON THE POLITICAL SITUATION IN WASHINGTON

FRED EAST BARITONE WHOSE RECITALS ARE FEATURES OF WRC'S PROGRAMS.

OTTO F. BECK, WHO GIVES SEVERAL ORGAN RECITALS A WEEK FROM WRC

WRC, Washington, D. C., 469 (EST)—4:30 PM to 5; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:45.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10; 12 PM to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:20 PM; 1:30 to 3:20; 5:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFDY, Brookings, S. D., 273 (MST)—8 PM to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 10.
KFRX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12.
KFNF, Shenandoah, Iwa, 266 (CST)—12 15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:10 AM to 1 PM; 1:30 to 3; 4 to 7.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:30 PM; 5:30 to 11:30.
KJR, Seattle, Wash., 484.4 (PST)—10:30 AM to 11:30 AM; 1 PM to 6:30; 8:30 to 11.
KNX, Hollywood, Cal., 337 (PST) 11:30 AM to 12:30 PM; 1 to 2; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:35 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 8:45; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7:30 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST)—4 PM to 5.
KTHS, Hot Springs, Ark., 374.8 (CST)— 12:30 PM to 1; 8:20 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:25 to 3:30; 6:02 to 7:20; 9 to 1:30 AM.
CNRA, Moncton, Canada, 313 (EST)—6:30 PM to 10:30
CNRE, Edmonton, Canada, 516.9 (MST)—6:30 PM to 10:30.
CNRS, Saskatoon, Canada, 400 (MST)—9:30 PM to 3.
CNRT, Toronto, Canada, 357 (EST)—6:30 PM to 11.

SATURDAY, AUGUST 8

WAAM, Newark, N. J., 263 (EST)—7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 to 2 AM.
WAMD, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12
WBBM, Chicago, Ill., 226 (CST)—8 PM to 1 AM.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—11 AM to 12:30 PM; 7 to 9.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—10:45 AM to 12M; 3 PM to 4; 6:30 to 7:30.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12:30 PM; 2:30 to 5; 6 to 10.
WEAF, New York City 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 7 AM.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEMC, Berrien Springs, Mich., 286 (CST)—11 AM to 12:30 PM; 8:15 to 11.
WFAA, Dallas, Texas, 475.9 (CST)—12:30 PM to 1; 6 to 7; 8:30 to 9:30; 11 to 12:30 AM.
WFBH, New York City, 272.6 (ESTDS)—3 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 12.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—8:45 to 10:15 PM, U. S. Army Band.
WGY, Schenectady, N. Y., 379.5 (EST)—7:30 PM to 10.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:30 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—8:15 PM to 5; 7:30 to 10.
WHO, Des Moines, Iowa, 526 (CST)—11 AM to 12:30 PM; 4 to 5:30; 7:30 to 8:30.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 11:30.
WJY, New York City, 405 (ESTDS)—2:30 PM to 5; 8 to 10:30.
WJZ, New York City, 455 (ESTDS)—9 AM to 12:30 PM; 2:30 to 4; 7 to 10.
WKRC, Cincinnati, O., 326 (EST)—10 to 12 M.
WLWC, Cincinnati, O., 422.3 (EST)—9:30 AM to 12:30 PM; 7:30 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—10:25 AM to 12:30 PM.
WMCA, New York City, 341 (ESTDS)—3 to 5 PM; 6:30 to 2.
WNYC, New York City, 526 (ESTDS)—1 to 3 PM; 7 to 11.
WOAW, Omaha, Neb., 526 (CST)—10 AM to 1; 2:15 to 4; 9 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 5:45 to 7:10; 9 to 12.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30; 8 to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 3 AM.
WPG, Atlantic City, N. J., 299.8 (CST)—7 PM to 12.

(Continued on next page)

Features of the Week

FRIDAY, AUGUST 7

WWJ, Detroit, Mich., 352.7 (EST)—8 PM to 9 PM, Goldman's Band concert from N. Y.
WEAF, New York City, 492 (ESTDS)—9:15 to 10:15, Goldman Band Concert.
WHT, Chicago, Ill., 238 (CSTDS)—8:45 to 10:15 PM, Elmer Kaiser's Review Park Ballroom orch.
WGBS, New York City, 315.6 (ESTDS)—7 PM to 7:10, Herman Bernard, "Your Radio Problem."
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

SATURDAY, AUGUST 8

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez orch.
KGW, Portland, Ore., 491.5 (PST)—10 PM to 12 PM. dance music from Portland Hotel by Jackie Souders' orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.

SUNDAY, AUGUST 9

WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band Concert.
WBBM, Chicago, Ill., 226 (CST)—12 PM to 2 AM—Sunday, Midnight Nut Club Feature, Sanovar Orch.

MONDAY, AUGUST 10

WWJ, Detroit, Mich., 352. (EST)—8 PM to 9, Goldman Band Concert from N. Y.
WEAF, New York City, 492 (ESTDS)—9:15 PM to 10:15, Goldman Band concert; 11 to 12, Jack Albert and his Hotel Bossert orchestra.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

TUESDAY, AUGUST 11

WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WEAF, New York City, 492 (ESTDS)—9 PM to 10. "Everday Hour,'; 11 to 12 PM Vincent Lopez Hotel Pennsylvania orchestra.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.
WEEI, Boston, Mass., 476 (ESTDS)—10 PM to 11—From New York, WEAF Grand Opera Company.

WEDNESDAY, AUGUST 12

WHO, Des Moines, Ia., 526 (CST)—10 to 11:30 PM—The Barret-Philbreck Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WEEI, Boston, Mass., 476 (ESTDS)—8:30 PM to 9—"Earl Nelson and His Uke," courtesy Radio Equipment Company.

THURSDAY, AUGUST 13

WEAF, New York City, 492 (ESTDS)—11 PM to 12 PM. Vincent Lopez Hotel Pennsylvania orch.
WGR, Buffalo, N. Y., 319 (ESTDS)—8 to 11 PM—Joint broadcasting with WEAF, N. Y. City, Atwater Kent Radio Artists, and Goodrich Silvertown Chord Orch.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—3 PM to 4. "Song of the Surf,"—surf sounds of Atlantic Ocean, picked up by special microphone, underneath the breakers of Steel Pier at Atlantic City, N. J.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—7:30 PM to 8:30, dinner music by the Hotel Adelphia Roof Garden orch.

WRC, Washington, D. C., 469 (EST)—4:30 to 5:30 PM; 6:45 to 12.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 12.
WRNY, New York City, 258.5 (ESTDS)—11:59 to 2 PM; 7:59 to 9:30; 12 M to 1 AM.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 3 to 4; 5 to 6; 10:45 to 12.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10; 11:55 to 1:30 PM; 3 to 4.
KDKA, Pittsburgh, Pa., 309 (EST)—10 AM to 12:30 PM; 1:30 to 6:30; 8:45 to 10.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 268 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10:30.
KFOA, Seattle, Wash., 455 (PST)—Silent.
KGO, Oakland, Cal., 361.2 (PST)—11 AM to 12:30 PM; 3:30 to 5:45; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 6 to 7; 10 to 11.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—7 AM to 7:30; 10 to 1:30 PM; 2:30 to 3:30; 5:30 to 2 AM.
KJR, Seattle, Wash., 484.4 (PST)—1 PM to 2:45; 6 to 6:30; 8:30 to 10.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 6:30 to 2 AM.
KOA, Denver, Colo., 322.4 (MST)—11:30 AM to 1 PM; 7 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.
KPO, San Francisco, Cal., 429 (PST)—8 AM to 12 M; 2 PM to 3; 6 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7 PM to 8:30.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—11 AM to 12:30 PM; 4 to 5; 7 to 8.
CKAC, Montreal, Canada, 411 (EST)—4:30 PM to 5:30.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7:30 PM to 10.
PWX, Havana, Cuba, 400 (EST)—8:30 PM to 11:30.

SUNDAY, AUGUST 9

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (ESTDS)—10 AM to 12 M; 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (ESTDS)—3 PM to 5; 7:20 to 10:15.
WEAR, Cleveland, O., 390 (EST)—3:30 PM to 5; 7 to 8; 9 to 10.
WFBH, New York City, 272.6 (ESTDS)—5 PM to 7.
WGBS, New York City, 316 (ESTDS)—3:30 PM to 4:30; 9:30 to 10:30.
WGCP, New York City, 252 (ESTDS)—8 PM to 11.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:30 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 319.5 (EST)—9:30 AM to 7:15 to 8.
WGY, Schenectady, N. Y., 379.5 (EST)—9:30 AM to 12:30 PM; 2:35 to 3:45; 6:30 to 10:30.
WHAD, Milwaukee, Wis., 275 (CST)—3:15 PM to 4:15.
WHN, New York City, 360 (ESTDS)—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CSTDS)—9:30 AM to 1:15 PM; 5 to 9.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 4:15 to 5:30.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12:15 PM; 7 to 7:30.
WNYC, New York City, 526 (ESTDS)—9 PM to 11.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—10:45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J., 299.8 (CSTDS)—3:15 PM to 5; 9 to 11.
WQJ, Chicago, Ill., 448 (CST)—10:30 AM to 12:30 PM; 3 PM to 4; 8 to 10.
WREO, Lansing, Michigan, 285.5 (EST)—10 AM to 11.
WRNY, New York City, 258.5 (ESTDS)—3 PM to 5; 7:59 to 10.
WSBF, St. Louis, Mo., 273 (CST) 9 to 11 PM.
WWJ, Detroit, Mich., 352.7 (EST)—11 AM to 12:30 PM; 2 to 4; 6:20 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 10:30; 11:55 to 12 M; 2:30 PM to 5:30; 7 to 11.
KFNF, Shenandoah, Iowa, 266 (CST)—10:45 AM to 12:30 PM; 2:30 to 4:30; 6:30 to 10.
KOA, Denver, Col., 322.4 (MST)—10:55 AM to 1 M; 4 PM to 5:30; 7:45 to 10.
KOIL, Council Bluffs, Iowa, 278 (CST)—11 AM to 12:30 PM; 7:30 to 9.
KGW, Portland, Oregon, 491.5 (PST)—10:30 AM to 12:30 PM; 6 to 9.
KHJ, Los Angeles, Cal., 405.2 (ESTDS)—10 AM to 12:30 PM; 6 to 9.
KJR, Seattle, Wash., 384.4 (PST)—11 AM to 12:30 PM; 3 to 4:30; 7:15 to 9.
KTHS, Hot Springs, Ark., 374.8 (CST)—11 AM to 12:30 PM; 2:30 to 3:40; 8:40 to 11.

MONDAY, AUGUST 10

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 2 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—10 PM to 12.
WBBM, Chicago, Ill., 226 (CST)—6 PM to 7.
WBBR, New York City, 272.6 (ESTDS)—8 PM to 9.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:30.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 12.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—9:30 AM to 12 M; 1:30 PM to 6:15. to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 4 PM to 5; 6 to 11:30.
WEAR, Cleveland, O., 300 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 7 to 8.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Springs, Mich., 286 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (EST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:18; 8 to 10:45.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 3:30 to 5:57.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:30 PM; 2:30 to 4:30; 7:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—1 PM to 2; 5:30 to 8:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—2:15 PM to 5; 6:30 to 12.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11:15 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 5:30; 6 to 6:30; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 1; 2 to 3; 4:30 to 6; 7:30 to 11:30.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 10.
WMAK, Lockport, N. Y., 265.5 (EST)—8 PM to 12.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4:15; 6:20 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 10:30.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 6.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 to 4; 6:15 to 11:30.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:30 to 11.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 10:30; 12 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 10.
KFAE, State College of Wash., 348.6 (PST)—7:30 P. M. to 9.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:45 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—9 AM to 10:30; 11:30 AM to 1 PM; 1:30 to 6; 6:45 to 7; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30; 5 to 8.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 10.
KJR, Seattle, Wash., 384.4 (PST)—1 PM to 2:45; 6 to 6:30; 7 to 11.
KNX, Hollywood, Cal., 337 (PST)—12 M to 1 PM; 4 to 5; 6:30 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 10.
KPO, San Francisco, Cal., 429 (PST)—10:30 AM to 12 M; 1 PM to 2; 2:30 to 3:30; 4:30 to 10.
KSD, St. Louis, Mo., 545.1 (CST)—7:30 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 3:30; 6:02 to 7.

TUESDAY, AUGUST 11

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 PM to 1:05 AM.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 12.
WBOO, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.

WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 PM to 4; 5:30 to 10.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM. to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 7 to 10; 10 to 11.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 1 PM to 2; 6:30 to 10.
WFAA, Dallas, Texas, 457.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1; 2:30 to 6; 6:45 to 7; 8:30 to 9:30; 11 to 12.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 P.M; 5:30 to 11:30.
WGR, Buffalo N. Y., 319 (ESTDS)—11 AM to 12:45 PM; 7.30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—11 PM to 2:30; 5:30 to 7:30; 9:15 to 11:30.
WHAD, Milwaukee, Wis., 275 (CST)— 11 AM to 12:15 PM; 4 to 5; 6 to 7:30.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (ESTDS)—12:30 PM to 1; 2:15 to 3:15; 4 to 5:30; 7:30 to 10:45; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 7:30 to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (ESTDS)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WJY, New York City, 405 (ESTDS)—7:30 PM to 1:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6 PM to 12.
WLIT, Philadelphia, Pa., 395 (EST)—11 AM to 12:30 PM; 2 to 3; 4:30 to 7
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 1 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:45 PM to 5; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5:45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 5:45 to 10.
WOO, Philadelphia, Pa., 508.2 (ESTDS)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (ESTDS)—7 PM to 11.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—4:30 PM to 5:30; 6:45 to 11.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 11.
WRNY, New York City, 258:5 (ESTDS)—11:59 AM to 2 PM; 4:30 to 5; 8 to 11.
WSB, Atlanta, Ga. 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 8 to 9; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 8 to 10; 11:30 to 1 AM.
WWJ, Detroit, Mich., 352.7 (EST)—8 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 PM to 12 M; 1:30 PM to 3:20; 5:30 to 10:45.
KFI, Los Angeles, Cal., 467 (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30; 5:15 to 6:15; 9:30 to 12:30.
KFMQ, Fayettville, Ark., 299.8 (CST)—9 PM to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 11.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 3; 4 to 6:45; 8 to 1 AM.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM; 5 to 11.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 3:20 PM; 5:30 to 11.
KJR, Seattle, Wash., 384.4 (PST)—9 AM to 6:30 PM; 8:30 to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—9 AM to 10; 1 PM to 2; 4 to 5; 6:30 to 12.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9; 11 to 12 M.
KPO, San Francisco, Cal., 429 (PST)—7 AM to 7:45; 10 to 12 M; 1 PM to 2; 3:30 to 11.
KSD, St. Louis, Mo., 541.1 (CST)—6 PM to 7.
KTHS, Hot Springs, Ark., 374.8 (CST)—12:30 PM to 1; 8:30 to 10:30.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:30 to 1 PM; 2:15 to 4; 6:02 to 11:30
CNRA, Moncton, New Brunswick, Canada, 313 (EST)—9:30 PM to 11.
CNRR, Regina, Saskatachewan, Canada—8 PM to 11.

WEDNESDAY, AUGUST 12

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12 M to 1:05 PM; 8 to 12.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (ESTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9:30 AM to 12 M; 1:30 to 4; 5:30 to 11.
WDAF, Kansas City, Kansas, 365.6 (CST)—3:30 PM to 7; 8 to 9:15; 11:45 to 1 AM.
WEAF, New York City, 492 (ESTDS)—6:45 AM to 7:45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAO, Ohio State University, 293.9 (EST)—8 PM to 10.
WEAR, Cleveland, O., 390 (EST)—11:30 AM to 12:10 PM; 3:30 to 4:10; 6:45 to 7:45.
WEEI, Boston, Mass., 476 (ESTDS)—6:45 AM to 8; 3 PM to 4; 5:30 to 10.
WEMC, Berrien Spring, Mich., 266 (CST)—8:15 PM to 11.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12:30 PM to 1.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30; 12 M to 1 AM.
WGCP, New York City, 252 (ESTDS)—2:30 PM to 5:18; 8 to 10.
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 7; 10:30 to 1 AM.
WGBS, New York City, 316 (ESTDS)—10 AM to 11 PM; 1:30 to 4; 6 to 7.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 PM; 5:30 to 11:30.
WGR, Buffalo, N. Y., 319 (ESTDS)—12 M to 12:45 PM; 2:30 to 4:30; 6:30 to 11.
WGY, Schenectady, N. Y., 379.5 (EST)—5:30 PM to 7:30.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12:15 PM; 4 to 5; 6 to 7:30; 8 to 10; 11:30 to 12:30 AM.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 368 (ESTDS)—2:15 PM to 5:30; 7:30 to 11; 11:30 to 12:30 AM.
WHO, Des Moines, Iowa, 526 (CST)—12:15 PM to 1:30; 6:30 to 12 M.
WHT, Chicago, Ill., 238 and 400 (CSTDS)—11 AM to 1 PM (238 meters); 7 to 8:30 (400 meters); 8:45 to 10:05 (238 meters); 10:30 to 1 AM (400 meters).
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 568 (ESTDS)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 8.
WJZ, New York City, 455 (ESTDS)—10 AM to 11; 1 PM to 2; 4 to 6; 6 to 11:30.
WKRC, Cincinnati, Ohio, 326 (EST)—8 PM to 10.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 7:30 to 9.
WLW, Cincinnati, O., 422.3 (EST)—10:45 AM to 12:15 PM; 1:30 to 2:30; 3 to 5; 6 to 11.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—6:30 PM to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 PM to 2; 3 to 3:30; 4 to 7:05; 9 to 11.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 12 M.
WPAK, Fargo, N. D., 283 (CST)—7:30 PM to 9.
WQJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to 4; 7 to 8; 10 to 2 AM.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 4 to 6:30.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (ESTDS)—11:59 AM to 2 PM; 7:59 to 9:55.
WSB, Atlanta, Ga., 428.3 (CST)—12 M to 1 PM; 2:30 to 3:30; 5 to 6; 10:45 to 12.
WSBF, St. Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4; 7:30 to 9
WWJ, Detroit, Mich., 352.7 (EST)—6 AM to 8:30; 9:30 to 10:30; 11:55 to 1:30 PM; 3 to 4; 6 to 7; 8 to 10.
KDKA, Pittsburgh, Pa., 309 (EST)—6 AM to 7; 9:45 to 12:15 PM; 2:30 to 3:20; 5:30 to 11.
KFAE, State College of Wash., 348.6 (PST)—7:30 PM to 9.
KFI, Los Angeles, Cal., 467, (PST)—5 PM to 11.
KFKX, Hastings, Neb., 288.3 (CST)—12:30 PM to 1:30 5:15 to 6:15; 9:30 to 12:30 A. M.
KFMQ, Fayettville, Ark., 299.8 (CST)—7:30 PM to 9.
KFNF, Shenandoah, Iowa, 266 (CST)—12:15 PM to 1:15; 3 to 4; 6:30 to 10.
KFOA, Seattle, Wash., 455 (PST)—12:30 PM to 1:30; 4 to 5:15; 6 to 10.
KGO, Oakland, Cal., 361.2 (PST)—11:30 AM to 1 PM; 1:30 to 2:30; 3 to 6:45.
KGW, Portland, Oregon, 491.5 (PST)—11:30 AM to 1:30 PM., 5 to 10.
KHJ, Los Angeles, Cal., 405.2 (PST)—7 AM to 7:15; 12 M to 1:30 PM; 5:30 to 12.
KJR, Seattle, Wash., 484.4 (PST)—9 AM to 1 AM.
KNX, Hollywood, Cal., 337 (PST)—1 PM to 2; 7 to 12.
KOB, State College of New Mexico, 348.6 (MST)—11:55 AM to 12:30 PM; 7:30 to 8:30; 9:55 to 10:10.
KOIL, Council Bluffs, Iowa, 278 (CST)—7:30 PM to 9.

The Weekly Rebus

KPO, San Francisco, Cal., 429 (PST)—7 AM to 8; 10:30 to 12 M; 1 PM to 2; 4:30 to 11.
KSD, St. Louis, Mo., 545.1 (CST)—7 PM to 10.
KTHS, Hot Springs, Ark., 374.8 (CST)—8:30 PM to 10.
KYW, Chicago, Ill., 536 (CSTDS)—6:30 AM to 7:30; 10:55 to 1 PM; 2:15 to 4; 6:02 to 11:30
PWX, Havana, Cuba, 400 (EST)—8:30 PM to
CNRM, Montreal, Quebec, Canada, 411 (ESTDS) 9 PM to 11.
CNRO, Ottawa, Ontario, Canada, 435 (EST)— PM to 11.

THURSDAY, AUGUST 13

WAAM, Newark, N. J., 263 (ESTDS)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—12 PM to 1:05.
WAMB, Minneapolis, Minn., 243.8 (CST)—12 M to 1 PM; 10 to 12 M.
WBBM, Chicago, Ill., 226 (CST)—8 PM to 10.
WBOQ, Richmond Hill, N. Y., 236 (ESTDS)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (ESTDS)—6 PM to 11:45.
WCAE, Pittsburgh, Pa., 461.3 (CSTDS)—12:30 PM to 1:30; 4:30 to 5:30; 6:30 to 11.
WCBD, Zion, Ill., 344.6 (CST)—8 PM to 10.
WCCO, St. Paul and Minneapolis, Minn., 416.4 (CST)—9 30 AM to 12 M, 1 30 PM to 4; 5:50 to 10.
WEAF, New York City, 492 (ESTDS)—6.45 AM to 7 45; 11 to 12 M; 4 PM to 5; 6 to 12.
WEAR, Cleveland, O., 390 (EST)—10:30 AM to 12 10 PM; 3 30 to 4 15; 7 to 11.
WEEI, Boston, Mass., 467 (ESTDS)—6:45 AM to 7:45; 1 PM to 2; 2:30 to 10.
WFAA, Dallas, Texas, 475.9 (CST)—10:30 AM to 11:30; 12 30 PM to 1; 2 30 to 6; 6.45 to 7; 8 30 to 9 30; 11 to 1 AM.
WFBH, New York City, 272.6 (ESTDS)—2 PM to 7:30
WGBS, New York City, 316 (ESTDS)—10 AM to 11; 1:30 PM to 4; 6 to 7.30
WGCP, New York City, 252 (ESTDS)—2.30 PM to 5:15
WGES, Chicago, Ill., 250 (CSTDS)—5 PM to 8; 10 30 to 1 AM
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:00 PM; 5.30 to 11:30.
WHAD, Milwaukee, Wis:. 275 (CST)—11 AM to 11:30; 6 PM to 7.15; 8:30 to 11.
WGR, Buffalo, N Y., 319 (ESTDS)—12 M to 12 45 PM, 2 to 4; 7 30 to 11.
WHAD, Milwaukee, Wis., 275 (CST)—11 AM to 12 15 PM; 4 to 5; 6 to 7 30, 8 to 10.
WHAS Louisville, Ky., 399 6 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 ESTDS)—2 15 PM to 5; 7 30 to 11; 11 30 to 12:30 AM
WHO, Des Moines, Iowa, 526 (CST)—7:30 PM to 9; 11 to 12.
WHT, Chicago, Ill., 400 (CSTDS)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM
WJY, New York City, 405 (ESTDS)—7:30 PM to 11:30.
WJZ, New York City, 455 (ESTDS)—10 AM to 11 PM; 1 to 2; 4 to 6; 7 to 12 M
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WLW, Cincinnati, O , 422.3 (EST)—10 40 AM to 12:15 PM; 1:30 to 5; 6 to 8; 10 to 11
WMAK, Lockport, N. Y., 265.5 (EST)—11 PM to 1 AM.
WMCA, New York City, 341 (ESTDS)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (ESTDS)—3:15 PM to 4 15; 6:50 to 11.
WOAW, Omaha, Neb., 526 (CST)—12:30 PM to 1:30; 5 45 to 11.
WOC, Davenport, Iowa, 484 (CST)—12:57 AM to 2 PM; 3 to 3:30; 4 to 7:10; 8 to 9.
WOR, Newark, N. J., 405 (ESTDS)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.
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WRC, Washington, D.C., 469 (EST)—1 PM to 2; 4 to 6:30
WREO, Lansing, Michigan, 285 5 (EST)—8.15 PM to 9 45; 10 to 11.
WRNY, New York City, 258 5 (ESTDS)—11:59 AM to 2 PM; 7:39 to 10.
WSB, Atlanta, Ga., 428 3 (CST)—12 M to 1 PM; 2:30 to 3 30; 5 to 6; 8 to 9; 10 45 to 12.
WSBF, St Louis, Mo., 273 (CST)—12 M to 1 PM; 3 to 4, 8 to 9
WWJ, Detroit, Mich., 352.7 (EST.—8 AM to 8:30; 9:30 to 10:30; 11 55 to 1:30; 3 to 4; 6 to 7; 8 to 9.
KDKA, Pittsburgh, Pa., 309 (EST)—9:45 AM to 12:15 PM; 2 30 to 3:30; 530 to 10:15.
KFAE, State College of Washington, 348.6 (PST) 7:30 PM to 9
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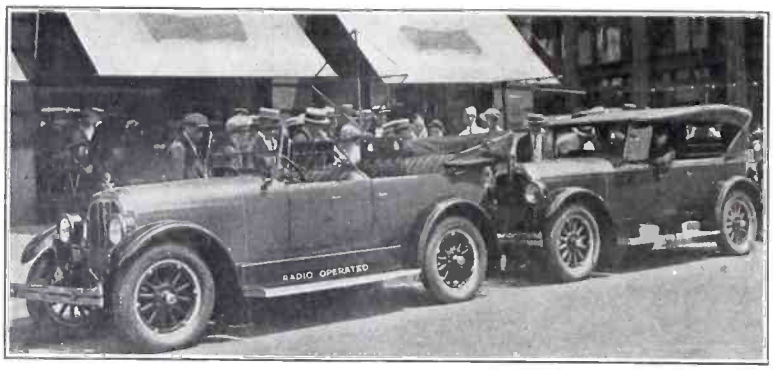
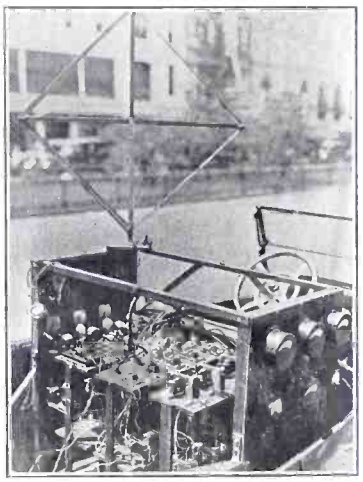
Phantom Auto a Success After Mishap Amid Crowd





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Three New Power Tubes

Three new types of tubes, designed solely for audio-frequency amplification and for use in the last stage, will be marketed. One is the UX120, a special dry-battery power amplifier tube, requiring 135 volts on the plate and 22½ volts grid bias which, when connected to the last audio stage will provide loud speaker volume approximately double that obtainable from the 201A.

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Lignon, 13 years old, a crippled youth

ouncer. Then came an orchestration
wn "Hello, everybody!"
ds in New England as well as else-
good-by, but only au revoir. I have
ek. And now I am tired. I want to

assisted me—the management of the
e and Telegraph Company, and the
ted me—all those I want to thank. I

rry on in my new theatre, which will
in October, 1926. From there I hope
s. To all those on the radio tonight,

ntinued as he turned to Major Bowes.
l obligation. You will be affected by
ve been."

ew Tube Bases, Three Types of r on Last Audio

will be known as UX112, which also requires 135 volts on the plate for maximum performance and which, when connected to the last audio stage gives speaker volume much in excess of that obtainable from a 201A tube in the last audio stage.

A third super-power amplifier tube is to be known as UX210, which provides speaker volume far in excess of any type of audio amplifier tube heretofore introduced. The filament of the UX210 may be operated directly from a 6-volt storage battery (no rheostat), with upward of 150 volts for the plate. It may also be used as a 7.5-watt transmitting tube or as an audio-frequency amplifier, the plate and filament current for which can be supplied by a rectifier-amplifier unit.

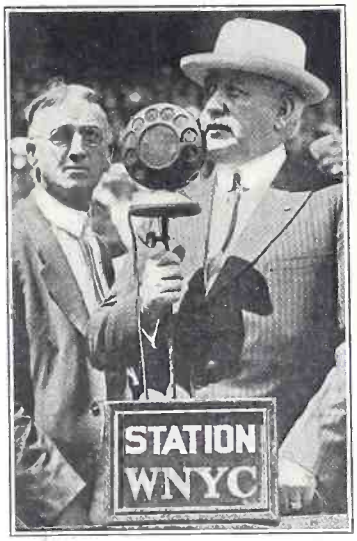
Rectifier Tubes, Also

It is also reported that the Radio Corporation will introduce two types of rectifier tubes for use in B battery eliminators and current supply device. One tube, known as UX216B, has an output of 65 milliamperes. This is a singleway or half-wave rectifier. There is another rectifier tube, known as UX213, which is a double-way or full-wave amplifier and which provides an output of 65 milliamperes for "B" battery eliminators and other similar current supply devices.

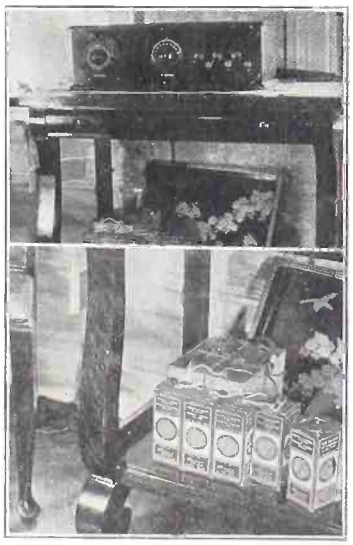
All of the new tubes are equipped with the UX base. Adapters will enable the use of these special tubes in the last audio stage of present receivers. All of the three amplifier tubes are low impedance tubes which provide improved quality of loud speaker reproduction.

None of these three supersedes existing types. The tubes will be delivered to the trade about September 1 the R. C. A. announced.

WNYC Fate Before Court



THE MICROPHONE of WNYC is being used for non-political purposes, for a change, since Leonard M. Wallstein, lawyer, 233 Broadway, New York City, started suit to close down the station as illegal. The suit was brought by Henry P. Fletcher as taxpayer, on behalf of the Citizens Union, of which Mr. Wallstein is chief counsel. Police Commissioner Enright is shown broadcasting details of a baseball game between teams of the Norfolk, Va., and New York police departments. As for the score, he had sad news to tell. (Underwood & Underwood.)

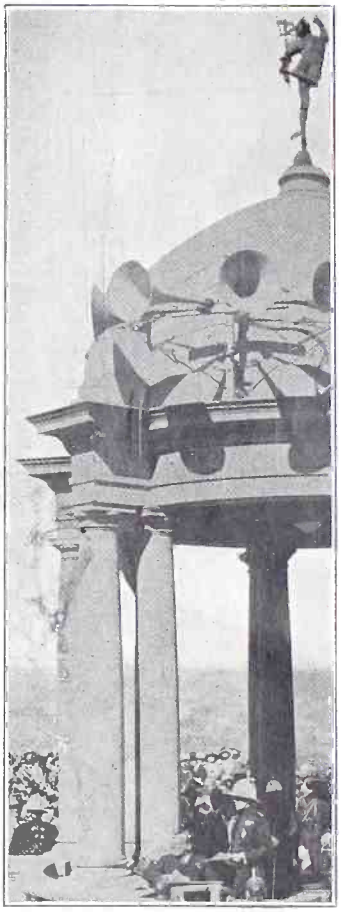


THE RADIO SET (top photo) these days is an ornament in the home. The batteries, if offensive to the aesthetic eye (lower photo) may be hidden beneath a 5-sided mahogany box, or shielded by a fancy curtain secured to a rod.

ESPERANTO ADOPTED

At the International Amateur Radio Congress in Paris recently, Esperanto was adopted as the official international radio language. It furnishes the medium for addresses and special courses broadcast from numerous European stations. Esperanto has a place in the curriculum of schools in many of the cities of Europe. Courses are frequently conducted for policemen, post office, hotel and industrial employees and for boy scouts.

Prince Heard By Thousands



THE PRINCE OF WALES replying to the address of welcome by means of the specially installed public speaking address system from a cupola in Johannesburg, South Africa. Note the microphone to the left of the Prince, also the loud speakers in the tower. (Underwood & Underwood)

A CLIP comes in handy for wired connections in experimental hookups. Leads may be changed very quickly. The contact is strong and is electrically sound. Two such clips on a panel or baseboard may be used for phone tip connections. The photo shows a clip in use on a push-pull rheostat in course of construction. (Hayden.)

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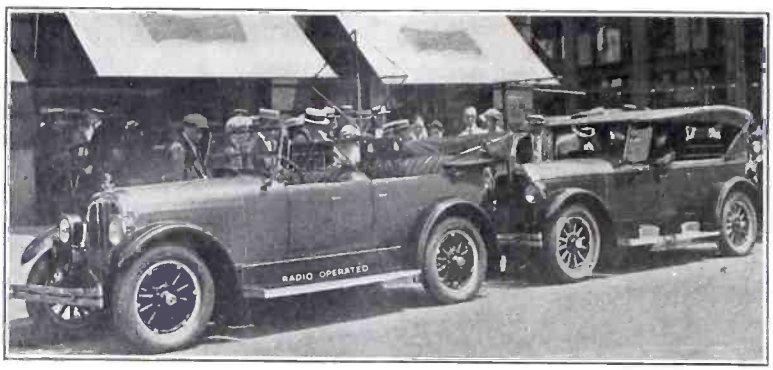

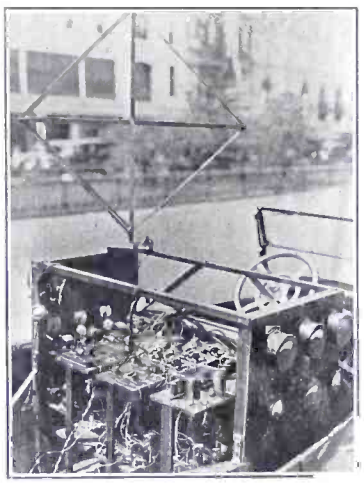

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good-by, but only au revoir. I have
ek. And now I am tired. I want to

assisted me—the management of the
e and Telegraph Company, and the
ted me—all those I want to thank. I

rry on in my new theatre, which will
in October, 1926. From there I hope
es. To all those on the radio tonight,

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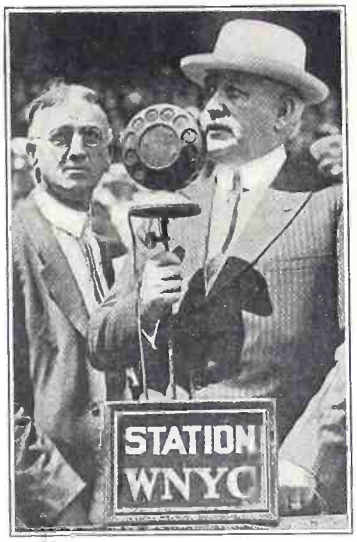

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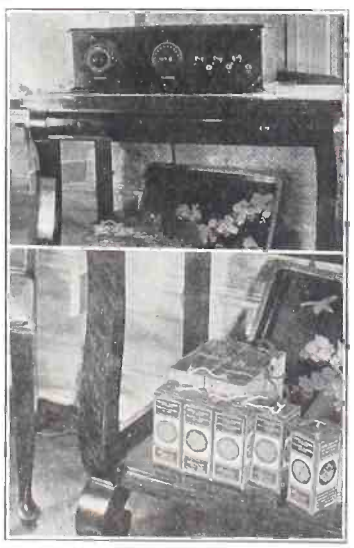

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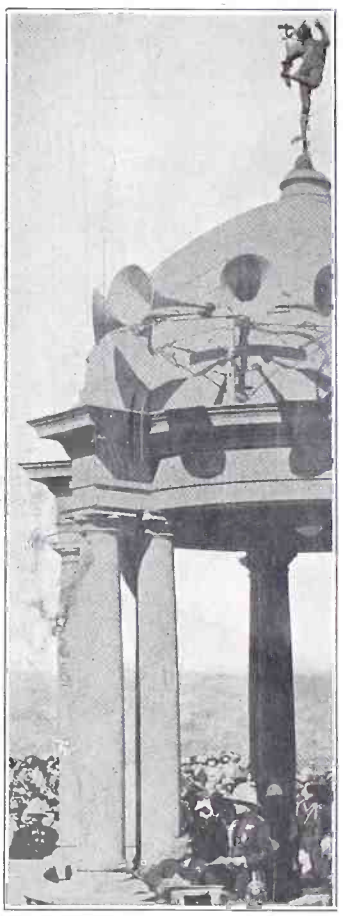

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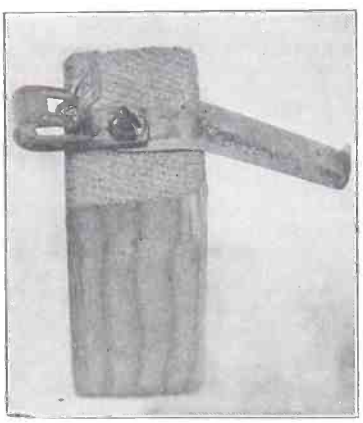

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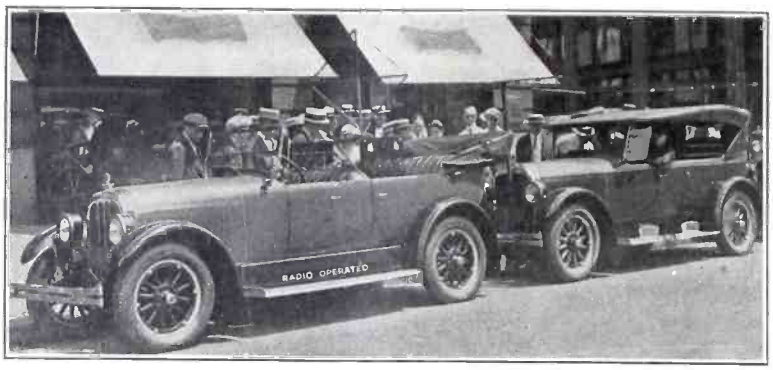
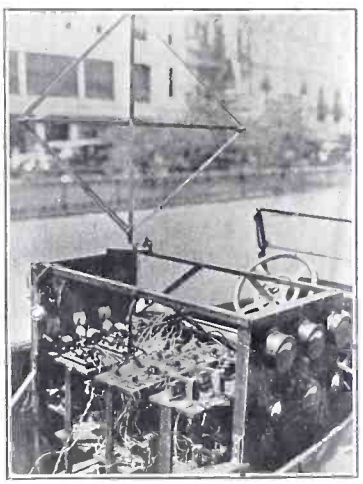
Phantom Auto a Success After Mishap Amid Crowd





THE radio operated auto at left in the upper photo is guided by waves from the car behind it. A cross-continental trip is planned. The other photo shows the receiving apparatus in the forward car.

(Kadel & Herbert.)

A radio-driven automobile, controlled by apparatus in another motorcar some yards behind, steered a wabbly course through heavy traffic on Broadway and Fifth Avenue, New York City, during a noon period, narrowly missing a speeding fire engine and crashing finally into a car in which moving picture men were grinding their cameras.

Blowing its horn, starting the engine, and sliding into its various gears, the radio automobile, as if a phantom hand were at the wheel, began its zig-zag career at Broadway and Sixty-second Street in front of the Hulett Motor Car Company, which supplied the exhibition automobiles.

Motorcycle policemen furnished escort to the novel caravan and Francis P. Houdina, demonstrator of the latest use to which wireless has been put, clung to the running board of the leading car, ready to take the wheel in an emergency. A crowd lined the sidewalks to watch.

A Slip-Up

A loose housing around the shaft to the steering wheel in the radio car caused the uncertain course as the procession got under way. As John Alexander of the Houdina Company, riding in the second car, applied the radio waves, the directing apparatus attached to the shaft in the other automobile failed to grasp it properly.

As a result the radio car careened from left to right, down Broadway, around Columbus Circle, and south on Fifth Avenue, almost running down two trucks and a milk wagon, which took to the curbs for safety.

Worked O. K. in Park

At Forty-seventh Street Houdina lunged for the steering wheel but could not prevent the car from crashing into the fender of an automobile filled with camera men. It was at Forty-third Street that a crash into a fire engine was barely averted. The police advised Houdina to postpone his experiments, but after the car had been driven up Broadway, it was once more operated by radio along Central Park drives.

The telegraph keys of a radio transmitter in the second car controlled the operations. The two radio waves of 109 and 120 meters, each operating one set of circuit breakers, were picked up by apparatus in the tonneau of the radio car.

When the control has been perfected, a tour across the continent will be made, Houdina declared. He is the head of a radio specialty company at 1,426 Broadway.

Harbord Gives Plans for Marine Solution

Two alternatives are open to the United States, in the opinion of General J. G. Harbord, President of the Radio Corporation of America, if this country is to establish a sound merchant marine policy. These are either continued Government operation at a cost, ultimately, of about $40,000,000 a year, or Government aid to private shipping at a cost of approximately $15,000,000 yearly. Failing the adoption of one of these plans, General Harbord sees the "gradual but certain disappearance of our flag from international trade routes and the return to pre-war trade conditions, when less than 10 per cent of our foreign commerce was carried in American vessels."

General Harbord spoke as Chairman of the Committee on the Relation of the Merchant Marine to American Foreign Trade and the National Defense, in New York City. This is one of four committees which are to hold hearings in various sections of the country and submit their findings to the National Merchant Marine Conference to be held this Fall under the auspices of the Chamber of Commerce of the United States, probably in Washington.

Roxy Quits

Roxy is out of the radio ranks. N night programs of the Capitol Theatre, a rest. On his return he will concer building. Maybe there'll be broadcasti as much. But it isn't settled. And, an

Major Edward Bowes, managing dir the duties performed by Roxy (S. A.

Mr. Rothafel was presentation mana charge of the broadcasting. His uniqu a nationwide reputation among radio was contemplated.

Before saying adieu he received a England Governors and many disabled brought to the Capitol studio by Edwa from Boston.

Major Bowes introdued the retiring rendering, followed by "Roxy's" well k

"I am eternally grateful to all my where," he said. "I am not going to worked three years here—seven days a take a rest.

"I want to thank all those who ha Capitol Theatre, the American Telep entire personnel who so wonderfully a will always cherish their co-operation.

"After my return from Europe I wil be named after me, when it is comple to keep my old friends and make new au revoir and God bless you.

"I'm turning over to you my gang," h "It is a great responsibility and a bea their loyalty many times, the same as

R. C. A. to Use N Also to Produce Bulbs for Pow

The Radio Corporation of America is going to produce "X" type tubes, with a "push" type base, but otherwise the same as the existing line. Mechanical and electrical superiority is claimed for the contact by the push method. The WD11 and C11 tubes have always embodied the push type.

Although the X tubes will have bases of two different sizes (the larger for the storage battery tubes), the contact pins will be identical.

The X-model 201A, 200 and 12 type tubes may be used interchangeably in the standard bayonet socket and the push socket.

The present 200, 201A, 199 and 11 tubes will be continued "as is," so long as the demand lasts. The new bases will be put on the 200, 201A, 199 and 12 type tubes. The present type base comprises the UV and WD lines, the new types being the "UX" and "WX."

Storage battery tubes of both lines may be used interchangeably in both present and new sockets, but the UX199 and UX12 will require different sockets than at present, or adapters.

Three New Power Tubes

Three new types of tubes, designed solely for audio-frequency amplification and for use in the last stage, will be marketed. One is the UX120, a special dry-battery power amplifier tube, requiring 135 volts on the plate and 22½ volts grid bias which, when connected to the last audio stage will provide loud speaker volume approximately double that obtainable from the 201A.

The R. C. A. has another special audio amplifier in the course of development for sets of the storage battery type. This

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y, Roxy's gone.
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hafel).
at the Capitol in addition to having
anner of presentation gained for him
. For several months his resignation

e birthday card signed by six New
terans and crippled children. It was
Lignon, 13 years old, a crippled youth

ouncer. Then came an orchestration
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ds in New England as well as else-
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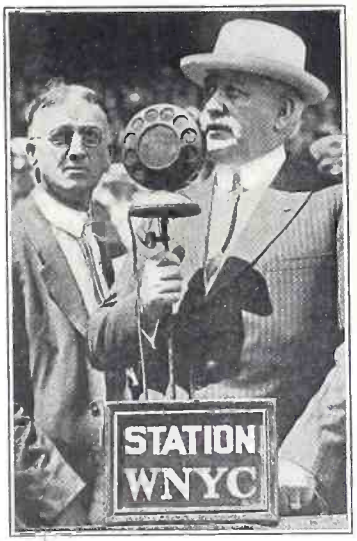

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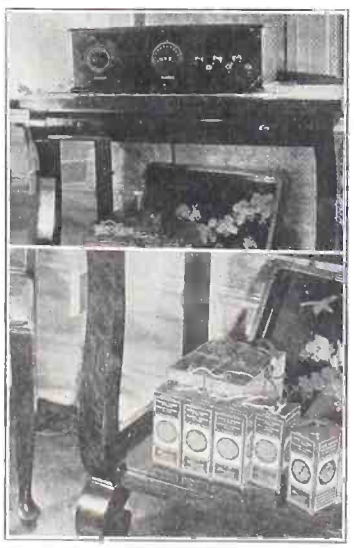

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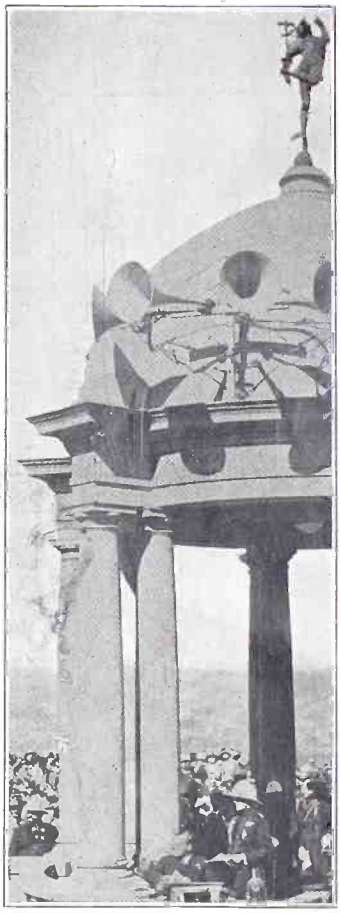

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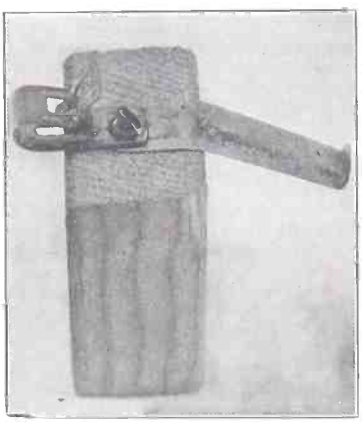

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A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Letters to The Radio University, RADIO WORLD, 1493 Broadway, New York City.

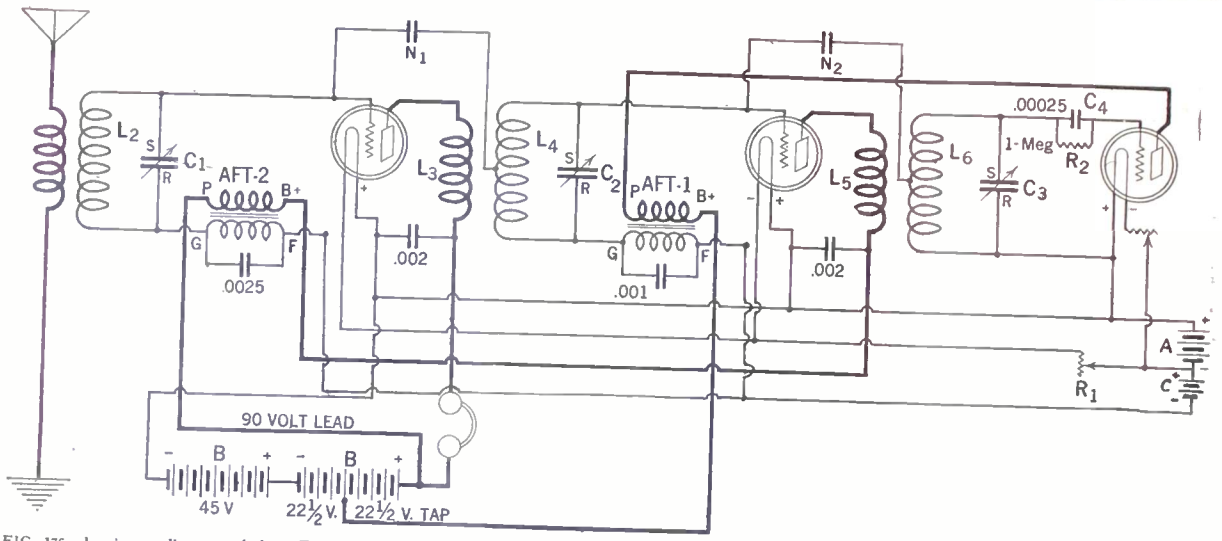


FIG. 176, showing a diagram of the 3-Tube Neutrodyne. This set is difficult to build, but when built properly gives tremendous volume. The antenna coil has 12 turns wound on a piece of tubing 4" high. Use No. 22 DCC wire. L2 has 45 turns, wound on the same tubing. Leave no spacing between L1 and L2. L3 has the same number of turns that the antenna coil has. L4 is a bit different than L2, in that there are 12 turns made and then a tap is taken; 33 more turns are wound. This makes a total of 45 turns. L5, L6 is wound in the same fashion as L3L4. All the coils are wound on 3½" forms of the same kind of wire. The capacities of all the variable condensers are .0005 mfd., normally 23 plates. AFT1 is a high ratio type, while AFT2 is a low ratio type. Use 201A tubes throughout. R1 is a 15-ohm rheostat and controls the first two tubes, while the other rheostat controls the last tube and has a resistance of 20 ohms. N1, N2 are both neutralizing condensers of variable capacity. The tap that was made is connected to one terminal of these condensers. This set does not radiate and is very simple to tune.

WILL YOU please give me a hookup of a 3-tube Neutrodyne which is very selective and loud. I am an experienced builder and do not mind if it is a bit difficult to build.—L. H. Notroman, Klingsley, Pa.

See Fig. 176.

* * *

I HAVE a thermiodyne set. I wonder if the Bretwood variable grid leak would be of service.—J. G. Whetstone, Huntsville, Ilinois.

Yes.

* * *

I AM interested in J. E. Anderson's Baby Super-Heterodyne as published in the July 11 issue of RADIO WORLD. (1) Is the set practical? (2) Approximately how far will it pull in on the speaker under average conditions? (3) As No. 22 DSC wire is difficult to get here, what wire can I substitute? (4) I have three variable condensers of .00023 mfd. capacity. Are these all right to use? (5) What wavelengths will this set tune to? (6) Can these condensers be used in the 3-tube Neutrodyne using the Reflex Plan, which was published in the May 30 issue of RADIO WORLD?—E. W. Miller, 1404 Summit St., Ft. Wayne, Ind.

(1) Yes. (2) About 300 miles. (3) No. 24 DSC. (4) Yes. (5) 190 to 550 meters. (6) Yes.

* * *

WOULD THERE be any increase in sensitivity if the first tube of a standard Super-Heterodyne were made regenerative? (2) Would such a detector tend to be unstable or to radiate, when used with a loop, with a center tap grounded to A minus. (3) Intermediate amplifier exhausts B battery current too much. Would a C battery result in any economy and where should it be connected? (4) There are 90 volts on the plate of both amplifiers. Tubes are of the one dollar variety. How can I get more volume?—Ansley Newman, 70 Main St., Buffalo, N. Y.

(1) The Pressley Super-Heterodyne which was described in the April 18 issue of RADIO WORLD employs such a scheme. (2) No. Ground to A plus. (3) No. (4) The tubes may be at fault. Good tubes mean good volume. The tubes are also the cause of a B battery running down quickly.

* * *

I HAVE a 180-degree variocoupler wound to cover the broadcast wavelengths. It is 3½" in diameter. There are 14 turns on the primary and 41 turns on the secondary. Could I use it in The Diamond of the Air?—Harry Lince, 140 Marth St., Allegan, Mich.

Yes, with .0005 mfd. condenser.

* * *

CAN THE Bremer-Tully old-style 3-circuit tuner with extra loading coil and new style air core transformer with adjustable primary be incorporated in The Diamond?—E. P. Baker, Vancouver, B. C., Canada.

Yes.

* * *

HOW WOULD you test the insulation of the antenna?—L. D. Caples, Buyor, N. D.

Insert a spark gap in series with the antenna and energize the antenna circuit with the high voltage from the secondary winding of an AC transformer. If the insulators are leaking the energy instead of discharging across the spark gap will pass across the insulators down the poles and then into the ground system, completely short-circuiting the transformer.

* * *

WHAT IS the difference between an alternating current generator with slip rings and a direct current motor?—P. L. Nomon, Altaba, Alaska.

The direct current motor uses a direct current to produce mechanical work, while the alternating current generator makes AC by the rotation of the armature, which has slip rings and brushes in a magnetic field. The instrument that leads the current from the alternating current generator is made up of two slip rings. The instrument for leading the current, coming into the armature of the motor, is made up out of a commutator. This commutator has many segments, which are connected to the terminals of the armature coils, in such a manner as to produce rotation. The field current for the motor comes from the power source which drives the armature, while in the case of the alternating generator, it is usually supplied from an external direct current source.

* * *

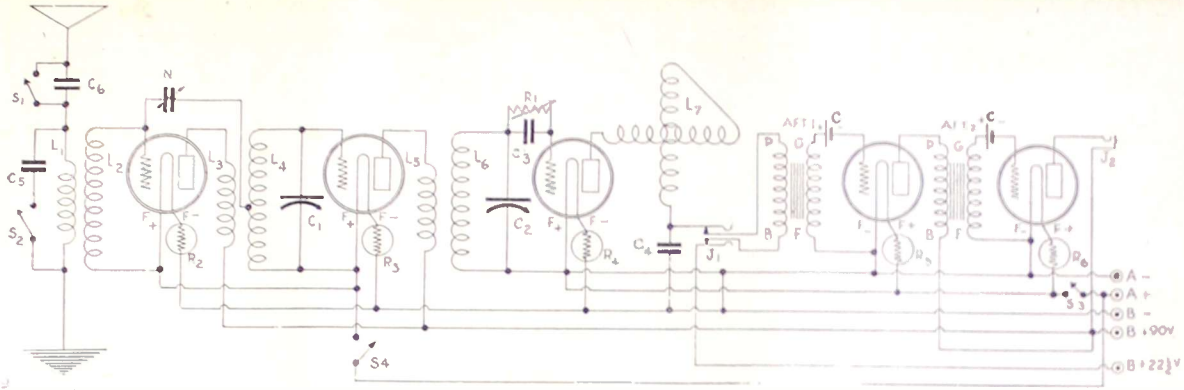
I HAVE a transmitter with an output of 50 watts, the plate supply of current coming from a motor generator set. The starting resistance for my motor has burned out and there is no way that I can either get a new one or fix this one. Could you help me?—P. Y. Yoldman, Arsanos, New Zealand.

There is a very simple remedy for this. Take an iron pot and fill it up with salt water (no other kind of water will do). Get a piece of iron, about half the length of the pail, also about the same width as the pail. Put one end of this plate to the 110-volt mains and a rope which has a pulley to the same terminal. The bottom of the pail goes to one terminal of the motor and also to the shunt winding while the other motor terminal and shunt winding goes to the 110 volt mains. Lower the iron plate in the water slowly. As this is done, the resistance of the armature will be reduced until the motor starts, drop the plate further into the pail until it touches the bottom. At this point the whole resistance is cut out of the circuit. At his point the armature is connected directly across the power source. You will have to be very careful when operating this little device as there is a chance of starting the motor too fast and burning out the armature.

* * *

I HAVE a 3-circuit tuner, some .00035 variable condensers and 301A tubes. Can these parts be utilized to build The Diamond of the Air and if so, what changes would you suggest in wiring the circuit.—H. J. Wittner, Wash., D. C.

Add on 5 turns to the secondary and tickler of the tuner and 5 turns to the



177, showing the diagram of the 5-tube receiver requested by J. K. Newman. L1 L2 is a commercial radio-frequency transformer (fixed type). L3 is wound on a tubing 3" in diameter and contains 12 turns, using No. 22 DCC wire. L4 has 46 turns wound on the same tubing, with no spacing left between the two windings. At the 13th turn of L4 bring out a tap for the purpose of connecting the neutralizing condenser. L5 has 12 turns wound on a tubing 3" in diameter and 4" high. Leave no space, wind 46 turns for the secondary L6. There is no tap taken on this coil. L7 is a commercial variometer. C1C2 are both .0005 mfd. variable condensers. R2, R3, R4, R5, R6 are all amperites to match the tubes used. C3 is a .00025 mfd. fixed condenser. C4 is a .001 mfd. fixed condenser. This condenser may have to be omitted in order to obtain more regeneration. J1 is a double-circuit jack, while J2 is a single circuit jack. R1 is a variable grid leak. C5 and C6 are both .001 mfd. fixed condensers. N, the neutralizing condenser, is variable. AFT 1 and AFT 2 are both audio-ratio transformers. S4 is the switch that turns off the first three tubes, while S3 is the switch that turns off the last two tubes. Use 201A tubes throughout, although dry cell tubes will work well, too.

secondary of the RFT, if you are using an antenna.

* * *

PLEASE GIVE me a diagram of a 5-tube set, which employs a step of untuned radio-frequency, a step of tuned radio-frequency, which is neutralized, a regenerative detector, and two steps of audio-frequency amplification.—J. K. Newman, Tri-City, Ind.

See Fig. 177.

* * *

A CIRCUIT of a 6-tube receiver, single control, is requested.—G Y. Reser, Portland, Me.

See Fig. 178.

PLEASE give the constants for the set described by Sidney E. Finkelstein, August 1 issue, one RF, detector, one transformer audio, three resistance audio. —J. E. Bosch, Detroit, Mich.

L1L2 is a radio-frequency transformer, tuned by C1, a .005 mfd. variable condenser. C2 also is .005 mfd. L3L4L5 is a 3-circuit tuning coil along the same line as the one used in the regulation type of sets. C3 is .00025 mfd. R3 is a variable resistance, maximum setting 100,000 ohms. C4 is .001 mfd. R1 and R2 are 20 ohms each, for the 5-volt tubes. The variable grid leak should have a range from 250,000 ohms (¼ megohm) to 8,000,000 or 10,000,000 ohms (8 or 10 megohms). C5 is .002 mfd. B represents the ballast resistances. The isolating condensers may be .006 mfd., if one must follow habits, or, if you feel inclined to be agreeable select 5 mfd. The plate resistors are 100,000 ohms each (0.1 megohm), while the grid leaks in the resistance amplifier are 1,000,000 ohms (1.0 megohm), 500,000 ohms (0.5 megohm) and 250,000 ohms (0.25 megohm) respectively, and are so designated in the diagram. The method of wiring is to have the plate resistors go from plate to B plus, while the leaks in the audio circuit go from grid to minus A, the fixed condenser isolating the plate and grid ends of the resistors and leaks.

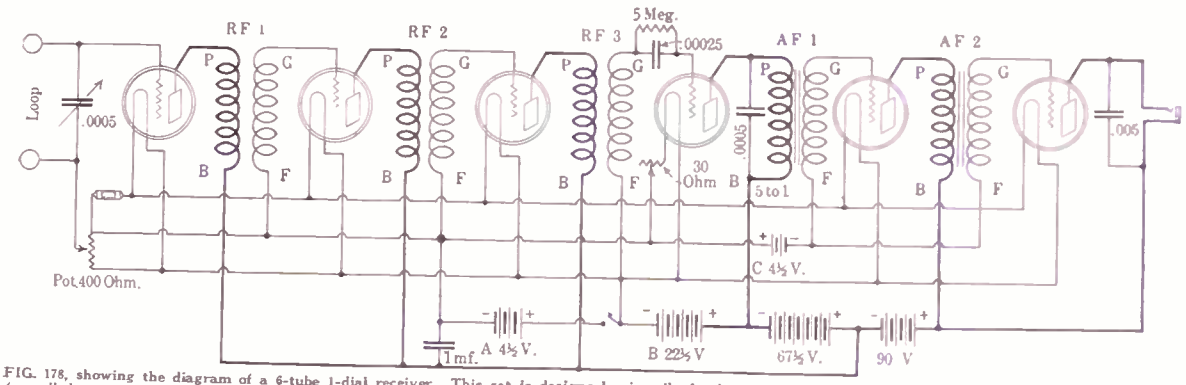


FIG. 178, showing the diagram of a 6-tube 1-dial receiver. This set is designed primarily for loop reception. The radio-frequency transformers are all fixed (so-called untuned). Any type of tubes may be used here. The loop has 20 turns, wound on an 18" square and spaced every half inch. A ballast resistance (Daven) controls the amplifier filaments.

IN LOOKING over the Jan. 31 issue of RADIO WORLD I discovered the Transcontinental 2-tube set, which I desire to make. I found that you did not give the capacity of the fixed grid condenser (C4), the grid leak (R3) and the two rheostats.—Norman Drake, 1340 Nivan, Wichita, Kansas.

The capacity of the fixed grid condenser is .00025 mfd., the grid leak has a resistance of 2 megohms, the rheostats 20 ohms apiece.

* * *

I AM building The Diamond of the Air. (1) Could I use an Ambassador coil for the coupler? (2) Could I use a Rico loud speaker for this set? (3) Could I use a variable resistance across the primary of the first transformer? (4) Would this set work without a C battery?—T. Gambino, 2526 Stillwell, Brooklyn, N. Y.

(1) Yes. (2) Yes. (3) Yes. (4) Yes, but your B battery will not last so long.

A THOUGHT FOR THE WEEK—There may be only six fundamental hookups, but a single lifetime is all too short to learn all that's to be known about them

RADIO WORLD

The Link Connecting Radio Fan, Dealer, Jobber, Distributor and Manufacturer

Radio World's Slogan: "A radio set for every home."

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HENNESSY RADIO PUBLICATIONS CORPORATION
ROLAND B. BURKE HENNESSY, President
M. B. HENNESSY, Vice President
FRED S. CLARK, Secretary and Manager
1493 BROADWAY, NEW YORK, N. Y.
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European Representatives: The International News Co., Breams Bldgs., Chancery Lane, London, Eng.
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San Francisco: Lloyd B. Chappell, 656 O'Farrell St.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard

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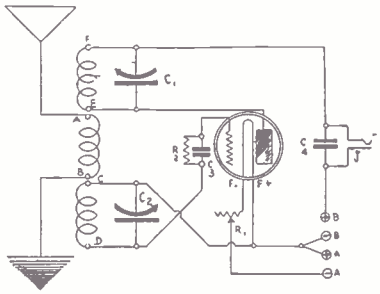

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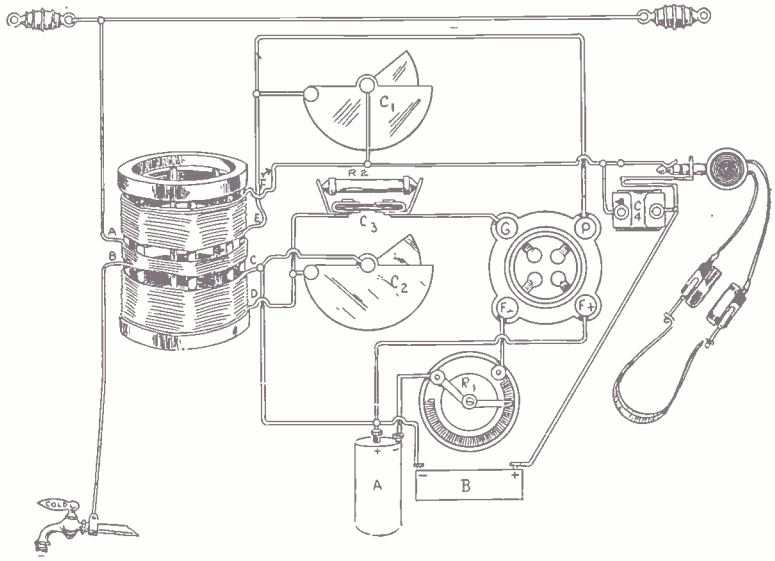

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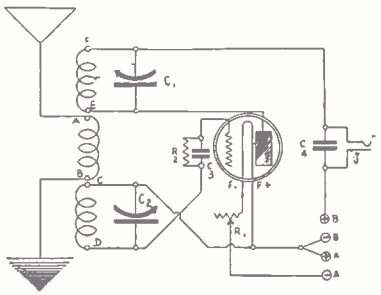

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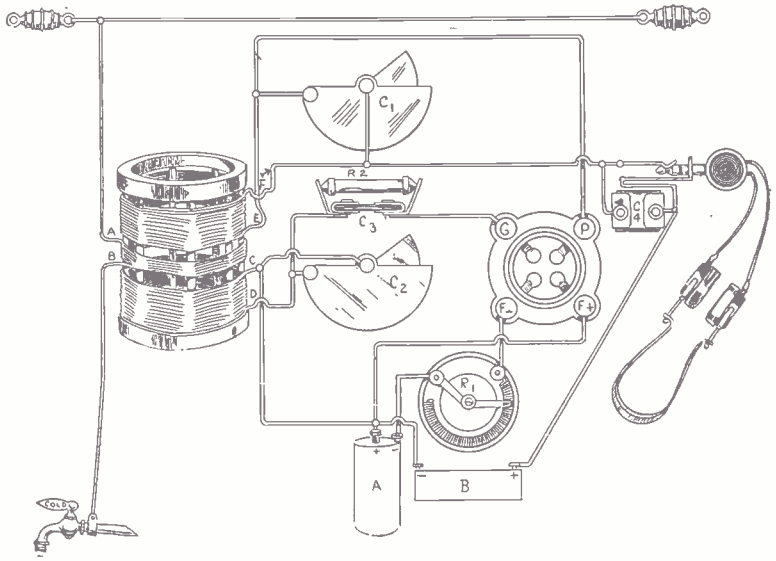

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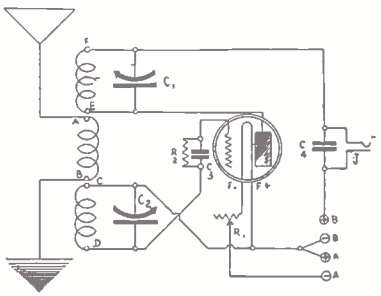
I have built the "Simple DX Set for the Novice," described in the May 23 issue of RADIO WORLD, and in the short time that I have had this set I am convinced it is a little wonder. It has wonderful DX possibilities. During the latter part of June and the beginning of July, a time of the year known to be bad for DX, I have received 37 stations. Among these are: WCBD, Zion City, Ill.; WTAM, Cleveland, O.; WSAI, Cincinnati, O.; CNRA, New Brunswick, Canada; WDAF, Kansas City, Kans. If that can be done in summer, you can imagine what can be done in the winter. The outstanding feature in this set is the great selectivity. It can separate and bring in clearly stations just a few meters apart, for example station CNRA, on 313 meters, was brought in through WGBS, 316 meters, and KDKA on 309 meters. Now if this isn't selectivity, I would like to know what is. Another virtue of this set is its volume and clearness, both of which ought not be neglected in the least. I use a C301 A tube with 20 volts on the plate, two USL condensers and a uni-vernier dial for tuning the secondary condenser.

LEON GREENE,
408 Hopkins Ave., Brooklyn, N. Y.



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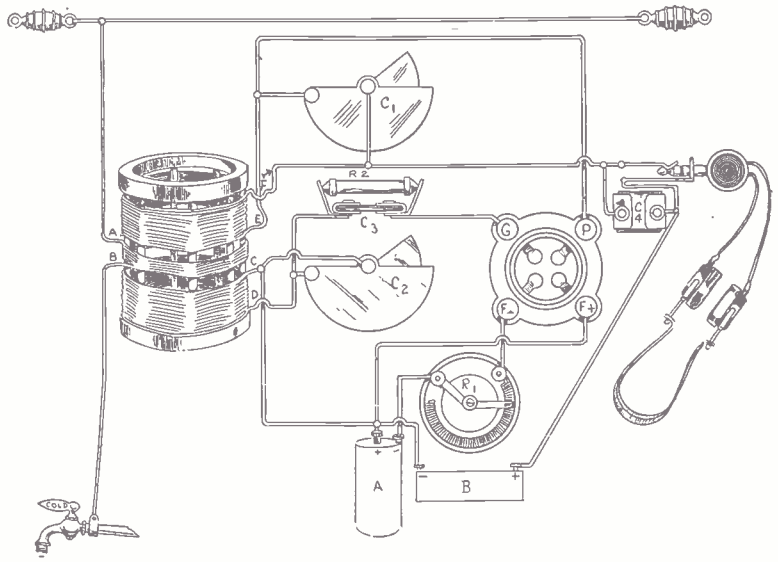

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THE RADIO UNIVERSITY

A QUESTION and Answer Department conducted by RADIO WORLD for its Readers by its staff of Experts. Address Letters to The Radio University, RADIO WORLD, 1493 Broadway, New York City.

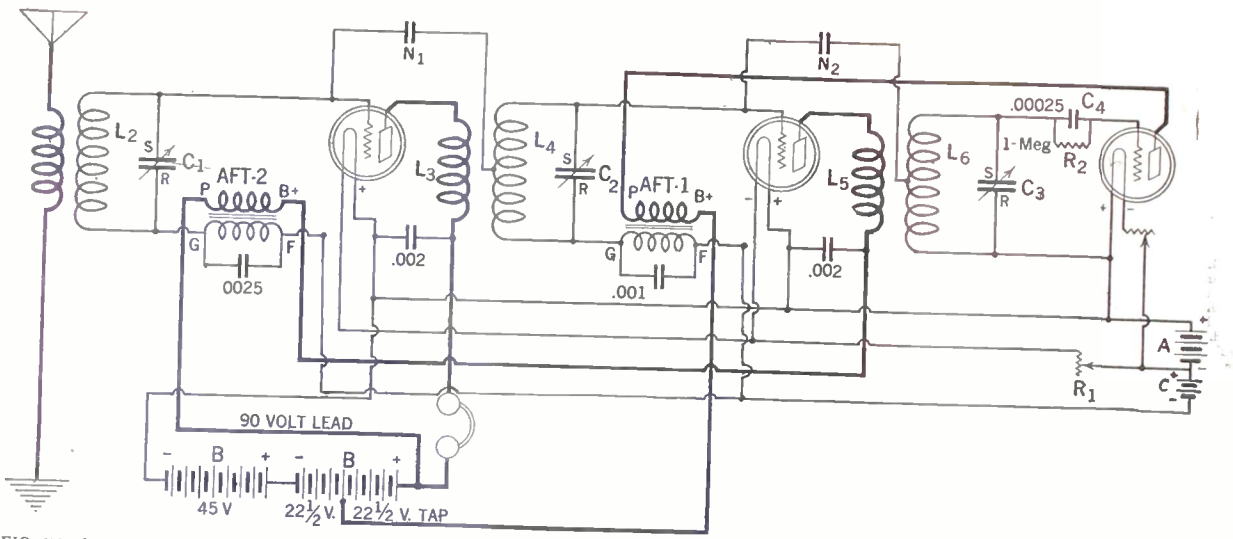


FIG. 176, showing a diagram of the 3-Tube Neutrodyne. This set is difficult to build, but when built properly gives tremendous volume. The antenna coil has 12 turns wound on a piece of tubing 4" high. Use No. 22 DCC wire. L2 has 45 turns, wound on the same tubing. Leave no spacing between L1 and L2. L3 has the same number of turns that the antenna coil has. L4 is a bit different than L2, in that there are 12 turns made and then a tap is taken; 33 more turns are wound. This makes a total of 45 turns. L5, L6 is wound in the same fashion as L3L4. All the coils are wound on 3½" forms of the same kind of wire. The capacities of all the variable condensers are .0005 mfd., normally 23 plates. AFT1 is a high ratio type, while AFT2 is a low ratio type. Use 201A tubes throughout. R1 is a 15-ohm rheostat and controls the first two tubes, while the other rheostat controls the last tube and has a resistance of 20 ohms. N1, N2 are both neutralizing condensers of variable capacity. The tap that was made is connected to one terminal of these condensers. This set does not radiate and is very simple to tune.

WILL YOU please give me a hookup of a 3-tube Neutrodyne which is very selective and loud. I am an experienced builder and do not mind if it is a bit difficult to build.—L. H. Notroman, Klingsley, Pa.

See Fig. 176.

* * *

I HAVE a thermiodyne set. I wonder if the Bretwood variable grid leak would be of service.—J. G. Whetstone, Huntsville, Ilinois.

Yes.

* * *

I AM interested in J. E. Anderson's Baby Super-Heterodyne as published in the July 11 issue of RADIO WORLD. (1) Is the set practical? (2) Approximately how far will it pull in on the speaker under average conditions? (3) As No. 22 DSC wire is difficult to get here, what wire can I substitute? (4) I have three variable condensers of .00023 mfd. capacity. Are these all right to use? (5) What wavelengths will this set tune to? (6) Can these condensers be used in the 3-tube Neutrodyne using the Reflex Plan, which was published in the May 30 issue of RADIO WORLD?—E. W. Miller, 1404 Summit St., Ft. Wayne, Ind.

(1) Yes. (2) About 300 miles. (3) No. 24 DSC. (4) Yes. (5) 190 to 550 meters. (6) Yes.

* * *

WOULD THERE be any increase in sensitivity if the first tube of a standard Super-Heterodyne were made regenerative? (2) Would such a detector tend to be unstable or to radiate, when used with a loop, with a center tap grounded to A minus. (3) Intermediate amplifier exhausts B battery current too much. Would a C battery result in any economy and where should it be connected? (4) There are 90 volts on the plate of both amplifiers. Tubes are of the one dollar variety. How can I get more volume?—Ansley Newman. 70 Main St., Buffalo, N. Y.

(1) The Pressley Super-Heterodyne which was described in the April 18 issue of RADIO WORLD employs such a scheme. (2) No. Ground to A plus. (3) No. (4) The tubes may be at fault. Good tubes mean good volume. The tubes are also the cause of a B battery running down quickly.

* * *

I HAVE a 180-degree variocoupler wound to cover the broadcast wavelengths. It is 3½" in diameter. There are 14 turns on the primary and 41 turns on the secondary. Could I use it in The Diamond of the Air?—Harry Lince, 140 Marth St., Allegan, Mich.

Yes, with .0005 mfd. condenser.

* * *

CAN THE Bremer-Tully old-style 3-circuit tuner with extra loading coil and new style air core transformer with adjustable primary be incorporated in The Diamond?—E. P. Baker, Vancouver, B. C., Canada.

Yes.

* * *

HOW WOULD you test the insulation of the antenna?—L. D. Caples, Buyor, N. D.

Insert a spark gap in series with the antenna and energize the antenna circuit with the high voltage from the secondary winding of an AC transformer. If the insulators are leaking the energy instead of discharging across the spark gap will pass across the insulators down the poles and then into the ground system, completely short-circuiting the transformer.

* * *

WHAT IS the difference between an alternating current generator with slip rings and a direct current motor?—P. L. Nomon, Altaba, Alaska.

The direct current motor uses a direct current to produce mechanical work, while the alternating current generator makes AC by the rotation of the armature, which has slip rings and brushes in a magnetic field. The instrument that leads the current from the alternating current generator is made up of two slip rings. The instrument for leading the current, coming into the armature of the motor, is made up out of a commutator. This commutator has many segments, which are connected to the terminals of the armature coils, in such a manner as to produce rotation. The field current for the motor comes from the power source which drives the armature, while in the case of the alternating generator, it is usually supplied from an external direct current source.

* * *

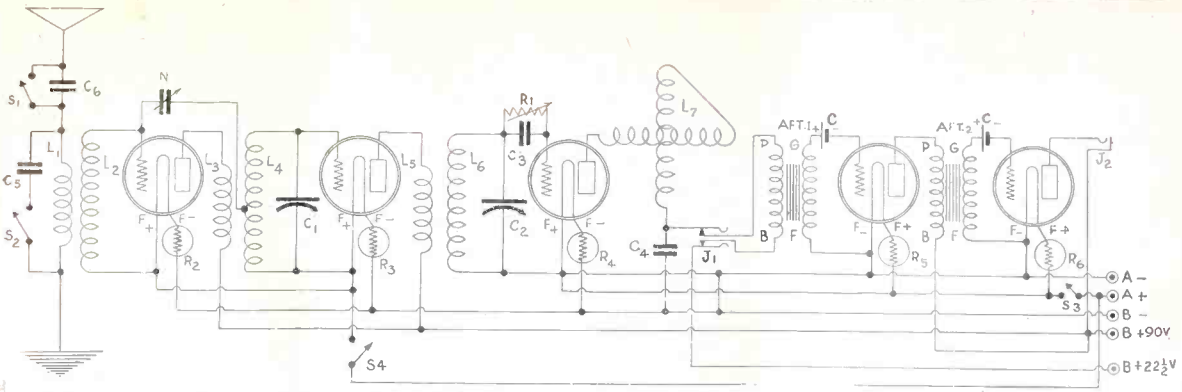
I HAVE a transmitter with an output of 50 watts, the plate supply of current coming from a motor generator set. The starting resistance for my motor has burned out and there is no way that I can either get a new one or fix this one. Could you help me?—P. Y. Yoldman, Arsanos, New Zealand.

There is a very simple remedy for this. Take an iron pot and fill it up with salt water (no other kind of water will do). Get a piece of iron, about half the length of the pail, also about the same width as the pail. Put one end of this plate to the 110-volt mains and a rope which has a pulley to the same terminal. The bottom of the pail goes to one terminal of the motor and also to the shunt winding while the other motor terminal and shunt winding goes to the 110 volt mains. Lower the iron plate in the water slowly. As this is done, the resistance of the armature will be reduced until the motor starts. drop the plate further into the pail until it touches the bottom. At this point the whole resistance is cut out of the circuit. At his point the armature is connected directly across the power source. You will have to be very careful when operating this little device as there is a chance of starting the motor too fast and burning out the armature.

* * *

I HAVE a 3-circuit tuner, some .00035 variable condensers and 301A tubes. Can these parts be utilized to build The Diamond of the Air and if so, what changes would you suggest in wiring the circuit.—H. J. Wittner, Wash., D. C.

Add on 5 turns to the secondary and tickler of the tuner and 5 turns to the



177, showing the diagram of the 5-tube receiver requested by J. K. Newman. L1 L2 is a commercial radio-frequency transformer (fixed type). L3 is wound on a tubing 3" in diameter and contains 12 turns, using No. 22 DCC wire. L4 has 46 turns wound on the same tubing, with no spacing left between the two windings. At the 13th turn of L4 bring out a tap for the purpose of connecting the neutralizing condenser. L5 has 12 turns wound on a tubing 3" in diameter and 4" high. Leave no space, wind 46 turns for the secondary L6. There is no tap taken on this coil. L7 is a commercial variometer. C1C2 are both .0005 mfd. variable condensers. R2, R3, R4, R5, R6 are all amperites to match the tubes used. C3 is a .00025 mfd. fixed condenser. C4 is a .001 mfd. fixed condenser. This condenser may have to be omitted in order to obtain more regeneration. J1 is a double-circuit jack, while J2 is a single circuit jack. R1 is a variable grid leak. C5 and C6 are both .001 mfd. fixed condensers. N, the neutralizing condenser, is variable. AFT 1 and AFT 2 are both low-ratio transformers. S4 is the switch that turns off the first three tubes, while S3 is the switch that turns off the last two tubes. Use 201A tubes throughout, although dry cell tubes will work well, too.

secondary of the RFT, if you are using an antenna.

* * *

PLEASE GIVE me a diagram of a 5-tube set, which employs a step of untuned radio-frequency, a step of tuned radio-frequency, which is neutralized, a regenerative detector, and two steps of audio-frequency amplification.—J. K. Newman, Tri-City, Ind.

See Fig. 177.

* * *

A CIRCUIT of a 6-tube receiver, single control, is requested.—G. Y. Reser, Portland, Me.

See Fig. 178.

PLEASE give the constants for the set described by Sidney E. Finkelstein, August 1 issue, one RF, detector, one transformer audio, three resistance audio. —J. E. Bosch, Detroit, Mich.

L1L2 is a radio-frequency transformer, tuned by C1, a .005 mfd. variable condenser. C2 also is .005 mfd. L3L4L5 is a 3-circuit tuning coil along the same line as the one used in the regulation type of sets. C3 is .00025 mfd. R3 is a variable resistance, maximum setting 100,000 ohms. C4 is .001 mfd. R1 and R2 are 20 ohms each, for the 5-volt tubes. The variable grid leak should have a range from 250,000 ohms (¼ megohm) to 8,000,000 or 10,000,000 ohms (8 or 10 megohms). C5 is .002 mfd. B represents the ballast resistances. The isolating condensers may be .006 mfd., if one must follow habits, or, if you feel inclined to be agreeable select .5 mfd. The plate resistors are 100,000 ohms each (0.1 megohm), while the grid leaks in the resistance amplifier are 1,000,000 ohms (1.0 megohm), 500,000 ohms (0.5 megohm) and 250,000 ohms (0.25 megohm) respectively, and are so designated in the diagram. The method of wiring is to have the plate resistors go from plate to B plus, while the leaks in the audio circuit go from grid to minus A, the fixed condenser isolating the plate and grid ends of the resistors and leaks.

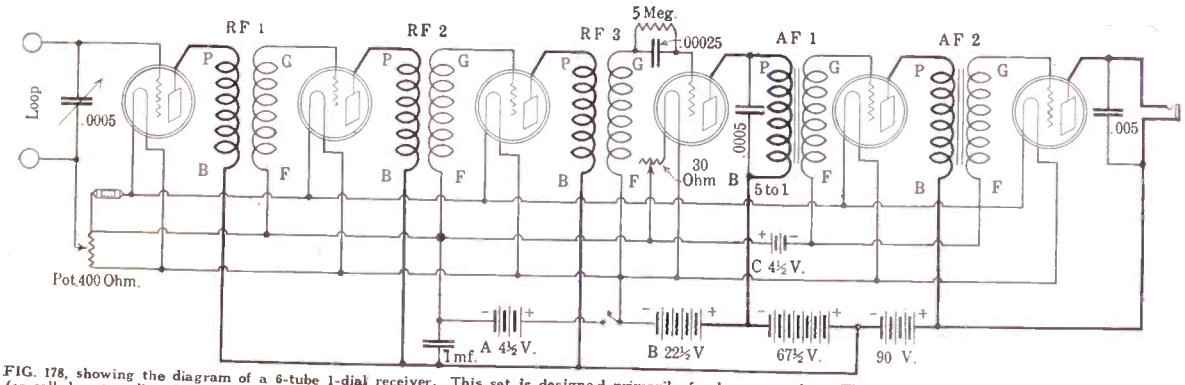


FIG. 178, showing the diagram of a 6-tube 1-dial receiver. This set is designed primarily for loop reception. The radio-frequency transformers are all fixed (so-called untuned). Any type of tubes may be used here. The loop has 20 turns, wound on an 18" square and spaced every half inch. A ballast resistance (Daven) controls the amplifier filaments.

IN LOOKING over the Jan. 31 issue of RADIO WORLD I discovered the Transcontinental 2-tube set, which I desire to make. I found that you did not give the capacity of the fixed grid condenser (C4), the grid leak (R3) and the two rheostats. —Norman Drake, 1340 Nivan, Wichita, Kansas.

The capacity of the fixed grid condenser is .00025 mfd., the grid leak has a resistance of 2 megohms, the rheostats 20 ohms apiece.

* * *

I AM building The Diamond of the Air. (1) Could I use an Ambassador coil for the coupler? (2) Could I use a Rico loud speaker for this set? (3) Could I use a variable resistance across the primary of the first transformer? (4) Would this set work without a C battery?—T. Gambino, 2526 Stillwell, Brooklyn, N. Y.

(1) Yes. (2) Yes. (3) Yes. (4) Yes, but your B battery will not last so long.

A THOUGHT FOR THE WEEK—There may be only six fundamental hookups, but a single lifetime is all too short to learn all that's to be known about them.

RADIO WORLD

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MANAGING EDITOR: Herman Bernard

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AUGUST 8, 1925

One-Sided Joy

A REGENERATIVE NEUTRODYNE FOR MORE DX

This article, with comprehensive illustrations, appeared in RADIO WORLD dated January 31, 1925. 15c per copy.

RADIO WORLD, 1493 Broadway, New York

The Conference Should Be Held!

SOME of Secretary Hoover's advisers are opposed to holding the Fourth National Radio Conference, on the ground that the Department of Commerce has no power to carry out any recommendations that the Conference might make on the important radio problems of the day.

It is true indeed that Congress has been disappointingly perverse about conferring power on some agency to cope with the great problems that fast-developing radio engenders. There has long seemed to be general belief that the Department of Commerce should enjoy these powers. But bills designated to ameliorate radio conditions always seem to get lost in the shuffle as Congress goes through its helter skelter operation of clearing the decks for the trip home.

That should not deter those who have the interest of radio close to their heart from conferring this year, as they have done during previous Falls and coming to an understanding. It is decidedly helpful that such a gathering be held, that the conflicting views be aired and that all should thereby reach a more sympathetic appreciation of the many phases of the problems. Not only do those who attend the conference thereby gain greater breadth, to help them see the situation correctly and with sane coolness, but as the Conference receives widespread publicity the general public becomes better acquainted with the facts. Hence as an instrumentality of public information, and thus the moulder of well informed public opinion, the Conference would justify its existence. Even some backward members of the House of Representatives and some unenhanced Senators might be brought around to a more intelligent viewpoint regarding radio problems and the necessity for solving them.

While at the present stage it would be an academic rather than a legally practical Conference, one may hope that this time, in spite of previous contrary experience, the exposed needs and the co-operative plans for meeting them might be embodied in a bill that by some mischance might become law.

There is no occasion for calling off the Conference which Secretary Hoover himself had announced would be held, a decision which some of his advisers will counsel him to reverse, when he returns to Washington. It is a weakness indeed to sacrifice principle to the practical exigencies of the moment. The atmosphere of impossibility with which some would surround the suggestion of a Conference is rather assumptive at best. It should not be for the friends of radio to accept defeat before the battle. If the plan is to stir public opinion by calling off the Conference, so that Congress may be shamed or frightened into action, the history of political scheming lends little encouragement to such hopeful souls.

There is much at stake in radio today and its problems are of vast concern. Besides the millions of broadcast listeners who turn attentive ears to the loud speaker for enjoyment and information, even indeed education, there are the commercial interests whose welfare should not be ignored because of the numerical minority of their membership. The stations that cause unwitting interference, those that are not very successful in delivering their programs to the public because of inutile wave lengths, the prospective stations that want a place on the air, the greater institutions that are using increased Power and planning further to augment the output wattage, the stations now using or building Super Power transmitters, the wholesale manufacturers of radio sets, parts and accessories, their jobbing and retailing adjuncts and co-workers—all these have are under the common cloak. If it is porous and unshielding, they suffer, and that means an imposing body of the general public.

Their opinion probably would be in favor of holding the Conference, for to the conferees, always men high in radio ranks, all these diversified classes look for facts and guidance. As an informational institution alone the Conference justifies its existence. Let not the dour expectations of well intentioned but erring experts defeat the hopes of the many that the conclave will go on.

If Congress receives the best advice of the moment from a self-supported Conference and ignores that advice we will know again that Congress is to blame. Otherwise we might suspect that the Department of Commerce is losing interest!

Talk of Hoover Cancelling Conference Because Lacking Power to Enforce Its Plans

By Thomas Stevenson

WASHINGTON.

There is a growing possibility that Secretary of Commerce Hoover may not call a national radio conference to meet in Washington this Fall. In the opinion of Government officials little or nothing can be accomplished by a conference. About the only thing that can help the present siaution, they assert, is legislation giving the Department of Commerce or some other agency regulatory powers.

During the middle of the summer Secretary Hoover announced his intention to call another national radio conference. While there are pressing radio problems it is believed that few can be disposed of by the conference, as the Department of Commerce is without the authority to put recommendations into effect.

The Biggest Problem

The most pressing problem is that of wavelengths. At the 1924 conference the most important problem was a reallocation of wavelengths so new channels might be created for additional stations. Almost as soon as the changes were made the new channels were exhausted. For every new wavelength created there were at least a dozen applicants.

In an effort to prevent trouble, Chief Radio Supervisor Terrell has tried to find room on the air for the new stations and some have been squeezed in here and there.

With stations so close together, just the minute one varies from its wavelength serious interference often results. The Bureau of Standards has perfected several methods for checking up on wavemeters so that stations may keep to their assigned wavelengths but interference has not been cut down to any great extent. In addition, there has been heterodyning which has caused whistles in the receivers.

There are too many broadcasting stations and until the number is cut down there is not going to be much improvement. Only Congress can give the Department of Commerce authority to limit the number of stations.

Could Reduce Low Limit

During the summer static has drawn attention away from interference caused by stations. But just as soon as cool weather returns fans are going to expect distance reception, and unless the receiver is very selective considerable interference will be experienced.

Of course, the broadcasting band of wavelengths could be extended downward below 200 meters. At this time, however, there are few sets that will tune below 225 meters.

About the only thing the conference could pass upon would be the question of station power. Due to the good results of the increase from 1,000 to 5,000 watts recommendation would be made at the next conference (if it is held) that an even further increase of power be permitted.

In anticipation of such a move several stations are already preparing equipment to increase the power of their stations to 10,000 watts or more.

Another Question

The question of interconnection of stations, taken up by the 1924 conference without decision, would also come up at the next conference. It is not believed, however, that the conference would go on record as favoring any particular method of interconnection, such as land wires, short waves, etc.

Experts question the value of a conference this fall. Just as soon as Secretary Hoover returns to Washington he will be told of the situation. It is believed Secretary Hoover will communicate with leaders in the radio field for their views on the subject. It is probable that the results of this survery will determine whether or not the conference will be held.

SEND IN PHOTOS

If you have built a set you are proud of, send in photographs of it, including view of the assembly. Address Gallery Editor, RADIO WORLD, 1493 Broadway, New York City.

Tax on Sets Proposed by Lawmaker

Sailing on the Leviathan, Representative Sol Bloom, of New York City, said he will investigate radio conditions abroad.

On his return he plans to introduce legislation in the House looking to the taxation of all private receiving sets and equipment, the proceeds of which are to supply artists and lecturers of the first rank for radio programs. He will also seek to promote, in Washington, an international treaty for government control of broadcasting.

The plan that he outlined has been discussed many times before and has been emphatically opposed by Secretary Hoover.

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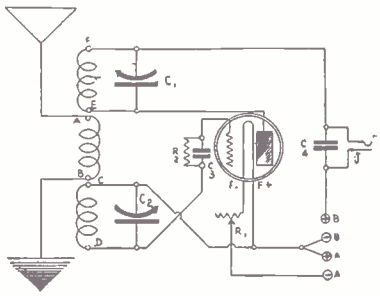

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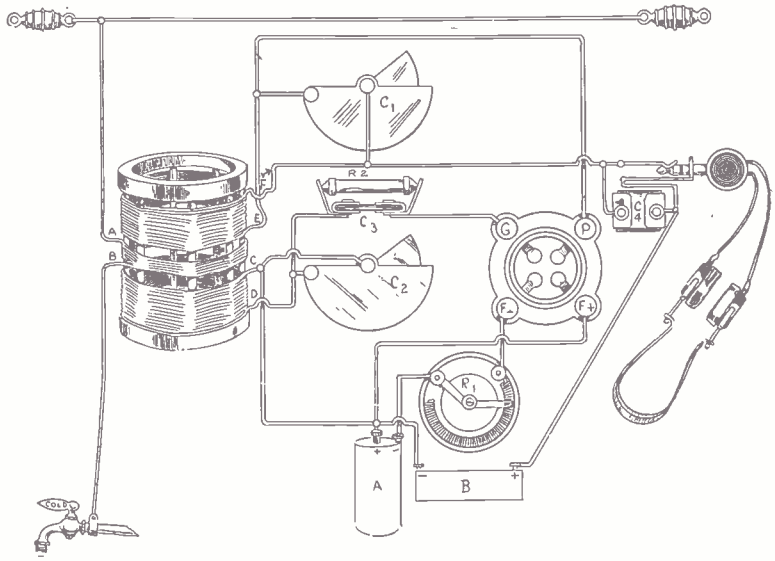

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MR. DX HOUND

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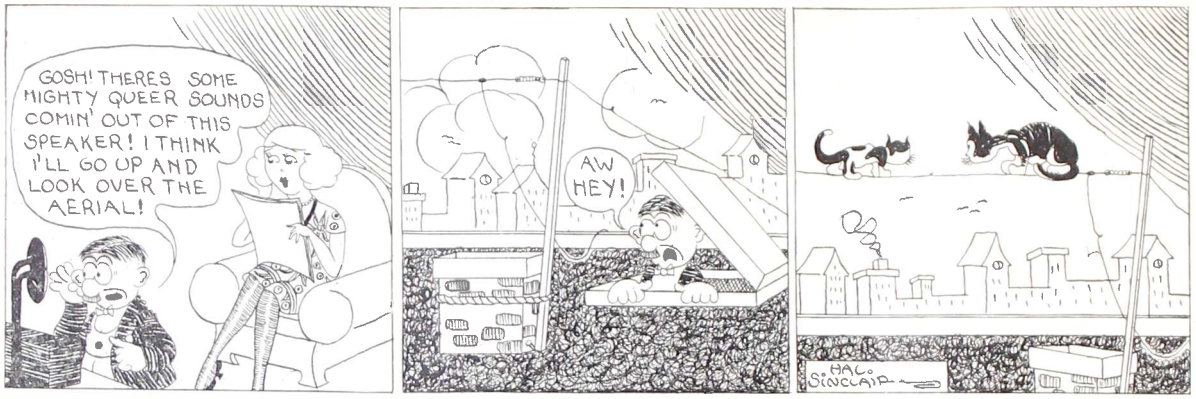
By HAL SINCLAIR



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THE RADIO TRADE

R. C. A. Has First Deficit

The Radio Corporation of America reported the first deficit in its history when its earnings for the quarter showed a loss of $391,053, compared with a net profit of $1,928,329 in the March quarter. This is taken as a reflection of the drastic "unloading" of radio apparatus by competing companies in the last several months.

Despite price cutting due to over-supplying, virtual duplication and a distinct let-up in the demand for sets, Radio Corporation has refused to cut prices. This explains the deficit, according to officers of the company, who said that there had not been sufficient radical changes in radio sets to cause the loss, in spite of reports to this effect.

The company's gross income from sales, communications and other business was $4,584,465, compared with $15,229,923 in the March quarter. Much of this discrepancy is assignable to seasonal conditions, which have always favored the first quarter against the Summer quarter.

General operating and administration expenses, depreciation, cost of sales, patent amortization, estimated Federal income tax and accrued reserve for year-end adjustments came to $4,975,518, or $391,053 more than gross income. In the preceding quarter the company's expenses were $13,301,594.

For the first six months of the year the company reported a profit of $1,537,276.

The company's rapid growth in sales from a gross business of $1,468,920 in 1921 to more than $50,000,000 last year has constituted an industrial romance almost without parallel. In view of the deficit there is considerable interest in financial circles as to what the company's showing for the year will be. Gross business in the six months was said by an official to have been about $700,000 above last year, while the profit reported was "not as good as last year." A revival of demand for sets is confidently expected in the Fall.

The statement contains no figures on gross or net business for the first six months of 1924. The corporation did not issue quarterly reports until its stock was listed on the New York Stock Exchange last Fall.

Coming Events

AUG. 18 to 21—3d National Convention, American Radio Relay League, Edgewater Beach Hotel, Chicago.

AUG. 22 to 29—3d Annual Pacific Radio Exposition, Civic Auditorium, San Francisco. Write P. R E., 905 Mission St., San Francisco.

AUG. 23 to SEPT. 6—Canadian National Expos., Exposition Coliseum, Toronto, Can.

SEPT. 5 to 12—Third annual National Radio Exposition, Ambassador Auditorium, Los Angeles, Cal. Address Waldo K. Tupper.

SEPT. 9 to 20—International Wireless Exposition, Geneva, Switzerland.

SEPT. 12 to 19—Fourth Annual National Radio Exposition, Grand Central Palace, N. Y. C. Write American Radio Exp. Co., 522 Fifth Ave., N. Y. C.

SEPT. 14 to 19—Second Radio World's Fair, 258th Field Artillery Armory, Kingsbridge Road and Jerome Ave., N. Y. C. Write Radio World's Fair, Times Bldg., N. Y. C.

SEPT. 14 to 19—Pittsburgh Radio Show, Motor Square Garden. Write J. A. Simpson, 420 Bessemer Bldg., Pittsburgh, Pa.

SEPT. 14 to 19—Radio Show, Winnipeg, Can., Canadian Expos. Co.

SEPT. 21 to 26—First Annual Radio Expos., Broadcast Listeners' Association, Cadle Tabernacle, Indianapolis, Ind. Write Claude S. Wallin, Hotel Severin.

SEPT. 21 to 29—International Radio Exposition, Steel Pier, Atlantic City, N. J.

SEPT. 28 to OCT. 3—National Radio Exposition, American Exp. Palace, Chicago. Write N. R. E., 440 S. Dearborn St., Chicago, Ill.

SEPT. 28 to OCT. 3—Midwest Radio Week.

OCT. 3 to 10—Radio Exposition, Arena, 46th and Market Streets, Philadelphia, Pa., G. B. Bodenhof, manager, auspices Philadelphia Public Ledger.

OCT. 5 to 10—Second Annual Northwest Radio Exposition, Auditorium, St. Paul, Minn. Write 515 Tribune Annex.

OCT. 5 to 11—Second Annual Radio Show, Convention Hall, Washington, D. C. Write Radio Merchants' Association, 233 Woodward Bldg.

OCT. 10 to 16—National Radio Show, City Auditorium, Denver, Colo.

OCT. 12 to 17—Boston Radio Show, Mechanics' Hall. Write to B. R. S., 209 Massachusetts Ave., Boston, Mass.

OCT. 12 to 17—St. Louis Radio Show, Coliseum. Write Thos. P. Convey, manager, 737 Frisco Bldg., St. Louis, Mo.

OCT. 12 to 17—Radio Show, Montreal, Can., Canadian Expos. Co.

OCT. 17 to 24—Brooklyn Radio Show, 23d Regt. Armory. Write Jos. O'Malley, 1157 Atlantic Ave., Brooklyn, N. Y.

OCT. 19 to 25—Second Annual Cincinnati Radio Exposition, Music Hall. Write to G. B. Bodenhof, care Cincinnati Enquirer.

NOV. 2 to 7—Radio Show, Toronto, Can., Canadian Expos. Co.

NOV. 3 to 8—Radio Trade Association Exposition, Arena Gardens, Detroit. Write Robt. J. Kirschner, chairman.

NOV. 19 to 25—Milwaukee Radio Exp., Civic Auditorium. Write Sidney Neu, of J. Andrae & Sons, Milwaukee, Wis.

NOV. 17 to 22—4th Annual Chicago Radio Exp., Coliseum. Write Herrmann & Kerr, Cort Theatre Bldg., Chicago, Ill.

How to Wire Winner's Set

(*Concluded from page* 10)

fier. The filament minus goes to the minus of the C battery and the plus of the C battery goes to the A minus. The grid post of the second AFT goes to the grid post of the socket and the filament minus goes to the A minus. The plate of this last tube goes to the top of the single circuit jack, and the end terminal goes to the same terminal that the plate winding of the first AFT went to or to the B plus amplifier.

The C battery is advisable as it makes the signals very much clearer and also saves the B battery. As a matter of fact when the C battery is used the B battery will last nearly three times as long.

How to Know Your Set

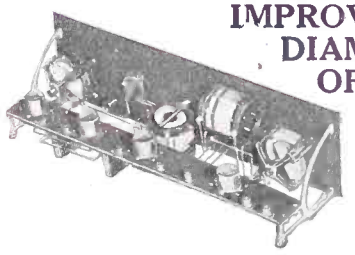
If, even after you have tested all your parts, followed all the directions carefully, the set does not work, there are plenty of things to do. If the set will not regenerate, reverse the terminals of the plate variometer. Also reverse the leads of grid variometer. Push the L3 coil nearer to the grid variometer. Take out the condenser C2. This will directly couple the plate to the antenna and will make the set very unstable, but will give you very loud signals if properly handled. However, the unstability can be done away with if the smaller capacity condenser is put here. Probably a .00025 will fit the bill. I say probably because I had to try various sizes before I got hold of the right one. But for all the tubes I used a .0005 mfd. condenser seemed to work best. If you do not get enough selectivity reverse the secondary of the RFT L2. Reverse your A battery for possible louder signal strength. See that your plug makes good contact with the prongs of the jack. A storage battery to light the filament is best suited here, as dry cells will run out very quickly. Use No. 14 bare copper covered wire for wiring the set. Do not use bus bar. Don't forget to change the tubes around. Use a 75-foot antenna, with a very short lead-in and ground. Solder all the connections in the set as well as in the antenna and ground. If you cannot solder the antenna use silver paper, otherwise known as tinfoil. Wrap the tinfoil around the connection and put some tape over this tin foil. Keep the lead-in a foot away from the wall.

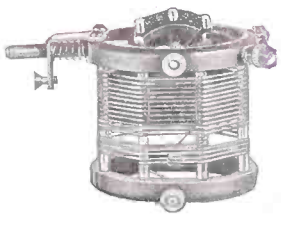
The tuning is very simple. The very first time that you try to tune in on the set you will find that it breaks into oscillation very easily. However, after one or two trys, it will become easy to do away with this trouble.

The stations should come in on the same place all the time, except during damp weather, when the fundamental wavelength of the antenna is changed. The grid variometer does very little in tuning in the stations. The main controls are the variable condenser and plate variometer which controls the regeneration. If the tube does oscillate freely after you have done all of the above, put in a very high value grid leak about 9 megohms.

LIST OF PARTS

One 6-ohm rheostat (R3).
Four Amperites (R1, R4, R5).
Two variometers (Amrad) (L4 and L5).
Two pieces of hard-rubber tubing, 3½" in diameter, one 5" high and one 2" high.
Five sockets.
One .0005 mfd. variable condenser (C1).
One .0005 mfd. fixed condenser (C2).
One .00025 mfd. fixed condenser (C3).
One grid leak, variable if desired (R2).
One double-circuit jack (J1).
One single-circuit jack (J2).
One terminal strip.
Two audio-frequency transformers (AFT).
One lb. No. 22 DCC wire.
One filament switch.
Three 4" dials.





Theory of Set Operation Described for the Novice

(Concluded from page 8)

an incoming wave causes resonance—that is, a condition of the receiver for greatest response to a selected wave. The energy is still radio. The plate of the tube, representing the output, as the grid represents the input, delivers both radio and audio, since the rectification has been accomplished through the instrumentality of the grid condenser and leak. The frequencies are so far apart that there is no clash. The radio current travels so much faster that it is returned to the grid circuit (L2) and builds up the incoming signal by the phenomenon of regeneration, which is not very fully understood even yet, although it is known to be a method of reducing the effective resistance, and may indeed result even in a negative resistance. The great speed at which the wave is traveling enables the signal to be built up many times, until the maximum point is reached, before collapse and repetition on the next cycle of the wave train. The energy at its new peak is subjected to rectification, the direct pulsating current passing through the wire of the tickler windings to the phones, through which the circuit is completed to B plus. The radio waves, on the other hand, travel on the outside of the wire, and do not flow through the core. This is the "skin effect."

The Tube Function

The object of using a B battery is to make the plate of the tube much more positive than the filament. The tube, when lit, throws off tiny particles of negative electricity, known as electrons. The positive plate attracts these negative particles, the electronic stream having to pass through a wire mesh in the vacuum tube, known as the grid. Hence the current in the grid is transported to the plate, the electronic stream acting as the bridge. A smaller voltage impressed on the grid results in a much greater voltage on the plate, in other words, a small input becomes a greater output due to the B battery voltage. In a regenerative set like this the increase runs into the hundreds or thousands, depending on the efficiency of the tube, set, etc. That is why a tube is a much better detector than the crystal, in point of sensitivity and magnification. The tube performs somehing akin to transformer action, since its operation steps up the voltage. This is radio-frequency voltage, and is very much smaller than the direct current voltage of the batteries. It is measured in microvolts.

Attention, Readers and Newsdealers!

READERS: If you are going away on your vacation, and wish to have a complete file of RADIO WORLD, be sure to tell your newsdealer to put aside a copy of each issue until you return.

NEWSDEALERS: Your regular RADIO WORLD customers will undoubtedly want for file copies that they have missed while away on their vacations. The publisher suggests that each week you put aside copies of RADIO WORLD for these customers. They will consider this service.

Readers and newsdealers can get back numbers of any issue for the summer of 1925 at our regular price; or a subscription can be started with any back number published during the summer.

Circulation Manager, RADIO WORLD, 1493 Broadway, New York City.

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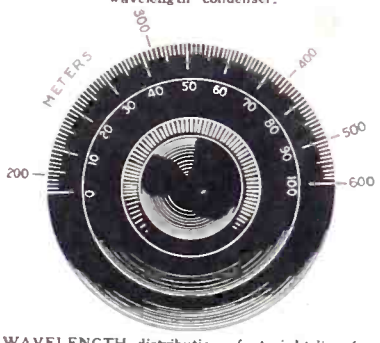
WAVELENGTH distribution of the circular plate condenser.

WAVELENGTH distribution of straight-line wavelength condenser.



WAVELENGTH distribution of straight-line frequency condenser. ("Radio News").

Europe to Transmit to U. S. On Very High Frequencies

Short waves will be used for sending British programs to the United States the coming Winter. The programs will be picked up by the Radio Corporation station at Belfast, Me., and re-transmitted. They will be picked up again by WJZ at New Brunswick, N. J., and broadcast for the entertainment of American listeners on WJZ's regular wave, using the super-power apparatus (50,000 watts).

Arrangements for the mutual broadcasting of the programs were made in London. A new British radio station at Daventry, seventy-five miles from London, will transmit on a wave of 1,600 meters, but its re-transmission will be on short waves to be announced later. Not only will it be able to transmit British programs to Americans, but it will transmit programs to the United States from the various capitals of Europe.

America will broadcast to Europe, too. It is planned to broadcast programs several times weekly or perhaps nightly at hours most suitable for listeners on the other side of the Atlantic.

Similar arrangements have been made with Germany, though it is not known yet whether the German high power apparatus will be ready to operate by next winter.

The towers already are erected.

British Market Available; Barriers Are Lifted Again

WASHINGTON.

Wireless specialties of American manufacture, which have not thus far been offered to any extent on the British market because of the barriers against the use of imported radio apparatus, are expected to make their appearance now that import restrictions have been lifted permitting freer use of foreign-made equipment, according to a report on the British radio situation by commercial attache Hugh D. Butler, Department of Commerce.

The entrance of American equipment into this market will be gradual, Mr. Butler says, depending for success upon the acceptance of American standards by the British radio enthusiasts. There is no present great opportunity to sell large quantities of standard sets, he says. American equipment, which is not now well known, must make its appeal on a quality basis. To find ready sales in the market at this time, radio equipment must be offered either on the basis of efficiency or uniqueness or be quoted at an appeal price for unquestionable value. If patent rights do not intrude, reasonably priced tube sets of superior manufacture should be well received.

It is believed that American sets will have the strongest appeal to the large and growing number of "fishers" who are daily discarding crystal sets for tube sets and a log book. As the mainland is only as large as the states of New York and Pennsylvania combined, the twenty-one broadcasting stations have heretofore furnished ample entertainment to owners of small sets. Local reception, however, is giving way to a desire for distance and it is expected that American long-range sets will meet the popular favor of the distance seekers.

The ownership of broad basic patent rights, an extraordinary trade organization, and import duties coupled with the rapid development made during the period of import restriction have placed the home industry in a strong position to meet competition from foreign manufacturers of ordinary equipment. Mr. Butler believes that the success of American manufacturers in this market will be in proportion to the efforts made to introduce the better class of American radio apparatus.

The full report is published as Trade Information Bulletin No. 358, "The Radio Situation in Great Britain" and outlines in detail the general situation in the radio field, patent rights now held, prices and duties, trade association activities, local trade discounts and conditions of sales, and other pertinent information for the guidance of American manufacturers. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., or any of the district offices of the Bureau of Foreign and Domestic Commerce. The price is 10 cents.

Likes 3-Tube Reflex

RESULTS EDITOR:

I built the 3-tube inverse reflex by Capt. Peter V. O'Rourke, in Feb. 28 issue, and for distance it can't be beat. I cut through WLW and WSAH and received KFI and KNX, Los Angeles, with good volume on two pair of phones. I received 49 distinct stations in two weeks, three in Canada, including Calgary, and one in Porto Rico. All of these, except Porto Rico, were heard when locals were on. Try to beat that on any 3-tube set that has ever been printed in any magazine.

I hope our friend at Columbus, O., sees this and the results I got on this 3-tuber.

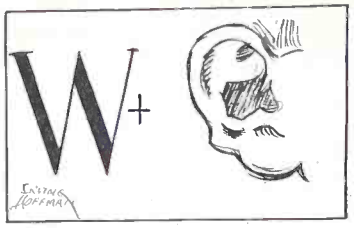
JOHN F. COOPER
1029 Courtlandt Street,
Cincinnati, O.

20 EXCEED 500 WATTS

Twenty stations were using more than 500 watts power. They are:

KDKA, 10,000 watts; WSAI, WLW, WOC, WCCO, WCBD, 5,000; WEAF, 3,500; KFI, KGO, 3,000; WTAM, 2,500; WGY, KOA, WBZ, KFKX, WORD, 2,000; KYW, WHT, WBBM, WTAS, WOAI, 1,000.

What Station Is This?



Send in your solution and if it is correct your name will be published. Address RADIO WORLD, 1493 Broadway, New York City.

JOIN THE A. B. C.

A. B. C. stands for American Broadcast Club, an organization of fans banded together to promote the welfare of radio. There are no dues, no obligations. Address A. B. C. Editor, RADIO WORLD, 1493 Broadway, New York City.

Herman Alkrdyo, Palm Beach City, Sanford, Me.
R. Scheibeck, 244 Locust Street, Chillicothe, O.
Herbert Dugan, 916 E. McCarty Street, Indianapolis, Ind.
Herman Acosta Florez, 63 Seventh Avenue, New York City.
I. Gerstenhaber, 8428 Roosevelt Ave., Elmhurst, N. Y.
Joe Ross, 1127 Fort St., Victoria, B. C., Canada.
P. Tarkoff, 827 N. 6th St., Philadelphia, Pa.
W. E. Rosenlieb, Box 264, New Matamoras, O.
Morris Goldfinger, 147 Ferry St., Newark, N. J.
N. V. Murray, 300 Clinton St., Buffalo, N. Y.
L. J. Kirk, care Palace Drug Co., Ton Kaiva, Okla.
A. A. Lanzasone, Benton Ave., Richmond, Va.

LISTEN IN every Friday at 7 P. M. and hear Herman Bernard, managing editor of RADIO WORLD, discuss "Your Radio Problem," from WGBS, Gimbel Bros., New York City, 315.6 meters.

A. B. C. Editor, RADIO WORLD,
1493 Broadway, New York City.
Please enroll me as a member of the American Broadcast Club.
Name .....
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"The Diamond Is the Best," Court Decides After Fair Trial

F. D. Love, Williamson County Judge (Texas), Finds "It is the Last Word in Receiving Sets" And "Can Not be Improved On in Any Respect."

DIAMOND EDITOR:

Radio is my hobby, the diversion I have availed myself of after office hours. I have constructed several sets. I tear them up and rebuild other circuits, all just for the pleasure I derive from the mystery of it. Sometime since I began assembling of The Diamond of the Air, as described by Herman Bernard. I was somewhat skeptical about the fundamentals of the set and therefore had apprehensions about its working. I followed his simple, plain and clearly outlined directions for constructing the set. Finishing it, I allowed it to stand for several days, for the purpose of rechecking, as well as the pleasure I derived from the beautiful appearance of the set. Finally, I got courage and hooked it up, feeling that I was about to get a croaker and squealer that would terrify the natives hereabouts. Behold, however, when the current was turned on, there came in from the distance such a volume of beautiful music that I almost fell backward from the greatness and beauty of it.

It is the last word in receiving sets—and Mr. Bernard should stop right here, as it is now and always will be his chef-d'oeuvre. It cannot be improved on in any respect. For selectivity, volume, distance and faithfulness of reproduction it is unexcelled. This circuit should end the craze for a Super, for a Super cannot do more, nor as much when it comes to beauty of tone. I am not using the loop, although my set is constructed for that as well as outside antenna. I am going to shelve my Neutrodyne now, or sell it if I can, and use The Diamond of the Air altogether; it's better in every respect. Please do not think I am extravagant. The trouble has been Mr. Bernard has been too modest. He should have claimed more for the set and perhaps more of us would have built The Diamond. Any fan who wants the best should lose no time in building this set. He will stop after he does, for he will have a jewel which will be a joy forever.

F. D. LOVE,
(County Judge) Georgetown, Tex.

* * *

THE VOICE OF THE PULPIT IS LIFTED IN PRAISE

DIAMOND EDITOR:

I have been a reader of your wonderful magazine for some time, and have built sets from designs by various contributors with good success, but none of them has ever approached my latest, which is The Diamond of the Air. I completed it and tried it out last night. Result, every thing in the country that I cared to listen to, and this notwithstanding electrical storms all around. I used a 6-tap coupler, 40 turns to the first tap, 5 turns between taps, with primary wound directly over the 40 turns. I consider it the ace of all 4-tube sets, and I wish to extend to Herman Bernard my congratulations on his achievement. Please send nameplate.

The REV. GEO. A. BLEWSTER,
Clemmons, N. C.

LISTEN IN every Friday at 7 P. M. and hear Herman Bernard, managing editor of RADIO WORLD, discuss "Your Radio Problem," from WGBS, Gimbel Bros., New York City, 315.6 meters.

A SIMPLE 1-TUBE DX SET FOR THE NOVICE, by Percy Warren. Send 15c for May 23 issue, RADIO WORLD.

A RADIO COMMENCEMENT

Kansas claims the first radio commencement in history. The Kansas Agricultural College sent invitations this year to 1,800 "aggies of the air" students enrolled in courses conducted by radio, to attend this notable event in person.

SONORA NAME IN DISPUTE

The Sonora Phonograph Co. has sued the Sonora Tube Co. of Chicago, alleging unfair competition in use of the name. A temporary injunction was issued, pending trial.

THE 3-TUBE MIDGET ON A 4½x9" PANEL

(*Continued from page* 5)

being required. These tubes were chosen because they take up so little room and yet deliver real volume. One rheostat was used to control all three tubes, and this is a justifiable makeshift, since the audio tubes are not critical, and what will be the correct voltage for the detector will do very nicely for the audio.

The panel being 4½x9" is not of standard size. Hence get a 7x10" panel and cut it down, unless you buy a panel already cut, which has the advantage of really squared-off sides that will fit nicely into a cabinet of proper size. Cutting a panel straight is a machine job. Using a hacksaw at home isn't so satisfactory.

The Panel

The two shafts (condenser and tickler) are mounted on a horizontally centered line (2¼" from top and bottom of panel). At left, as you have the panel before it just as it appears in the set as you tune it, the tickler dial is at left, shaft hole 1¾" from extreme left of panel. The condenser shaft hole is 5½" from extreme left of panel, on that some horizontal line. The tickler dial is 3", while the dial on the condenser may be furnished with that instrument and is 2½" diameter. So you have at least 2¼" from the circumference of the condenser dial, at its extreme point, to the right-hand side of the panel. That gives you enough room to mount the rheostat with shaft 1½" from top of panel and 1¼" from right-hand side of panel. Below the rheostat is the jack, the hole being 1" from panel bottom and ¾" from the right-hand side of panel.

The Sub-panel

A hard rubber sub-panel is used. It is 7" wide x 6" deep. It is supported by two brass angles. Holes for securing the angles to baseboard and panel are drilled accordingly, screws being inserted and nuts tightened on them. Each angle will require two holes on panel and two on subpanel, but only three of the screws will show on the panel, because the tickler dial (at left) will hide one. All the holes should be countersunk, particularly the one that the dial will pass over, for otherwise there would result a most annoying scraping sound as one turned the dial.

The audio transformers are mounted on the sub-panel on a 3" depth by 5½" width, that is, they take up no more room than that. They are mounted at right angles. Those used in the model shown were Jefferson, 3-to-1 ratio.

As you look down on the set, the detector tube socket would be mounted on subpanel between the second audio-transformer (the right-hand AFT), and the back of the condenser.

The notch for the lockpin of the tube would appear at right as the socket is mounted. To the right of the detector socket, but a little bit forward of it, that is, with one side of this socket about flush with the back of the main panel, is mounted the first audio socket. The second audio socket is placed to the rear of the first AFT socket. Take care to have the notch of the first audio socket also at right, but place that of the second audio socket in front, that is, nearer the main panel. The Radio Products sockets used made placement easy, despite small room allowed.

Tips for Mounting

A good plan is to mount the parts on the main panel, then temporarily mount the subpanel and place the other parts thereon, laying out the placement thereof with a pencil or scratch-awl. Using actual tubes as guide, be sure that you

THE MIDGET

allow room to insert these, and you will find that there is room enough, indeed. Then remove the subpanel. Then the parts that go on it may be much more conveniently disposed of than if you were cramping yourself while the subpanel remained attached.

The grid condenser is mounted on the coil form, preferably at the terminal of L2 which is at right when the coil is mounted horizontally, with tickler at left. That puts the aperiodic primary at right. Do not mount the coil in the conventional up-and-down manner.

No terminal block is provided, as insulated stranded-wire leads, 10" long, are used for connections from set to batteries, aerial and ground. Six of these are employed. One goes to aerial and is connected directly to the terminal of L1, the second goes to ground and is treated likewise. There is one each for A plus and A minus, and then one for detector B voltage and one for amplifier B voltage. B plus No. 1 is detector voltage in the diagram and the other the amplifier voltage.

The set should be wired with care, round bus being very handy indeed.

The outstanding features of the set are its compactness and its adaptability to a sewing cabinet. Therefore the mechanical features are stressed, as it is assumed that the reader is familiar with the wiring. The set may be easily carried about (as a portable) but was designed for home use primarily.

FACTS ON FADING

Although there is no direct known method by which fading may be eliminated, there are some practical methods, by which fading may be reduced.

The fault may be present at the transmitting station. Then the BCL can do nothing. The station will come rolling back with the same amplification factor that was prevalent before the signal faded.

The only "domestic" things that will actually cause the fading of the signals at the receiving station are a swinging antenna, loose joints between the various connections in the antenna. A swinging or sagging antenna will hit different objects, which probably have wonderful grounding characteristics. An imperfect connection in the head telephone cords will cause the signals to fade in and out also.

The best thing to do when the signal starts to fade is to let the set alone, for always the signals will come back with the same amount of strength. To date there has only been one real good practical method by which the fading may be slightly corrected at the receiving end. Place four loops in a box fashion. Each of these loops should be of the same dimensions in height as well as in length. You will note that the fading signal never really disappears. That is due to the fact the wave is coming in several directions, which is due to the wave being refracted. If, however, you desire to see if this test works, procure four receivers which work off a loop. Place them side by side. Place each one of the four loops in a different direction. In other words, one loop would be facing east and one west, etc. You will hear if you are quick enough to change plugs from one receiver to another. the signal travel from one set to the other. sometimes in consecutive fashion and sometimes jumping from one receiver which may be at one end to a receiver at the other end. This is usually tried with two or more operators and with series-parallel connected phones.

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2650 MILES DISTANCE with one tube. We send complete understandable instructions with panel layout, picture diagrams, etc., for 25c. Or BIG BOOKLET FREE. VESCO RADIO CO., Box 117-RW, Oakland, California.

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MAKE MONEY! RADIO BUSINESS. Write Konkle, 192 Market St., Newark, N. J.

DINING AND SLEEPING CAR CONDUCTORS (White). Exp. unnecessary. We train you. Send for book of Rules and application. Supt. Railway Exchange, Sta. C, Los Angeles.

HOW TO BECOME AN AMATEUR OPERATOR—A comprehensive, illustrated article appeared in issue of June 27, 1925. 15c per copy, or start your subscription with this number. RADIO WORLD, 1493 Broadway, N. Y. C.

A DX TRANSMITTER, by C. H. West, May 23 issue, RADIO WORLD, 15c.

FINEST HARD RUBBER PANELS—7x24, $2.00; 7x18, $1.50, postpaid. Drilled to specifications, $1.00 extra. Leitch, Ruston, Louisiana.

A SMALL RADIO MANUFACTURING BUSINESS, established three years needs an associate. A good opportunity to go into the radio business. Some capital required. Midland Electric Mfg. Co., Transportation Bldg., Indianapolis, Ind.

WOUND WIRE AERIAL: Sound theory, concerns the added capacity of the aerial wire itself. 43,000 turns to an aerial. It gets results. Radio owners write. Sample showing construction, 5 cents postpaid. Patent buyer solicited. Will sell interest to market big. Wound Wire Aerial Company, Reedville, Virginia.

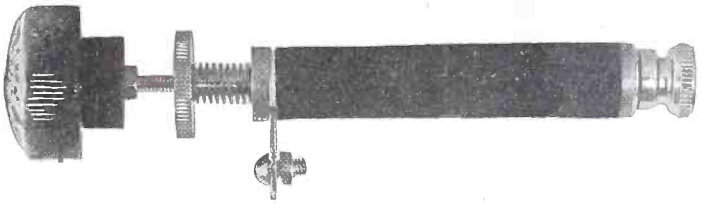
The Leak That Does The Trick!

NOW you can get it for the first time in America

Used in eighty per cent of all receiving sets in Great Britain

The "BRETWOOD"

Palls in inaudible stations



Eliminates tube noises

Range 300,000 to 10,000,000 ohms

Variable Grid Leak

Bretwood, Ltd., London, Eng., Sole Patentees and Owners.

The Bretwood Variable Grid Leak used in a detector tube circuit, strengthens weak signals, makes DX easier, eliminates tube noises and internal howling, due to incorrect leakage from the grid of the tube.

By simply turning the knob the carrier wave may be tuned from the silent point to maximum audibility.

The Bretwood is absolutely noiseless in operation and will hold any given setting indefinitely. It is a single-hole panel mount leak.

The Bretwood Variable Grid Leak, tested in the National Physical Laboratory (the official laboratory of Great Britain) and by RADIO WORLD'S Laboratory, proved to be a scientifically accurate instrument. The total range, 9,700,000 ohms, produced by 25 turns of the knob, make a minute adjustment very simple.

The Bretwood Variable Grid Leak is constructed on a different principle and produces better results than any other grid leak. In its specially-constructed barrel is a patented plastic, non-drying resistance material, in which there is a small movable plunger which again moves freely in an absorbent cartridge which gives the setting of the instrument great stability, making it far superior to the graphite, carbon or fibre, compressed or decompressed, resistance elements. It can be used in the most critical circuits with the greatest success.

Sent You on a Money Back Absolute Satisfaction Guarantee

The Bretwood Variable Grid Leak will be immediately shipped on receipt of order to any address in the United States, prepaid for $1.50. After 10 days' trial if it is not 100% better than any grid leak you have ever had and does not in every way substantiate all claims made for it, your money will be refunded without question.

The North American Bretwood Company

Sole Distributors for United States and Canada

1505 BROADWAY, NEW YORK CITY

Dealers and Jobbers Write for Special Trade Terms

THE NORTH AMERICAN BRETWOOD CO.
1505 Broadway, New York City
Room 326

Gentlemen:

Enclosed find $1.50 for which you will please send me one Bretwood Variable Grid Leak prepaid. Satisfaction guaranteed or my money back after trial within ten days of receipt by me.

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STREET.....

CITY.....STATE.....

EVEREADY HOUR
EVERY TUESDAY AT 8 P. M.
(Eastern Standard Time)

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WJAR	Providence	WWJ	Detroit
WEEI	Boston	WCCO	Minneapolis, St. Paul
WFI	Philadelphia		
WGR	Buffalo		
WCAE	Pittsburgh	WOC	Davenport

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It is no accident that more Eveready Radio Batteries are purchased by the radio public than any other radio battery made.

Such complete and voluntary endorsement can lead to but one conclusion—for best reception and longest life, Eveready Radio Batteries lead the field.

You can prove this for yourself by hooking Eveready Radio Batteries to your set. You will find that they deliver a steady, vigorous stream of power that lasts longer. It is Eveready economy that has created such an overwhelming preference for Evereadys. For every radio use there is a correct, long-lasting Eveready Radio Battery. There is an Eveready dealer nearby.

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NATIONAL CARBON COMPANY, Inc.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY
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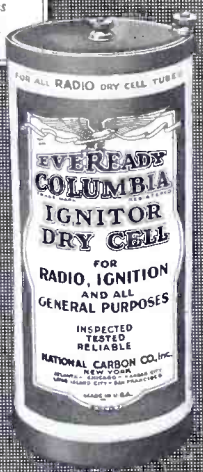
—they last longer

Eveready Columbia Ignitor "A" Battery The proven dry cell for all radio dry cell tubes 1½ volts



No. 772 45-volt Large Vertical Price $3.75

No. 767 45-volt Large Horizontal Price $3.75 With variable taps