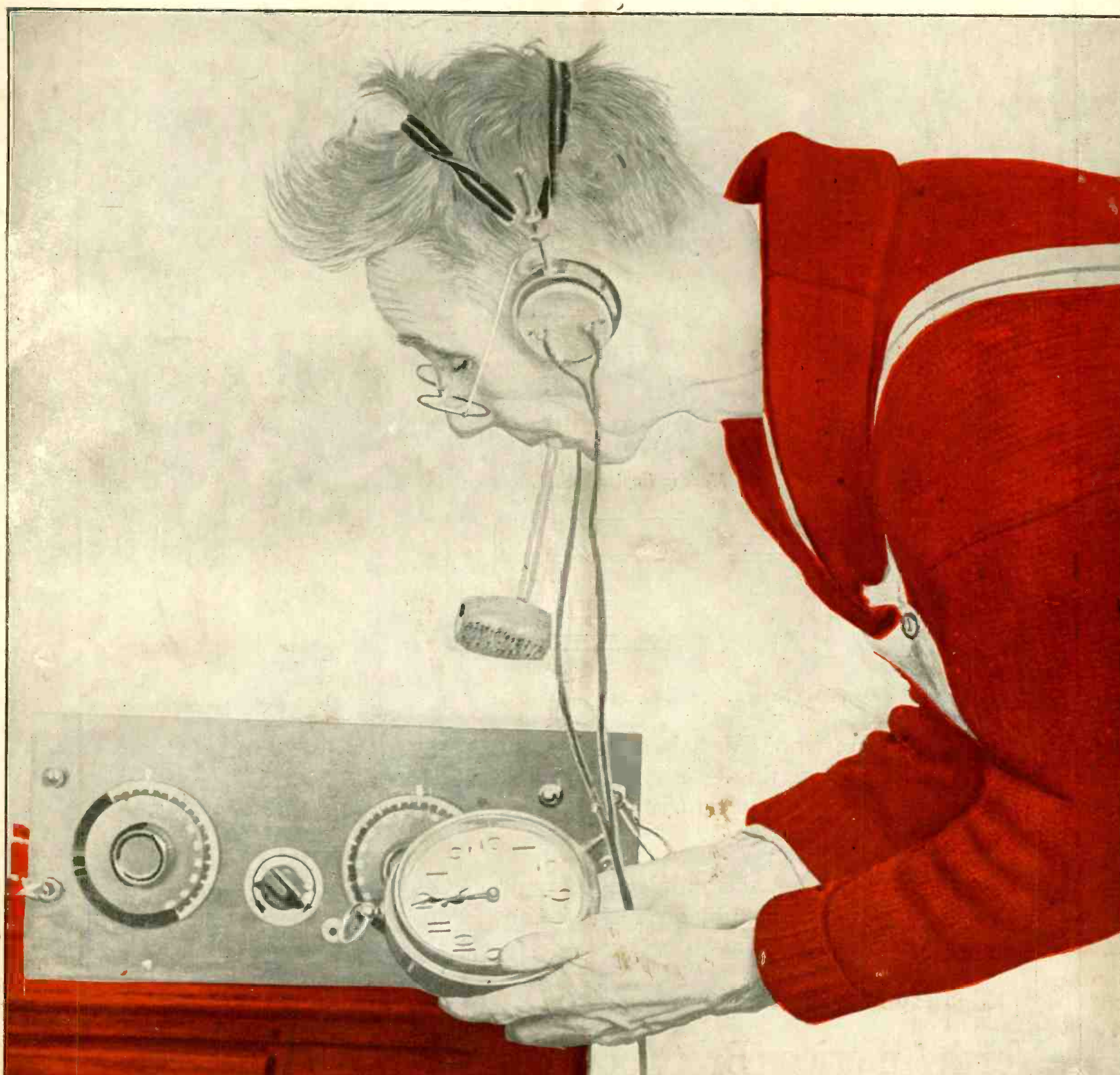
OCT. 31
1925.

15 Cents

RADIO WORLD

Title Reg. U.S. Pat. Off

Vol. 8. No. 6 ILLUSTRATED Every Week



THE TIME SIGNAL

IN THIS ISSUE: The 4-Tube Pathfinder, by Sidney E. Finkelstein; Coils for Short Waves, by J. E. Anderson; How to Make a Loop, by Herbert E. Hayden; New Style Terminal Strip, by Herbert Irwin.

RADIO WORLD

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under the Act of March 3, 1879]

A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 West 45th Street, New York, N. Y. Telephones: BRYant 0558, 0559

Vol. VIII, No. 6. Whole No. 187. **October 31, 1925** **15c per copy, $6.00 a year**

THE PATHFINDER

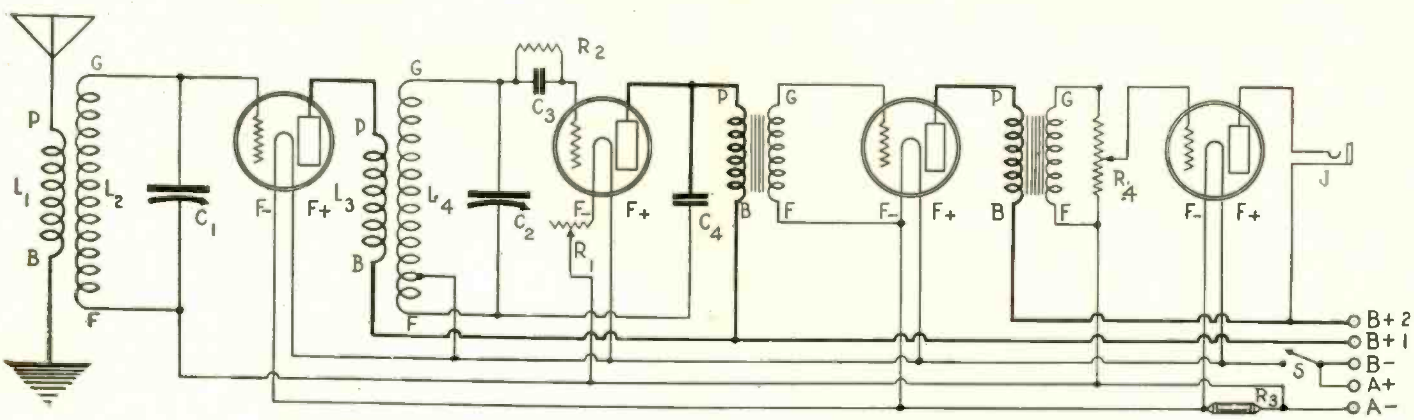


FIG. 1, the wiring diagram of the Erla Pathfinder, constructed by Sidney E. Finkelstein.

By Sidney E. Finkelstein

Associate, Institute of Radio Engineers

PART I.

THE stability of a set that otherwise might be hard to handle is enhanced by the use of the toroidal coil, which is growing in popularity and which, when Winter comes, will be among the coils in commercial ascendancy. These coils, as is well known, have a very limited magnetic field, therefore, the chances of stray inductive coupling, which induces over-oscillation, are reduced almost to zero. Another favorable point is the mounting ease. Add to that the attractive appearance of the toroid and you have a combination of reasons that compels you to give this form of inductance serious attention.

SIDNEY E. FINKELSTEIN

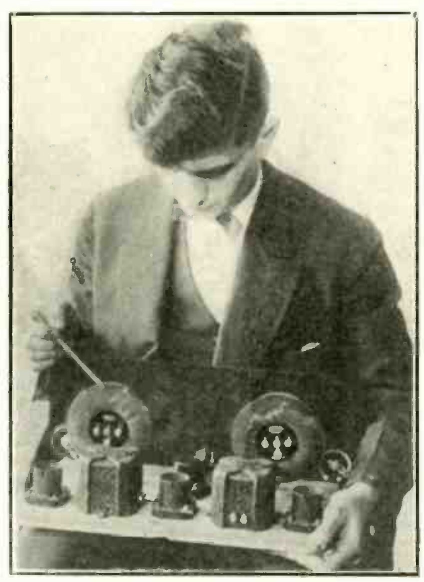
Early Experiments

When experimenters were pottering around with toroidal coils, before the present stage of efficient development, they found this type to have too high a resistance and, incidentally, distributed capacity in comparison with the inductive value. But by closely winding the turns at the inside and by other means already popular in the manufacture of such coils, the erstwhile evils have been eliminated, leaving the coil one which may be freely introduced in any type of circuit.

The toroidal winding was used in the circuit shown in Fig. 1 with fine success. This receiver is capable both of extremely distant reception and very fine volume. There are a stage of tuned radio-frequency amplification, a specially sensitized detector stage, one stage of transformer coupled audio, and a final stage of transformer audio that is volume-controlled. The device used to control the volume is a high maximum resistance potentiometer.

Load Carefully Apportioned

On the radio side you have all the amplification that it is advisable to crowd into two tubes. The conventional tuned RF stage is followed by a detector input that utilizes some of the radio component of the detector plate output for sensitizing purposes, through the fixed condenser C4. This should be of very low capacity, say .0001 mfd., and not the .001 or .002 mfd. instrument usually found in an equivalent position. While it serves a by-pass purpose it turns some of this salvaged radio current back to the grid of the detector tube, instead of just passing it around the batteries.



THE AUTHOR shows the rear view of the set and points to the interstage coupler, L3L4.

Simple Filament Wiring

The three ampliefiet tubes—one radio and two audio—are controlled, as to filament heating, by a ¾-ampere ballast, R3, as the tubes are, like the detector, 201A-301A. The detector tube filament is governed by a rheostat, R1, which should be 30 ohms, instead of the more customary 20, because it is used as a volume regulator, but need be varied only when the set is tuned suddenly from a low wave to a high one, say from WRNY, 258 meters, to WEAF, 492 meters. Just a trifling in innumerable instances where this set is constructed only the switch need be manipulated to turn the set on and off as a unit, and the detector rheostat, once set, is left that way.

The tap N on the toroidal coil is used for connection to A+, the detector grid return.

The set, in actual operation, found its way about the air with such sureness that I called it the Pathfinder and the name has stuck in my family ever since. This was only ten days ago, to be sure, as any one familiar with the radio trade will notice that some brand-new apparatus is included in the receiver. These include the Erla audio-transformers and vernier dials.

Novice Can Make It

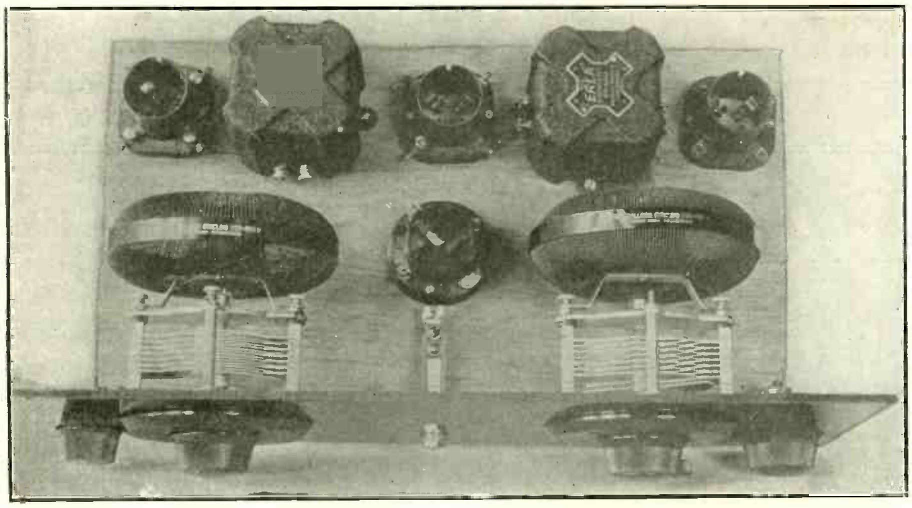
Anybody can wire the set, even the absolute newcomer in radio. The panel layout is shown in a photograph and the other views bring out very clearly the placement of the parts. The RF tube is at left rear, the detector tube is the one nearest the back of the panel, while the first and second audio tubes are located in alignment with the RF tube, and make that alignment read, left to right, as one stands at the front of the panel, RF, first AF and second AF.

The photographs were taken after the set was partly dissembled, so that the wiring would not obscure the view.

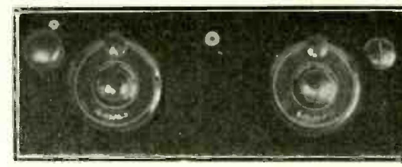
Strong Amplification

The potentiometer should not be omitted, because the audio transformers amplify so strongly that it is well to have some easy adjustment at hand to cut down volume on some of the local stations. Nearly every one living in or near a large city finds considerable disparity in volume, as among the several stations, hence a blasting effect may be introduced in any receiver by too close a station, and it is hard to get rid of this simply by manipulating the radio input, e.g., vary a rheostat setting. Then again, when a far-distant station is being received, one desires all the volume possible, consistent with clarity, and that is when the strong amplification is needed. One might have three stages of audio coupling and use two without a volume control, plugging in the third stage for extra volume, but that would mean an extra tube, and the

Pathfinder Easy to Wire



TOP VIEW. The sockets are RF, left rear; detector, center foreground; first AF, center rear; second AF, right rear.



THE PANEL view of the Pathfinder. The 4" dial on the left turns the rotary plates of the antenna condenser. The other 4" dial turns the rotary plates of the condenser shunted across the secondary of the second radio-frequency coil.

potentiometer-control method, combined with two high amplification transformers, is a more satisfactory and economical solution.

Notice that the panel has on it only the switch, rheostat knob, jack, potentiometer knob and two dials. The potentiometer is the Centralab 500,000-ohm type (0.5 meg.). As for the other items, the grid leak and grid condenser are a unit, known as the Daven Leakandenser, also something new. The leak is 2 megohms (2,000,000 ohms). It is of the fixed type.

C4 should be a very high-class condenser. The Sangamo is excellent to use here.

To wire the set, consult the photographs and the wiring diagram, study them carefully, then drill the panel, which should be 7x21", and mount the panel parts. The photographs show the Erla SLW condensers.

The Wiring

First connect A minus to one side of the ballast R3 and to one side of the rheostat R1. Connect the other side of the ballast to the three amplifier sockets' F— posts. These are tubes 1, 3 and 4,

LIST OF PARTS

Two circloid coils, L1L2, L3L4.
Two .00035 mfd. variable condensers, C1, C2.
Two vernier dials.
Four sockets.
One grid condenser, .00025 mfd. (or less) C3.
One grid leak, 2 megohms, R2.
One .0001 mfd. fixed condenser, C4.
Two audio transformers.
One single-circuit jack.
One 7x21" hard rubber panel.
One 7x20" baseboard.
One A battery switch.
One 30-ohm rheostat.
One 3/4-ampere ballast resistor.
One 500,000-ohm potentiometer.

left to right in Fig. 1. Then join the other side of the rheostat to the F— post of the detector socket. Join A+ to one side of the battery switch S, the other side of this switch going to the F+ posts of all four sockets. This completes the filament wiring.

Join P of the aerial transformer to the aerial and B to ground. G goes to grid post of the RF socket and to the stator plates of C1. The open end of L2, marked E, goes to A minus and to the rotor plates of C1.

When to Connect B—

P of the interstage coupler goes to the plate of the RF tube. The B post goes to B+ No. 1, 45 volts. G is connected to one side of the grid condenser and to the C2 stator plates, while F is connected to the rotor plates of C2 and to one side of the .0001 mfd. fixed condenser, C4. The other side of C4 goes to the detector plate. A+ is connected to the tap N, which in other circuits is used for neutralization.

P post of the detector tube socket, already connected to C4, also goes to the P post of the first AFT 1, the B post of which goes to B+ No. 1, 45 volts. The G post of the first AFT goes to the grid post of the next socket, the F post of AFT to A minus. The P of the third socket goes to P of the second AFT, B going to B+ No. 2 (90 volts). G on the second AFT goes to one terminal of the potentiometer, the other terminal of which goes to the F post of AFT and to A minus. The arm of the potentiometer goes to grid of the last socket whose plate connects to one side of the jack J, the other side of the jack going to B+ No. 2.

This accounts for all the wiring, except the grid leak, which, because a unit is used, is automatically included, and excepting B—, which is connected to A+ only after it is found that the tubes light properly.

(Part II, the conclusion, will be published next week)

Redistribution of Stations Favored on Population Plan

By Thomas Stevenson

WASHINGTON.

The great big problem with which the Fourth National Radio Conference, which opens November 9, will be confronted is the wavelength situation. The future policy of the Department of Commerce in handling the wavelength problem probably will depend on the conference recommendations. An effort will be made to have Congress incorporate the recommendations into legislation, but whether this succeeds or not Secretary Hoover will follow them as closely as possible.

There are three phases to the wavelength problem.

(1) Providing new wavelengths for additional stations which are either under construction or contemplated.

(2) Redistributing wavelengths in order to decrease interference.

(3) Low waves.

Little consideration can be given at the conference to disappointed applicants for wavelengths. Secretary Hoover has let it be known pretty generally that there are no wavelengths except in class A, and these are nearly exhausted. Stations which have been constructed recently have received warning that it would be at the risk of being unable to get a wavelength.

There is a feeling that the present allocation of wavelengths constitutes an injustice to certain cities and parts of the country. A notable example of this is Baltimore. This city is the eighth largest in the United States. It does not possess a class B station. There were no applicants until recently, but with the erection of a class B station in Baltimore, the city feels that it is entitled to a class B wavelength.

It is felt that there should be a redistribution of class B wavelengths and that they should be divided proportionally according to population among the largest cities where the best class of entertainment and instruction are available.

Spite of the best efforts of radio supervisors and the Department of Commerce, the present arrangement of stations results in interference. Complaints testify to this fact. There are too many stations for the existing ether channels. If a wider separation between stations were provided it is believed interference of this type would be considerably lessened.

It is believed that the conference will do away with the present classification of stations. In the future, stations will be divided into two classes, the higher and lower power classes. No specific wave band will be provided for either class. Stations will be assigned wavelengths wherever it is found they will work with the best results.

There has been a lot of talk of commandeering the band between 150 and 200 meters for broadcast purposes. This band is now used by the amateurs. But until sets are produced which will tune that low, there seems little if any use of the broadcasters acquiring this band.

One outstanding feature is that the conference probably will recommend a limitation of stations, and Secretary Hoover, in turn, may make such a suggestion to Congress. Plans on this point have not fully materialized, but it is believed that under such a scheme each section of the country would be given a certain number of wavelengths, according to population.

If this plan were adopted, Secretary Hoover believes that future applicants for licenses should be called upon to show reason why they should be permitted to operate.

A Snap-Catch Terminal Strip

FIG. 1, the completed strip.

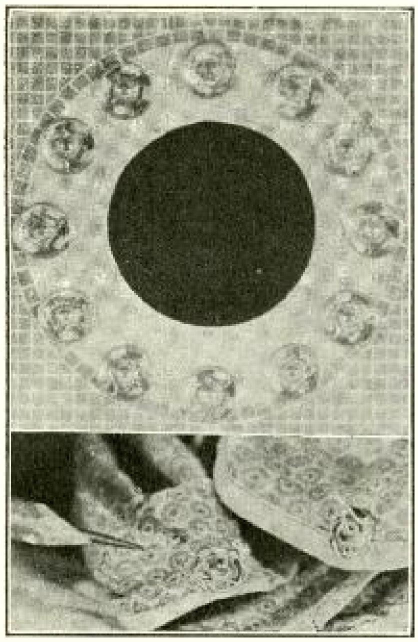


FIG. 2 (top), a cardboard holding a dozen snap-catches. Fig. 3, the usual purpose these catches serve.

By Herbert Erwin

THE wish for greater flexibility of use than is afforded by the general run of terminal strips is the demand of many fans. I base this assumption on the fact that I have often wished that I could more readily disconnect the battery leads from the terminal strip. To fill the gap several suggestions have been put into practice, some of them commercially, like the multi-plug. Confining ourselves, however, to the idea of a strip, we may use the snap catches that are usually sold to women for dressmaking purposes.

What You Need

The object of our endeavor will be to make a strip like that shown in Fig. 1. The little upright extensions of the base are rounded, so that when the head is pressed on the contact is firm, yet when it is desired to disconnect the wire all one need do is to lift up the head, since the rounded extension yields readily.

To make this outfit we need a hard rubber or Bakelite strip, say 7" long x 1½" wide, the snap catches and seven screws and seven nuts, about 6/32. The screws should be about ½" long. Also you will need seven lugs.

In Fig. 2 you see what the snap catches look like when bought by the dozen for a few cents. They come mounted on cardboard. In Fig. 3 is shown the more conventional purpose for which they are used.

The First Step

The first thing to do is to drill the strip, making seven holes ¾" apart at centers. Then at extreme right and left, on a central line, drill two more holes. These two will be for wood screws to mount the strip on the baseboard. Usually extension bushings are used, so that the under part of the strip is kept safely above the baseboard level The drilling operation is shown in Fig. 4.

Now we come to an optional point. If only the battery leads are to be easily removable, seven snap-catches are needed—one for each hole, granting that aerial and ground are included, as is the case of the seven holes are employed in the conventional manner. But you can make the leads from set to strip removable, too. Fig. 5 exemplifies this. The set lead is soldered to the lug, hence this snap head may be lifted off the base at will. In Fig. 5 the lug is mounted one way, while in Fig. 7 it is mounted upside down, so to speak, but you may select your own method.

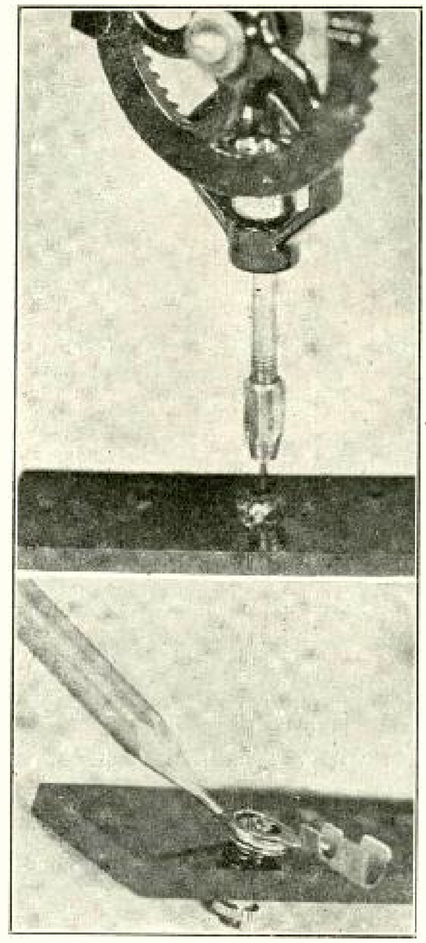
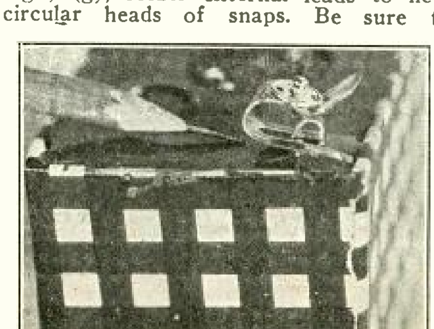


FIG. 4, drilling the hard rubber strip. Fig. 5, showing one way of providing ready removability. Here the lug is attached to the ring of the catch, the collar-button base of the catch being soldered to the end of a screw already inserted in the drillhole of the strip.

The soldering operation necessary for the double-duty purpose—which object requires 14 snap-catches—is as follows: (a), solder snap base, which looks like a collar button, to the flat head of a machine screw, as in Fig. 6; (b), insert screw in drilled hole on strip; (c), fasten down knurled locknut; (d), solder collar button to free end of screw; (e), solder lug to ring of snap catch; (f), solder set leads to lugs; (g), solder external leads to new circular heads of snaps. Be sure to solder. Any play may be taken up by extra nut or washers. Even cardboard washers will do.



HOW the idea may be embodied at the battery end, too.

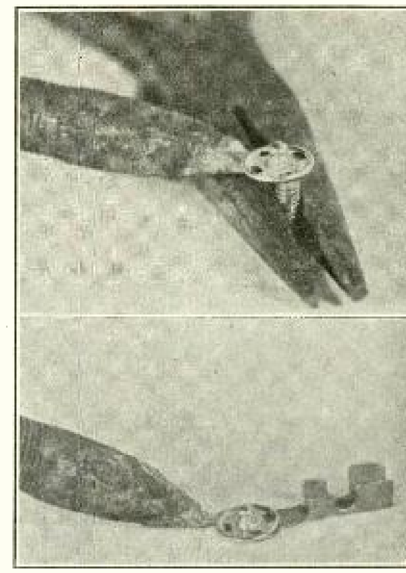


FIG. 6, soldering the screw to the "collar button." Fig. 7, how the lug is soldered to another "collar button."

These operations are for double duty service, but either set of leads may be made removable, instead of both.

Soldering Tips

In soldering take care to heat the catch sufficiently, that is, first hold the soldering iron against it, as the metal must be heated to the same temperature as the flowing solder before a joint can be made. If any difficulty is experienced in making a success of the soldering job, apply some solder to the catch first, tinning it in this manner, and allow this to cool off. Then do the same thing to the head of the screw. The next operation will be to hold together, with the aid of the pliers, the two things that are to be soldered together. The solder that has been placed on both of them will be amply sufficient for the joint, and usually not even a speck of extra flux will have to be added.

Shielded Underground, Antenna Cuts Static

CHICAGO.

Elimination of atmospherics and interference caused by "man-made static" has been furthered within the last year or so through additional experiments with underground antenna for radio reception.

Experiments conducted over a number of years by several prominent radio men have developed that while an underground antenna does not down interference, including that caused by some of the electrical inventions of man, there is a drop in volume.

The underground "aerial" consists of a buried wire which has been carefully insulated so as to exclude dampness. Sometimes this wire is buried in the form of a spiral and at others it is laid in a long trench.

Greater success has attended the system when the insulated wire is encased in a metal shield, which, of course, is grounded, giving what is known as a condenser effect aerial. This shield tends to keep from the receiver a large part of the static and other interference, permitting clearer reception and at times louder signals.

How to Make a Simple Loop

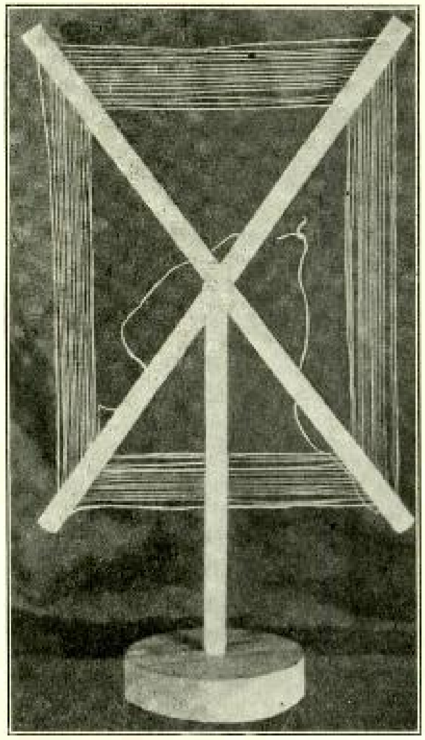


FIG. 1.

By Herbert E. Hayden

Photographs by the Author

IN compliance with the many requests received from RADIO WORLD readers, I built a simple loop and photographed it. It may be used with any receiver, which requires a loop for picking up electro-magnetic energy, instead of the outdoor antenna. Since a great many of the sets are at present equipped with .0005 mfd. variable condensers, this loop was made for these condensers. However, those who have a .00035 mfd. variable condenser will be able to use this loop by adding three extra turns of wire. This will be discussed later.

HERBERT E. HAYDEN

In Fig. 1 we have the completed oblong loop, which stands three feet in overall height. This includes the base, the loop, the length of the stick holding the center of the loop, and the loop proper, which has 2 ft. arms.

Getting the Material

The first thing to do is get all your material together. You will need a small vise. This can be purchased in the hardware store for less than $1. You can purchase a much cheaper one, but it will not stand the strain and will crack. Now get three dowel sticks, which are 2 ft. each in length and about ½" in diameter. See that the wood is tough and the type that will not absorb moisture very easy. A good wood to use is cedar. This might be difficult to obtain. If you have had hard luck and cannot get it take the next bet, white pine. This will suit the purpose. By treating it with several coats of shellac, the wood will become a bit tougher. Don't do anything with the wood until you have made all the necessary slots and holes. Next get the base. This may be of the same wood. It can be circular or square. It is 2" in width and 1 foot in circumference or square, whichever the case may be. The wire with which the loop is wound is next obtained. This is No. 20 double cotton covered.

There are several tools required. A small breast drill with some ¼" drills, a hack saw, which is 12" long and carries a 12" saw, with about 9 teeth to the inch, a 12" ruler and a counter sink ½" drill comprise the list.

A 2" long machine screw with nut is needed, too.

Making the Arms

Now take the dowel sticks. Screw one of them in the vise. Get your ruler. Measure off 11½" from each end. This means that in the center between the two marks there will be a 1" box. Now mark down ¼" from the side circumference on both sides. Now take your hack saw, and saw out this portion which is 1" in length and ¼" in depth. Fig. 2 (top) gives you a clear view of the sawing out of this portion. Do the same with other dowel stick. Now take the two sticks, and see if these square portions fit snugly. That is, one is placed at right angles to the other, and they are both held tight by these notches. Now take one stick and again put it in the vise. Exactly in the center of the notch drill a ¼" hole. Do the same with the other stick. Take them both out. Get the screw. Fit it in through these holes. Now take the third dowel stick. Eleven and three-quarter

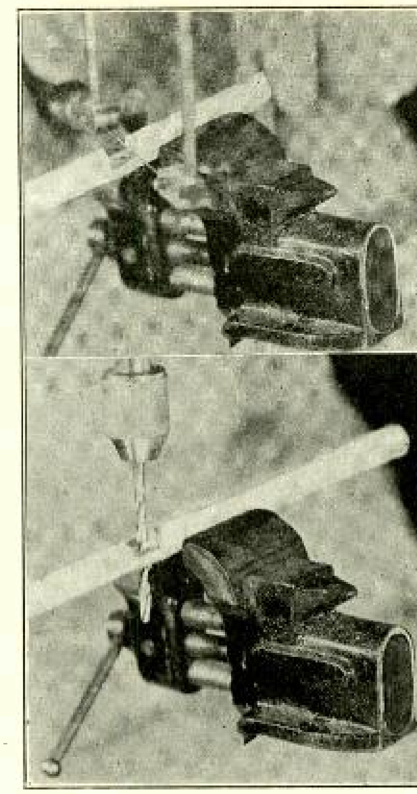


FIG. 2 (top); Fig. 3 (bottom).

inches from the end (either end) drill a ¼" hole. Again take one of the dowel sticks and place it in the vise.

Measuring Notches

Place the ruler on the side of the dowel stick. Now, you can start marking the slots right off the edge, as is shown in Fig. 5, or you can start 1" from the edge and make the slots. The latter is shown in Fig. 1. Whichever manner you may follow, make 14 marks, ¼" from each other. Now take your hack saw and make small ⅛" gashes, where ever there is a mark. This means that there will be 14 notches. Now on the other end of the same dowel stick, do the same. Mark off the 14 points, and then make the gashes. There will then be 28 notches in this dowel stick, 14 on each side of the 1" center notch. Take this dowel out of the vise and place the other one in. Make 14 notches on one end 14 on the other end, in the same manner that the notches for the other stick was made.

Now take the circular or square base and exactly in the center drill a ½" hole. This hole extends three-fourths of the way through the block. In other words the hole is 1¾" deep. Into this hole the dowel stick which has no notches in it is placed. Take the two sticks with the notches and place them so that the center notches fit. Now take the stick without the notches, and place the center hole up against the holes of these two sticks. Run the screw through these three holes. Take the nut and tighten it down. You should now have a strong frame. Place the center stick in the hole of the block. Now take the wire. Run a wire around one of the ends of the notches. Now run the wire up vertically, and then through the notch on the cross stick. In this manner make 14 turns. Run the end of the wire around the stick twice.

Use Some Shellac

After this is done give the sticks a couple of coats of shellac. Take care though that the shellac does not hit the wire proper.

There is still another type of loop to

Garage a Radio Church, General Waits for "Gas"

WASHINGTON.

In the autumn number of Cathedral Age, published by the Washington Cathedral, stories are told concerning actual members of the congregation which "listen in" on the services at the cathedral broadcast on Sunday afternoon.

A Washington General, driving down a dusty Maryland road a few Sundays ago, was informed by the chauffeur that the gasoline was getting low. They stopped in front of a wayside garage and tooted the horn in vain. Finally both walked into the building.

As they stepped across the threshold of the place they halted. Fifteen or twenty men, some in working jumpers, others in Sunday blacks, were standing silently in a group with their hats in their hands. Through the garage echoed a sonorous voice, in prayer.

As the General stood there a man stepped up and said in a low voice:

"We cannot serve you now, sir; the bishop is praying."

He pointed to the loud-speaker on the seat of a rusty old Ford. Off came the General's hat, followed by that of the chauffeur, and they joined the worshippers in this radio church.

After the bishop had pronounced the benediction the garage owner explained:

"You see, sir, there is no church within ten miles of this place, so the neighborhood men have gotten into the habit of coming in here on Sunday afternoons to hear the cathedral services. We never sell while the garage is a church."

Wind 14 Turns, Tune In!

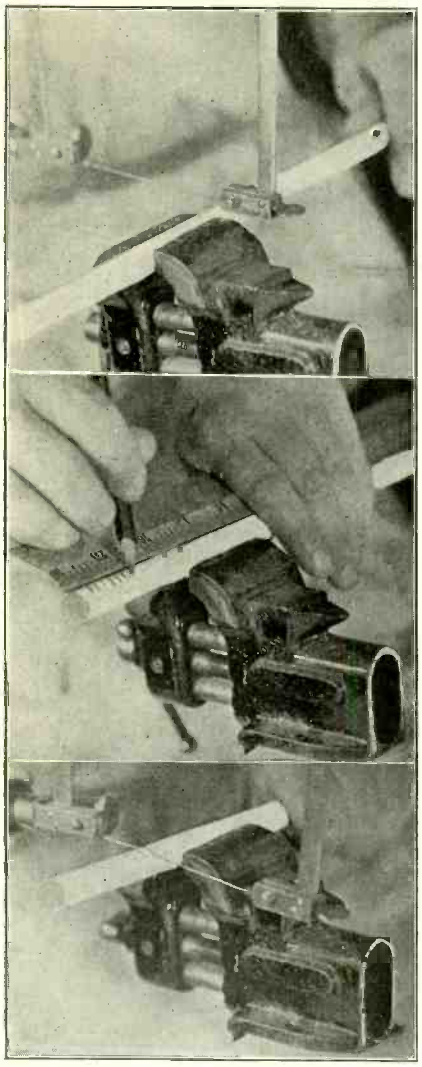


FIG. 4 (top); Fig. 5 (center); Fig. 6 (bottom).

make, which is much simpler. This is shown in Fig. 9, bottom view. Here only two dowel sticks are used. The center one which had no notches in it is laid aside. This loop will work just as good as the one just described, with same capacity condenser. The only difference between the one just described so fully, and the above is that it takes the shape of a box, while the other takes the shape of a diamond. This is not to be confused with the box-shape loop, in which the windings are made on a 2" flat surface. This is then attached to dowel sticks, and unlike this one is not a direct portion of the stick proper. There are 14 turns on the diamond-shaped loop, using the same sized wire.

Fig. 7 (top) shows the windings in the notches. The next view from the top shows how the dowel sticks are placed in the base. The bottom view shows how the three dowel sticks of the box loop are joined by the screw.

If you wish to use a .00035 mfd. variable condenser, then make 18 notches. This will then give you 18 turns, using the same wire, on the same form. If you find that the loop is not easily turned, then make the hole in the base larger.

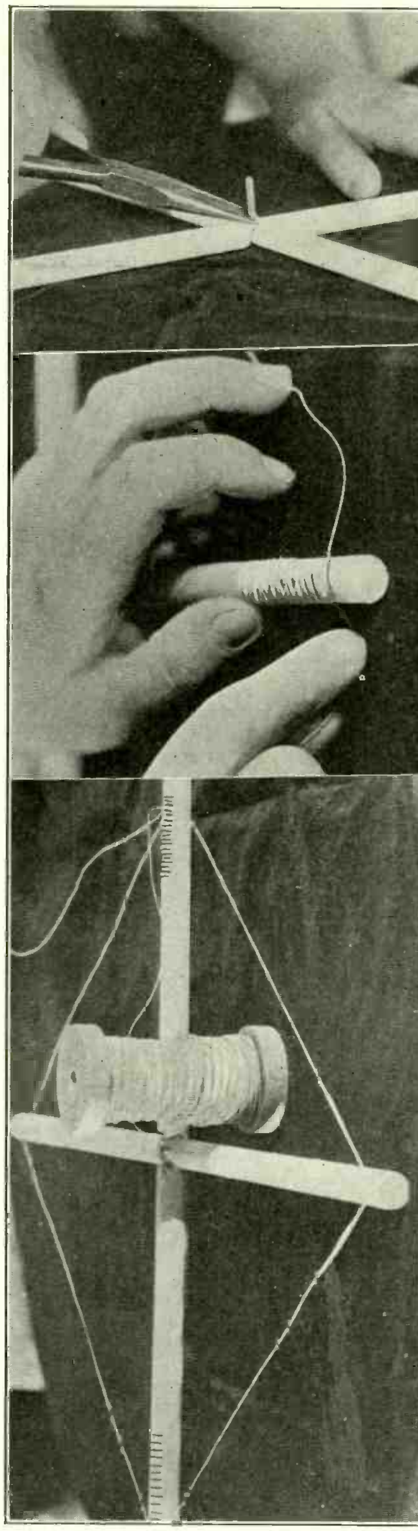


FIG. 7 (top); Fig. 8, Fig. 9 (bottom).

FIG. 10, Fig. 11 and Fig. 12.

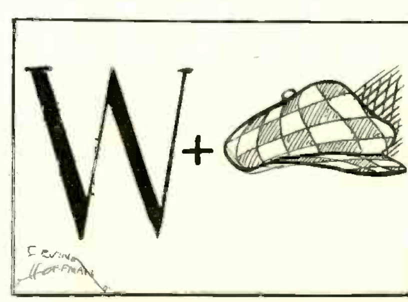
Eight New Stations

WASHINGTON.

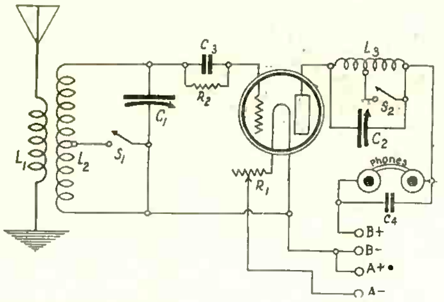
Eight new class A broadcasting stations were licensed by the Department of Commerce and one station was transferred from class A to B. The new stations:

Station Owner Location	M.	W.
KFYD—N. Baker, Muscatine, Iowa	256	250
KSO—A. A. Berry Seed Co., Clarinda, Ia.	242	500
WGHB—Geo. H. Bowles Developments, Clearwater, Fla.	266	500
WBT—Charlotte Chamber of Commerce, Charlotte, N. C.	275	250
WABI—First Universalist Church, Bangor, Me.	240	100
WMAL—M. A. Leese Optical Co., Washington, D. C.	212.6	15
WWAO—Michigan College of Mines, Houghton, Mich.	263	150
KFOJ—Moberly High School, Moberly, Mo.	242	10
Class A to Class B		
WOQ—Unity School of Christianity, Kansas City, Mo.	278	1000

What Station Is This?



Winding Data for Short Waves



HOW a set may be constructed for composite use—short waves or broadcast band. C1 may be any tuning condenser you desire to use for broadcast reception and the same is true of C2. However, the smaller the better, say, .00035 mfd. or .00025 mfd. S1 and S2 are switches. The taps on L2 and L3, if located at a point 1/3 down, counting from grid and plate connection, will work on short waves. This is a makeshift method, but it works.

"If It Is Desired to Cover the Short Wavelength Range from About 200 to 20 Meters It Is Not Practicable to Use a Single Coil or a Combination of Coil and Condenser Which Gives a High Capacity to Inductance Ratio" — "A High Inductance to Capacity Ratio Gives Louder Signals."

By J. E. Anderson

Consulting Engineer

A HIGH-FREQUENCY coil should be wound in the shape of a circular solenoid a little longer than its diameter, with heavy wire, with a minimum of solid insulation, and with the turns well spaced. It should be a circular solenoid because this shape gives a greater inductance to resistance ratio than any other form of winding; it should be a little longer than its diameter because the distributed capacity is proportional to the diameter and independent of the length of the coil, and it is of utmost importance to keep the distributed capacity down to a minimum, it should be wound with heavy wire because the high frequency-currents travel only over the surface of a conductor, and a heavy wire presents a greater surface. It should be wound with as little solid insulation as possible because solid dielectrics increase the distributed capacity somewhat and very greatly increase the losses; and it should be wound with the turns separated because this reduces the distributed capacity and the losses.

J. E. ANDERSON

Suitable wire sizes for high-frequency coils are from No. 20 to No. 12 copper, preferably bare, but if this is not available, then with single silk or cotton insulation. These sizes are rigid enough so that a coil wound with them will be nearly self-supporting, or at least require very little solid support to give them adequate strength and permanence. The separation between any two adjacent turns may be equal to or somewhat greater than the bare wire diameter of the conductor.

An Efficient Coil

A good high-frequency coil may be made in the following manner. On a circular cylinder of the proper diameter and requisite length cut from four to six narrow grooves axially and at equal angular separations. The cylinder may be made of hardwood, with the convex surface polished a little. The grooves may be about ¼" wide. Cut strips of thin celluloid just wide enough to fit into the grooves, and adjust the depth of the grooves so that the celluloid extends above the surface of the cylinder just a trifle. Fasten the strips with glue or with small tacks. Then wind the wire over the cylinder, spacing carefully. Exert a good deal of tension on the wire and make sure that there are no kinks in it. When the correct number of turns has been wound on the cylinder fasten the terminals securely. Then paint over the celluloid strips with a solution of celluloid in amyl acetate. The celluloid solvent will soften the strips allowing the wire to sink into the celluloid a little, and the celluloid in solution will unite with the strips and securely bind the wire. When thoroughly dry carefully remove the coil from the cylinder and trim. This will make a coil which is practically self-supporting, and will be about as low-loss as it is possible to make it. Coils of large diameter and small wire require more celluloid strips than coils of small diameter and heavy wire. Coils of low inductance intended for the higher frequencies should be made of heavier wire, since the higher the frequency the more conducting surface is required.

The Ranges

If it is desired to cover the short wavelength range from about 200 to 20 meters, i.e., the high frequency range from about 1,500,000 to 15,000,000 cycles, it is not practicable to use a single coil. A set of inductance coils is required, the number of coils depending on the size of the condenser used and on the zero setting capacity in the circuit. The larger the condenser is the fewer the coils needed. However, it is not good practice to use a combination of coil and condenser which gives a high capacity to inductance ratio. A high inductance to capacity ratio gives louder signals. Also if a large condenser is used with a given coil to cover a wide range of wavelengths the tuning on the lower end becomes extremely critical. Hence a small maximum value condenser is desirable, and this necessitates the use of many coils to cover the range because the range for each coil is small.

If the maximum capacity in the tuned circuit is 500 micromicrofarads (.0005 mfd.), an inductance coil of 22.5 microhenries will be required to tune up to 200 meters. If the zero setting capacity is assumed to be 50 micromicrofarads the lower tuning limit will be about 63 meters with this coil. If it is not desired to go any lower down the scale only this coil will be required. It is not good practice to use this size condenser for any shorter wavelengths.

If the maximum capacity in the circuit is 350 micromicrofarads (.00035 mfd.), the required inductance is 32.2 microhenries to reach up to 200 meters. If a zero setting capacity of 50 mmfd. be assumed again, the lower limit in this case will be about 75 meters. To go lower than this another coil will be required. The next coil should tune up to about 80 meters with the given condenser. This 5-meter overlapping is required to make sure that no wavelength will be skipped. The required inductance in this set of coils will be 5.14 microhenries. If a minimum capacity of 25 mmfd. be assumed, the lower tuning limit will be about 22 meters.

Coil Winding Table for High Frequencies

L = 90 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	20	40.5	1.16
2"	20	69.0	.45

L = 45 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	20	24.0	1.96
3"	18	27.0	1.38
3"	16	30.0	.98
3"	14	33.5	.70
2"	20	39.0	.80
2"	18	45.0	.55

L = 32.2 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	16	23.0	1.28
3"	14	26.0	.90
3"	12	29.5	.63
2"	20	30.5	1.02
2"	18	34.5	.72

L = 22.5 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	14	20.0	1.17
3"	12	22.0	.84
2"	18	26.0	.96
2"	16	29.0	.68

L = 20 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	14	18.0	1.30
3"	12	20.0	.93
2"	18	24.0	1.03
2"	16	27.0	.73

L = 10.2 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
3"	12	12.0	1.55
2"	16	16.0	1.23
2"	14	18.0	.87
2"	12	20.0	.62
1.5"	16	23.5	.63

L = 5.14 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
2"	14	11.0	1.42
2"	12	12.0	1.03
1.5"	14	15.5	.75
1.5"	12	18.0	.52

L = 4.6 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
2"	12	11.0	1.12
1.5"	14	14.0	.80
1.5"	12	13.0	.71

L = 1.2 Microhenries

Diameter	*Wire*	*Turns*	*D to A Ratio*
1.5"	12	6.0	1.55
1.25"	12	7.0	1.10

[*Key: L = inductance; D = diameter of form; A = axial length of winding.*]

Using the .00025 Mfd.

If the maximum capacity in the circuit is 250 mmfd. (.00025), the required inductance to tune up to 200 meters is 45 microhenries. Assuming a minimum capacity of 50 mmfd. the lower limit will be about 90 meters. The next coil should tune up to about 95 meters. This re-

How to Cover the Wave Ranges

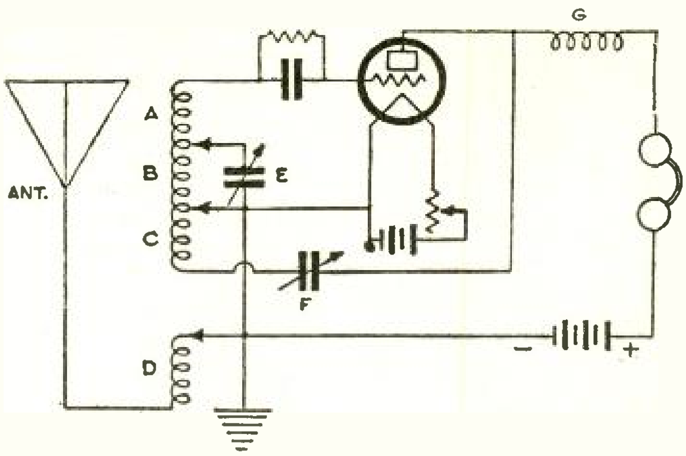
quires an inductance of 10.2 microhenries. The lower limit of this coil will be about 30 meters, assuming a minimum capacity of 50 mmfd. Another coil will be needed, and this should tune up to about 35 meters with the 250 mmfd. condenser. The required inductance is about 1.2 microhenries. This coil will tune way below the 20 meter mark.

If the tuning condenser used is such that the maximum capacity is 125 mmfd. the required inductance to reach up to 200 meters is 90 microhenries. If the minimum capacity be assumed to be 50 mmfd. this coil will tune down to 126 meters. The next coil in this series must tune up to about 130 meters. The required inductance is 38 microhenries, and this coil will tune down to about 82 meters with the same assumed minimum capacity. The next coil should tune up to about 85 meters. This requires an indctance of 16 microhenries, which will reach down to 53 meters. The next coil should reach up to about 55, requiring an inductance of 6.8 microhenries. The wavelength of this for 50 mmfd. in the circuit is 37 meters. The upper limit of the next coil should be about 40 meters. The required inductance is 3.6 microhenries. This coil will tune down below 20 meter provided the minimum capacity in the circuit is less than 31 micromicrofarads.

Although a minimum capacity of 50 mmfd. was assumed in most cases above it is usually less than that, and if a slow motion attachment to the condenser is used it is practicable to tune much lower with a given coil than the lower limit given. This would require a fewer number of coils. This is particularly true of the last condenser. Let us obtain another series of coils for this condenser on the assumption of 25 mmfd. minimum capacity. The first coil is the same as above, namely, 90 microhenries. In this case it will tune down to 90 meters. The next coil should tune up to 95 meters. This requires an inductance of 20 microhenries, and this coil will reach down to 42 meters. The next coil should reach up to 45 meters, requiring an inductance of 4.6 microhenries. This will just reach down to 20 meters.

Summing up then. With a 500 mmfd. condenser the required inductance is 22.5 microhenries and the wavelength range is from 200 to 63 meters. With a 350 mmfd. condenser the required inductance will be 32.2 and 5.14 microhenries with a combined range of from 200 to 22 meters, with overlapping of about five meters. With a condenser of 250 mmfd. capacity the required inductances will be 45, 10.2, and 1.2 microhenries with a combined range of from 200 to 20 meters, with ample overlapping. With a 125 mmfd. condenser the inductances required are 90, 20 and 4.6 microhenries, with a combined range of from 200 to 20 meters. This last is on the assumption that the minimum capacity for each coil is 25 mmfd. instead of 50 as in the previous.

Below will be given the turns and diameter data required for winding coils of 90, 45, 32.2, 22.5, 20, 10.2, 5.14, 4.6, and 1.2 microhenries. In all these coils it is assumed that the spacing between turns is equal to the bare wire diameter of the particular wire used in the given coil. The turns are given to the nearest half turn. The diameter given is the effective diameter of the coil, that is, the distance from the center of the wire on one side of the coil to the center of the wire on the other. The difference between the diameter of the cylinder upon which the coil is wound and the true diameter of the coil is quite considerable when the diameter of the wire is large or when the diameter of the coil is small.



THE ELECTRICAL WIRING diagram of the Short-Wave Reinartz Receiver. The coupling coil, ABCD, is wound on a spider-web form. The primary is wound right next to the hub, which is 2" in diameter. The outside diameter is 5". There are 4 turns wound for the primary. Take a tap off and continue the winding. Wind 2 more turns, take a tap, continue winding 10 turns, taking a tap at every second turn. This will give you 5 taps when concluded. Continue the winding until 15 turns are made. Take a tap at every third turn. This means that there will be five taps made. The first winding (10 turns) was for the grid coil, while the last winding made was for the grid return (15 turns) BCA. The condenser, E, is a .000375 mfd. variable. The condenser, F, is also a .000375 mfd. variable condenser. G is a choke coil and is wound with 300 turns on a form 1½" in diameter, using No. 30 enameled covered wire. The grid condenser has a value of .00025 mfd., while the grid leak has a value of 2 megohms.

The SLF Dial Explained As to Action and Purpose

For a long time it has been realized that radio receivers have one serious drawback: tuning is extremely difficult, especially at the lower wavelengths where the various stations are crowded together on the dials, while at the high wavelengths they lie far apart.

This is caused by the fact that broadcasting wavelengths are assigned according to frequencies. Every station, in order not to interfere with its channel neighbor, needs a frequency band of 10,000 cycles (10 kilocycles) of its own. Now, in tuning at the lower dial settings a small change in condenser capacity will cause a great variation in the frequency to which a tuned circuit responds, while a considerable change in condenser capacity is needed for the same frequency variation at the higher dial settings.

Hence, with ordinary condensers, the readings of the dial will not correspond to the variation in frequency, and the matter works out in such a way that at the lower settings of the dial the stations are crowded.

This problem may become even more acute when space will have to be allotted to more stations, because this may be done by assigning to the new stations wavelengths below 200 meters, which means lower numbers on the dial.

As a result of the above considerations some manufacturers have created condensers with such characteristics that at the lower readings the variation in condenser capacity is but small, thus spacing the stations at these settings farther apart. The best form of condenser for this purpose is the straight-line-frequency condenser, which, when well made, actually does space the various stations evenly over the entire dial scale, a highly desirable feature. It is not always convenient to mount them in an existing radio set, either home-built or manufactured.

It was with these facts in mind that means were sought whereby any existing receiver, equipped with the prevalent type (semi-circular plate) condensers, could be made to separate stations evenly. Thus arose the straight-line-frequency dial, such as the Tune-rite.

The goal is achieved by having the condenser move as usual, with a regular, steady pace, while the dial that rotates it moves at a changing pace, very slowly at first, then eventually very rapidly. Thus mechanical means are employed to achieve the equivalent of an electrical result.

Equal spacing of the stations has its limitations. Theoretical perfection would mean the manufacture of a special dial for every different make of condenser, as a number of manufacturers have adopted some special shape of condenser plate in an attempt to eliminate some of the crowding of the stations on the dial at the lower wavelengths. The way the SLF dial is constructed will make it serve all makes of semi-circular plate condensers and commercial receivers equally well, as in practice it will accomplish the purpose of a straight-line-frequency condenser at the low readings, where separation is essential, and bring stations together where they are separated too far.

The dial must be constructed as a vernier dial as a matter of course, and due to its peculiar vernier action with regard to the actual condenser, the settings change gradually from a ratio of 24 to 1 at low wavelengths to 22/3 to 1 at high wavelengths. Of course, the pointer moves uniformly.

The Phonograph Cabinet Set

[Part I of this article was published in the October 24. Part II, the conclusion, follows.]

By Lewis Winner

Associate, Institute of Radio Engineers

"BUT in order to get the condenser in so that it shouldn't hit the tops of the tubes you had to get a very small size condenser. Is that true?" I queried.

LEWIS WINNER

"Yes that was one of the propositions that I hit up against. It was easily solved though. You see, Jack used condensers with an overall shaft extension of only 2½". The height that the rotary plates reached, when completely out of mesh, was only 1½". All this depends upon the type of condenser, so that the dimensions that I am giving to you will hold true."

"But suppose I have a condenser which has an overall shaft extension of 3 or 4", and an overall surface dimension of 5"?

"Then you will have made your shelf which holds the sockets, much wider. The sockets will be placed back further, right near the edge. This will give you plenty of space all around, since you have 14¾" in the compartment."

"That means that one shelf instead of being 2½", will be 5½" and the other will be 6". This will then give me the extra ½" compensation. Is that correct?"

"That's O. K. The coils in the top shelf will be placed in front of the sockets, or in exact measurements, like this: Socket 1 instead of going 2¼" from the left-hand edge goes 4¼" from this same edge. This will allow plenty of space for the coil L1L2. This coil will then go right opposite this socket and be ¾" from the edge, since the diameter of the coil is 3½". Coil L3L4 placed between sockets 1 and 2. This is 4" long. The grid leak and condenser will then be in front of the socket and not between, as I drew on the diagram. The other two condensers will also be in front."

"Say, you know, as to the bottom shelf, we used small General Radio AFT. If you are going to use the large autoformers, those dimensions will not hold. That is you will have to place them on top of the shelf, instead of the bottom underneath the sockets. You see, we used the same transformers that were used in the other set. All that was done was to connect them up in the special AF fashion. This means that the sockets will be in the back and the AFT will be in front, with only the wiring and fixed condenser on the bottom."

"Well that was certainly fine of you to catch me on that. I forgot that these big AF were going to be used."

Remember folks, Jack's set was built on the dimensions given last week, and these changes took affect only when I and then Bill called these special details to each other's attention, while this was being told to my brother. I believe that a great many of you would have had the same trouble. I know I would. Nobody likes to complete a panel and the shelves and then find out that the condensers will hit the tubes or any thing to that effect. And especially after everything else has gone smoothly. If you will look, at the picture diagram of the internal view of the set (side view shown last week), you will see that the top of the tube cleared the bottom of the condenser. This of course was due to the peculiar construction of Jack's condenser, which in nine-tenths of the cases will not prevail.

"Now suppose, Bill, you tell my brother how to make the coils. Be specific, please," I requested.

Making the Coils

"All right, O. M., here goes. The first coil to be discussed will be the antenna coupler, better known as the first radio-frequency transformer in the diagram, L1L2. L1, the primary of the first radio-frequency transformer, is wound on a form 3½" in diameter and 4" in height. There are 10 turns. The beginning and the end of the windings go to the terminals on the form. The secondary, L2, is then wound. There is no space left between these two windings, but they are separate. There are 45 turns here. Again the beginning and the end of the windings go to the terminals on the form.

"Now that form is laid aside and the other radio-frequency transformer is wound. This is also wound on a form 3½" in diameter and 4" in height. The primary L3 is wound first. There are 8, not 10 turns here. The beginning and the end of this winding go to the terminal posts on the form. The secondary L4 is now wound. There is no space left between these two windings. The secondary contains 45 turns, the same as the secondary of the first radio-frequency transformer. The beginning and the end of this winding also go to the two terminals on the form. All these windings are in the same direction. The wire used when winding these coils is No. 22 double cotton covered."

Bill's description being finished, I carefully drew a diagram of the receiver, Fig. 1, and handed it to my brother, Herman.

"Now, please pay strict attention to each detail in the wiring of this set," I admonished. "We will first start to wire the parts lying on the upper shelf, which contains the antenna coupler, L1L2, the second radio-frequency transformer, L3L4, the two sockets, the two fixed condensers, C3C5, the grid leak and the condenser. The beginning of the antenna primary winding, L1, goes to the antenna binding post on the terminal strip. This lead may be flexible, as Jack has it in his set, or it may be sturdy bus bar. However, don't put any spaghetti on it. The end of this same winding goes to the ground binding post on the terminal strip. Now for the secondary winding, L2, of this same transformer. The beginning of this winding goes to the rotary plates of the variable condenser, C1. It also goes to the arm of the rheostat, R1 (the A— lead). This also goes to the ground binding post, which as I said before, goes to the end of the primary of this transformer. This winding as you will notice lies just adjacent to the ground winding, or the end winding of the primary. In other words, the low potentials are kept together. The end winding of this secondary goes to the stationary plates of the variable condenser, C1, and also the grid post on socket 1. The arm of the rheostat, R1, also goes to one terminal of the fixed condenser, C3. The beginning of the primary winding of the second radio-frequency transformer goes to the plate post on socket 1. The end of this same winding goes to the left-off terminal of the fixed condenser, C3. This means that the grid return is electrostatically coupled back to the plate. Care must be taken that this condenser is O. K., otherwise you will blow out your tube. The F— post on socket 1 goes to the resistance wire of the rheostat, R1. The F+ post on this socket goes to the F+ posts on socket 2. The beginning of the secondary winding, L4, of the second radio-frequency transformer goes to the rotary plates of the variable condenser, C2. This also goes to the arm of the rheostat, R2, which in turn goes to the one terminal of the fixed condenser, C5. Also see that this condenser is O. K. The end winding of this secondary goes to one terminal of the grid condenser, C4, and to one terminal of the grid leak, R8. It also goes to the stationary plates of the variable condenser, C2. The plate post of this same socket, 2, goes to the top terminal of the double circuit jack, J1, and to the left off terminal of the large fixed condenser, C5. Again the filament and the B+ post are by-passed by this condenser, and the same care must be taken that it is a good one. Now, the end winding of the primary, L3, of this transformer goes to the B+2 post on the terminal strip. The terminal on the jack touching, or nearest the frame goes to the B+ 1 post on the terminal strip. The resistance wire of rheostat, R2, goes to the F— post on the socket 2. The F+ post on the socket goes to the F+ post on socket 3. So far we have connected the F+ posts of 1, 2 and 3 together.

"The terminal nearest the top terminal of the double circuit jack goes to the P post on the first audio-frequency transformer. Note that this is not the auto-former. The only remaining terminal of this jack goes to the B+ post on the AFT. This completes the wiring of the first two tubes. I will now discuss the wiring of the audio-frequency amplifier stages."

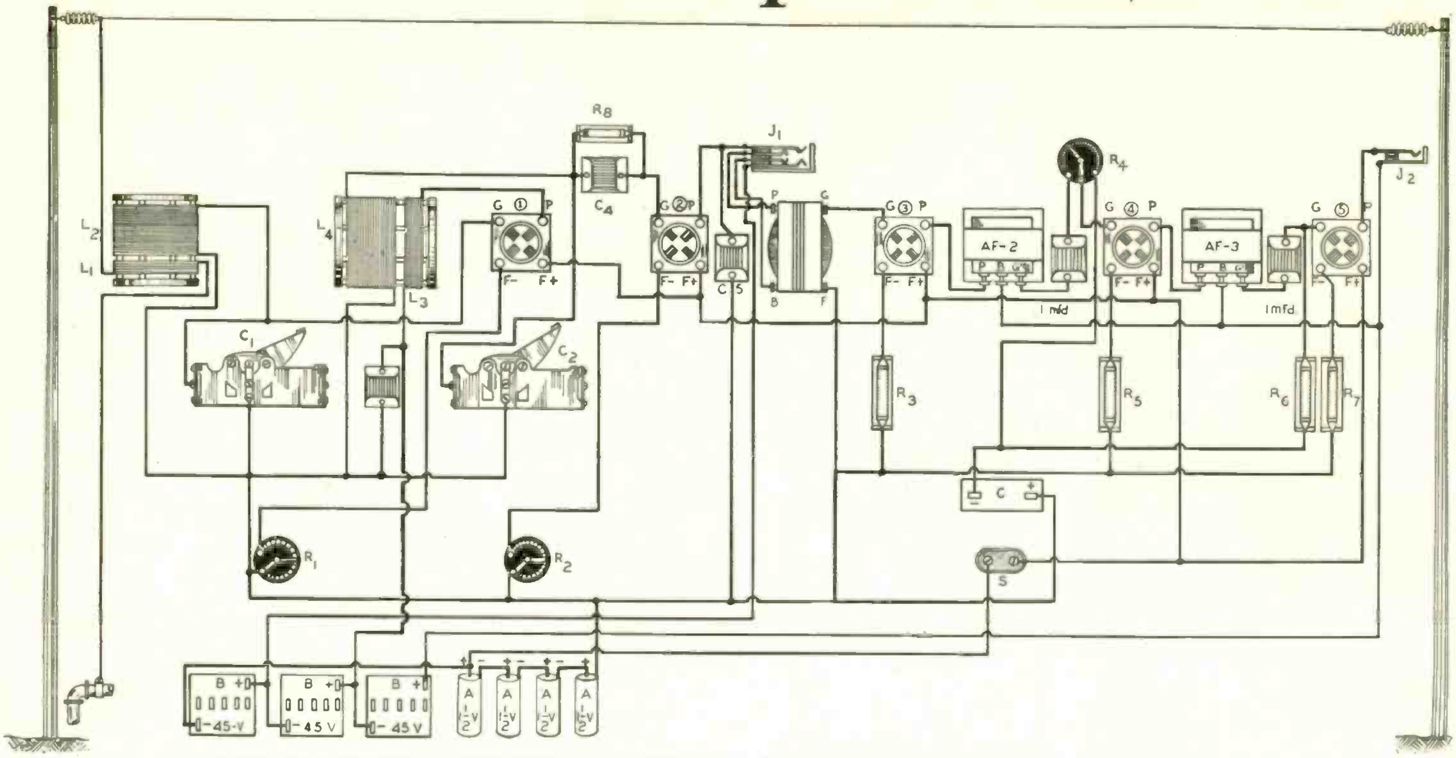
"The grid post on the audio-frequency transformer goes to the G post of socket 3. The F post on this same audio-frequency transformer goes to one terminal of the ballast resistor, R3. The other terminal also goes to the arm of rheostat, R2, and R1. The other terminal of the ballast resistor goes to the F— post on socket 3. This means that the resistance will be in the F— lead. The F+ post, of course goes to the F+ post of socket 4. Now comes the hooking up of the auto-transformers."

Auto-Transformer Virtues

You will notice that there is only one winding on an auto-transformer. However, a portion of this winding is utilized as a primary and the entire winding as the secondary. It is much better than the plain transformer, in point of quality of amplification, but not quite so powerful. The coupling between the P and S is also closer. We use 1 mfd. condenser, S1. C6 and C7 in the diagrams, and also the grid leaks, R4 and R6, to keep the plate voltage off the grid of the tube following. One thing to note here is that the input to the tube which follows is the voltage drop across the grid leak, and not the drop across the secondary of the transformer. Only by employing a large capacity and resistance can we obtain the full quality value. With the ordinary transformer the high and the low notes are not amplified equally, but the middle range is favored. This can best be seen from the computations given by J. E. Anderson in the Oct. 3 issue, which are very interesting.

"Now, to go on with the wiring of this portion of the circuit. The P post on socket 3 goes to the P post on the transformer, AF2. The G post on the transformer goes to one terminal of the fixed condenser, C6. The last terminal of the transformer, B, goes to the B terminal of AF3. The terminal of the fixed condenser that was not connected goes to one terminal of the potentiometer (the resistance wire), R4. The arm of this potentiometer goes to the G post on socket 4. The other resistance wire post goes to the C— post, and also to one terminal of the fixed resistance, R6. One terminal of the ballast resistor goes to the F— post on the socket, while the other end goes to the terminal of R3 that connects to the two rheostat arms. The F+ post on the socket goes

How to Wire Up the Receiver



THE ELECTRICAL WIRING of the Phonograph Receiver, shown in a picture diagram.

to the F+ post on socket 5. The plate post on socket 4 goes to the P post on AF3. The G post on this AF goes to one terminal of the fixed condenser, C7. The other terminal of the fixed condenser goes to the terminal of the fixed resistance, R6. Remember that the other end went to the C— post. The fixed condenser terminal of the resistance goes to the G post on the last socket, 5. The plate post of this socket, 5, goes to the top terminal of the single circuit jack, J2. The bottom or only remaining terminal goes to the B posts of the other two AF. They are all connected together, and go to the B+ 3 post on the terminal strip. One terminal of the ballast resistor, R7 goes to the F— post on the socket. The other terminal goes to the connection, R3 and R5 went to, or to the arms of the two rheostats. This one large lead goes to the A— post on the terminal strip, which means the resistances of the filaments are all in the negative leg of the A battery. The F+ post of socket 5 goes to one terminal of the switch, S. The other terminal of the switch goes to the A+ B— post on the terminal strip. Now you will see that all the F— posts are connected together, and the switch is so connected that when the battery is in the circuit, they are in the A+ lead. The positive side of the C battery goes to the A— post on the terminal strip. That is all there is to the wiring of the set."

"You forgot to tell me, what the values of the different constants of the circuit are."

"Yes, that's true. Well, C1 and C2 are both .0005 mfd. variable condensers. They are of the straight-line-frequency type—Streamline, to be exact. The feedback condensers, C3 and C5 both have a capacity of .001 mfd. The grid condenser, C4, has the usual .00025 mfd. capacity, while the value of the grid leak is 2 megohms. R1 and R2, the rheostats, have a resistance of 10 ohms. The first audio-frequency transformer is of the low ratio variety. The auto-transformers are the Thordarson Autoformers. The stopping condensers, C6 and C7, are both high value condensers, having a capacity of 1 mfd. These should be of the highest grade that you can lay your hands on. The resistance of the potentiometer, R4, is 500,000 ohms (.5 megohms). The resistance of the fixed leak R6, is also .5 megohms. The ballast resistors are all of the ¼ ampere type, the 201A tubes being used extensively here.

"Well, I guess everything is clear, but the operation of the set has not been discussed, so suppose you give me hints on this," said my brother.

"First," I said, "the wiring of this set should be done with No. 14 sandpapered or already bright copper wire, which has no tinning on it at all. Since radio-frequency currents travel on the surface it is always advisable to have a bright metallic surface, so that the currents may flow without any obstructions, which otherwise will occur, e.g., if the wire is tinned. The only good thing about tinned wire is that it is easy to solder. But if you are any kind of solderer you will be able to tin the wire at the juncture and make just as good a job.

LIST OF PARTS

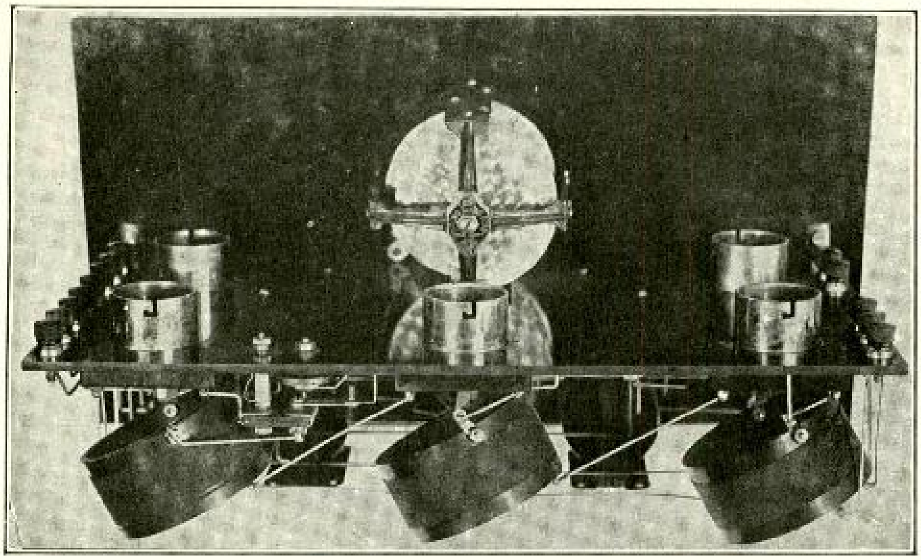
Two radio-frequency transformers (L1L2, L3L4).
Two SLF Streamline variable condensers, .0005 mfd. (C1, C2).
Two .001 mfd. fixed condensers (C3, C5).
Two 20-ohm rheostats (R1, R2).
One .00025 grid condenser (C4).
One 2-megohm grid leak (R8).
Three ballast resistances (R3, R5, R7).
One low ratio AFT (AFT1).
Two autoformers (AF2, AF3).
Two 1 mfd. fixed condenser (C6, C7).
One .5 megohm Centralab potentiometer (R4).
One .5 megohm fixed leak (R6).
Five sockets.
One double circuit jack (J1).
One filament switch (S).
Two 4" dials.
Three 2" dials.
One single circuit jack (J2).
One 12x18" panel.
One socket shelf, 11x6".
One socket shelf, 11x5½".
One dozen angle brackets.
Two strips of bakelite, 12" long.
One terminal strip, 12" long.
Accessories: Connecting wire, antenna wire, ground wire, lead-in wire, ground clamp, insulators, A, B and C batteries, phones, loud speaker, screws, nuts, plug and tubes, etc.

Making Tests

"Now every portion of the receiver should be tested for complete or short circuits. This is easily done by the following process. Procure a pair of phones, and a 1½-volt battery. Connect one end of the phones to the battery. This will give you two leads. Put some long flexible leads on both the phone terminal and the battery terminal. Make sure that these leads are making contact. Now test the variable condensers for a short. Before doing this you will have to take a lead of the condenser off so that it is not in the circuit. Otherwise you will get a click anyhow due to the complete circuit made through the coil. See if you get a click, when you turn the condenser through a complete revolution. You shouldn't. See that the prongs of the sockets are making contact with posts on the socket proper. You probably will have to tighten the set screws on the bottom a little, so that proper contact will be made. Push up all the prongs, so that when the tubes are inserted they will make contact with terminals of the tube. Test the transformers (audion) for complete circuits. That is, see if you get a click between the P and the S terminals. Test the fixed resistance for a short or an open. It will be difficult to tell if there is an open, as you will not get a click. The only way to test this type of an instrument is with a megometer. The fixed condensers are tested in the usual way. That is, the phone and the battery terminal is put across them. After a few moments' duration a faint click should be heard. If nothing is heard, then there is an open circuit. If at the very beginning you hear a loud click, the condenser is shorted, and you will have to get a new one.

[Photographs of a receiver built along the same lines as the one described in the foregoing article will be published next week.]

Completing the 3-in-1 Set



SOCKETS are arranged so that the two RF tubes and detector tube are in the rear, in alignment. These show up in front in the above photograph. The first AF socket is at left, above, and the final AF socket at extreme right.

[Part I of this article was published last week. Part II, the conclusion, is printed herewith.]

THE front panel of the laboratory set was 16½" x 9". The condenser C1 is mounted with shaft hole 8¼" from either side of the panel and 3½" down from the top. The drill should be more than ¼" on a ¼" shaft, so that no friction will take place between shaft and panel. If ¼" drill is the largest you have, then use a countersink on front and back of this shaft hole until you have widened it a little, or use an old pair of scissors or a file to scrape off enough for complete clearance of the shaft. Then locate the condenser mounting hole or holes (using a template), and drill these, countersinking. The potentiometer shaft hole is on the same perpendicular plane as the condenser shaft hole, but is only 1½" from the panel bottom. The radio-frequency rheostat is 4¼" from left of panel, 2¾" up from the bottom, and the detector rheostat is 4¼" from right of the panel and on the same horizontal line as the RF rheostat shaft. The filament switch, at left, and the telephone jack at right, are, like the potentiometer, 1½" up from the bottom, but respectively 2" from left and right of the panel. Except for two mounting screwholes for the subpanel and a dial pointer, nothing else appears on the panel. These holes are 4½" up and are 1" from panel left and right of panel respectively.

The Subpanel

The subpanel is 8½" x 15". On one of the long sides, considered the front, cut away a piece 1¾" wide and 4 ¾" deep. This is to allow room for the condenser, but it will not apply in every case, since the make of condenser employed will determine the size of this cutaway. This can be decided quite readily, since the mounting holes for the subpanel are located on the front panel itself, and the condenser is mounted thereon, too, the location of the cutaway therefore being merely a matter of ocular attention.

Considering the front as that length with the cutaway on it, the second RF socket would be mounted behind the condenser. In the laboratory model the central socket point was 7¼" back and at center of the width (7¼" from either side of the subpanel). The central points of the two other rear sockets was on the same left-to-right line, 2" from each end of the subpanel, respectively. The standard Navy socket flanges are about 1⅜" inside diameter, 1-7/16" outside diameter, and holes were drilled to pass this outside diameter, so that the cups would stick up through the subpanel, the socket bases being accommodated underneath. This required threaded drilling, to take a given small screw, so that two such holes and screws would be used to secure each socket to the subpanel. But most persons will not have the large drill or bit for the 1-7/16" socket holes, nor the means for making a threaded hole for the special socket mounting screws, hence will simply mount the sockets instead on top is the subpanel as if the subpanel were a baseboard, and will drill four small holes in the subpanel at each socket, just outside of where the socket binding posts are, so that the leads may be carried to the subpanel bottom, where all the wiring is done. Besides two holes must be drilled in the subpanel to mount the socket itself.

The audio tube sockets are on a same front-to-back plane as the first and third RF sockets, and are placed with centers 2⅝" back of the subpanel front. The binding posts are at right and left, each 1" apart, with one exception, from each other, running from front to back and all with centers ⅜" from left or right.

Binding Posts

The battery binding posts are at right. Reading from front backward. The first is 2" back of the front. It is A+. Next comes A— and the rest are C—, C+, B—, B+ 22½, B+ 45 and B+ 90. On the other side the first post is for plate and the other B+ 90 (speaker). The distance exception noted before is that the next post (ground) is 3" back of the B+ 90, and next to that need be only the aerial post. In the laboratory model two posts were used for the aerial, the primary L1 being tapped accordingly for long and short antenna, but experiments proved that this was unnecessary, so just a single aerial binding post need be used.

The location of the only remaining holes will depend on three things: (1) the type of grid leak used; (2) the size of the brass angle used in mounting the subpanel to the front panel; (3) the accommodation of the subpanel end of the three coil mountings; (4), the AFT.

The brass right-angles used for affixing the front and subpanels in the laboratory model were ½ x ⅜" (measurements of the length of the arms), but it is a simple matter to locate the subpanel hole for these two angle irons by affixing both irons to the front panel and seeing where the remaining holes hit the subpanel.

The grid leak, if fixed, should be about 2 megohms. Hence consideration (1), cited above, may be disregarded. But (4) will have to be taken care of by the constructor much on his own initiative, since it depends on the type and make of audio transformers used.

LIST OF PARTS

One antenna coupler, L1L2.
Two interstage couplers, L3L4, L5L6.
One 3-section condenser, each section .00025 mfd., C1.
One 30-ohm rheostat, R1.
One 20-ohm rheostat, R3.
One 2-meg. grid leak, R4.
One .75 amp. ballast resistor, R2.
One 400-ohm potentiometer, P.
Five sockets.
Two audio-frequency transformers.
One fixed grid condenser, .00025 mfd., C2.
One fixed bypass condenser, .0001 mfd., C3.
One double-circuit jack.
One dozen binding posts. (C—, C+, A—, A+, B—, B+ 22½, B+ 45, B+ 90, tel., ant., grd.)
Two brass angles, ⅜ x ¼" or thereabouts, for panel support.
Three brass angles, ¼", for mounting coils to subpanel.
One A battery switch.
One dial pointer.
One 4" vernier dial.
Accessories: One A battery, two 45-volt B batteries, one 4½-volt C battery, earphones, speaker, aerial wire, lead-in wire, ground connecting wire, bus bar, ground clamp, lightning arrestor, tubes, cabinet, one phone plug.

Other Resistors

The rheostats R1 and R3 have been considered, but the other resistors, R2 and R4, had better be of the ballast type, although resistance strips may be pressed into service. R2 would be of the 6-volt, .25 amp. type, while R4 would be of the 6-volt .5 amp. type, if 201A tubes are used throughout. If dry-cell tubes are used, the 99 type or their equivalent is to be preferred to the 11 and 12, which are not much good in an amplifying set, anyway. However, there need be no fear whatever of using the 99 type, and if such be incorporated, either standard Navy sockets or special 99 sockets may be employed. I always favor standard sockets, because of the choice they afford, and if the R. C. A. and Cunningham do not make 99 type tubes for standard sockets, instead of using adapters, buy tubes of this kind that will fit standard bases, such as DV3 and the 99 tubes made by some of the better independent tube manufacturers, such as Magnatron.

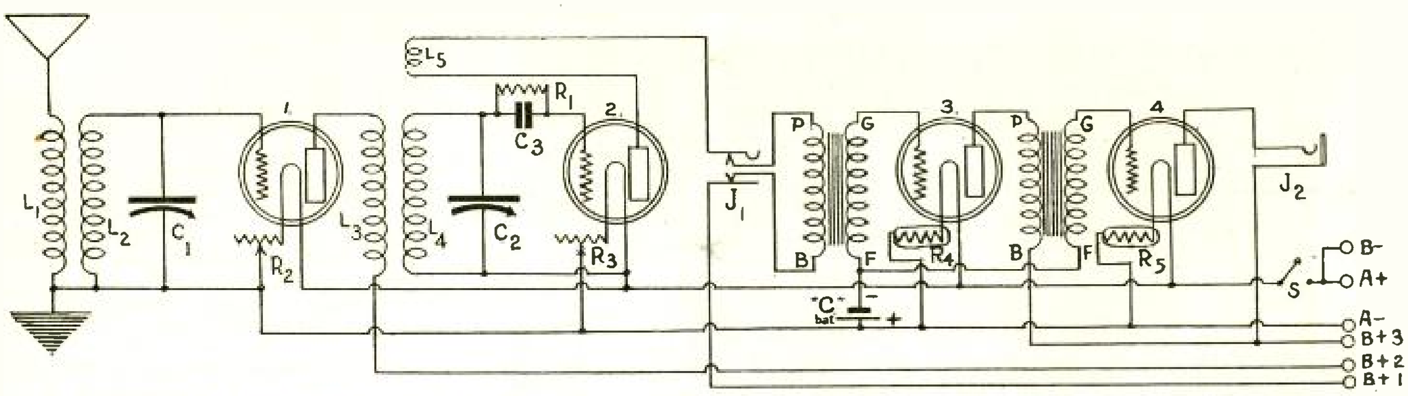
The .5 amp. ballast may be mounted on the switch.

The Polarity Question

Note in Fig. 1 that the aerial goes to the beginning of L1, the end to ground, the beginning of L2 to the potentiometer arm and the end of L2 to grid of tube (1). The beginning of L3 goes to plate of the first RF tube (1) and the end to B+ No. 1 (45 volts), the beginning of L4 to potentiometer arm and the end to grid of the second RF tube (2). The plate of tube (2) goes to the beginning of L5, the end to B plus No. 1, while the beginning of L6 goes to A minus and the end to the coil side of the grid condenser C2. Thus the antenna coupler is connected "out of phase," the first tube turns the

(Continued on page 24)

How to Eliminate a Control



THE 2-CONTROL 4-tube set described by Percy Warren. One dial tunes C1 and C2. This is accomplished by the Hanscom S-C Capacity Element.

By Percy Warren

WHERE one stage of RF and a detector tube are used, with regeneration in either stage, the usual three controls may be reduced to two, thus simplifying the tuning. An excellent way of accomplishing this is to use a gear system. Thus the rotors, as well as the stators, are mechanically and electrically separate and if a positive grid return is desired for detector tube this can be done simply by connecting the terminal of the interstage coupler's secondary to A+, which could not be done if the rotor were common to both condensers, for then the RF tube would have a positive grid return, which is inefficient.

PERCY WARREN

There is also another feature of this special attachment. If you will look at the diagram you wlil note that there is a special compensating device, attached to the condenser on the left. Here a piece of bakelite strip is attached to the variable plates. The bottom of this strip goes to a small cam. This cam is attached to a small arm. By moving this cam the movable plates of this condenser are moved. They are brought farther apart from or nearer to the stator. The variable plates of the other condenser are not affected. In this way the plates of this condenser may be put ahead or behind the other variable condenser so that both condensers tune exactly in step.

Let us suppose that the secondary winding, L2, of the radio-frequency transformer contains 40 turns, and the secondary winding, L4, of the 3-circuit tuner has 45 turns. This means the variable condenser which shunts the RFT will be about 8 degrees ahead of dial that controls the second RFT. However we only have one dial here and we therefore adjust the plates of the condenser that has this device on it so that the same dial reading represents resonance for both. In other words the secondaries of both circuits are equalized. Of course any divergence of tuning, such as due to tube plate capacity, etc., is made up in the same way.

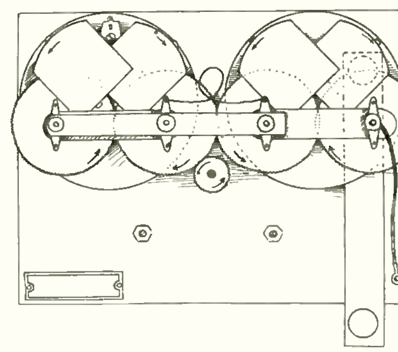


FIG. 3, showing how the condenser mechanism works. Remove the looped pigtail to construct the set shown in Fig. 1, as the two tuned circuits have different grid returns

Drilling the Panel

The first thing that ought to be done when building this receiver is drilling the panel. By doing this you automatically place the panel parts and save a great deal of trouble. The panel is 7x24". The variable condenser is placed in the exact center. That is, the center hole is 3½" from the top and bottom and 12" from each end. The holding holes are given in a special template provided with each condenser. Place this template over this 5/16" hole, and drill the others. This takes up 4" of the space in a square area. The center hole for rheostat R3 is placed 3½" from the left-hand edge, and 2½" from the top. The rheostat will not be in line with the condenser dial, which by the way is 3½" in diameter. The center hole of the other rheostat, R2, is 3" from the hole drilled for R3 and 2½" from the bottom, or on the same plane as R3. The diameters of the center holes are 5 1/16". The holding holes are placed ½" from the center of the center hole one on the left and one on the right. These are ⅛" in diameter. The single circuit jack, J2, is 1-1/12" from the left-hand edge, and 2" from the bottom. The diameter of this hole is ⅞". The filament switch is 12" from the left and the right-hand edge of the panel. It is 2" from the bottom. The diameter of this hole is also ⅞". The double-circuit jacket, J1, is placed 9" from the right-hand edge, and 2" from the bottom. The diameter of this hole is also ⅞".

The hole for the shaft controlling the tickler coil is 3½" from the top and the bottom, and 3" from the right-hand edge of the panel. A small knob, rheostat size, is used. The only holes that remain to be drilled are the bracket holes. The bottom hole of the bracket on the left is 19/32" from the bottom. This is a 1/8" hole. The top hole is 5 1/32" from the bottom hole. They are both ⅞" from the left-hand edge. The diameter of this hole is ⅛". Now on the right-hand side the other bracket holes are placed. The bottom hole of this bracket is 19/32" from the bottom, ⅞" from the edge, and has a diameter of ⅛". The top hole is 5-1/32" from the bottom hole, is also ⅞" from the edge, and has a diameter of ⅛". This is all the drilling there is to be executed on the panel. The next substance to be drilled is the socket shelf.

Drilling the Socket Shelf

If you are going to use the gang socket type of shelf there will be little drilling to be done. You can tell the socket terminals, though they are not marked, by the fact that the grid is at rear left of the slot in the shell where the tube pin catches. The slot at rear, the plate is at right rear, the F— at left front, F+ right front. Suppose you are going to use individual sockets. The shelf is 23" long and

(*Continued on page* 26)

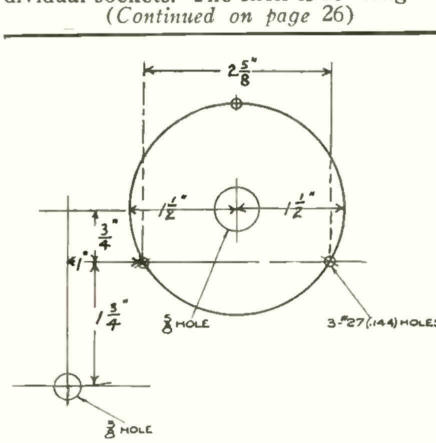


FIG. 4, showing the template for the condenser unit. The hole at the bottom is for the compensating strip. There are three holes for the mounting of the condenser unit. This template is pasted on the panel.

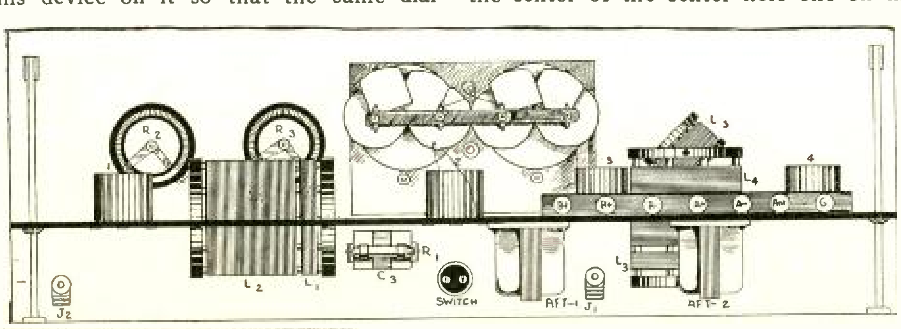


FIG. 2, showing the back view of the set, with the Hanscom capacity unit in view.

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, 145 West 45th St., New York City.

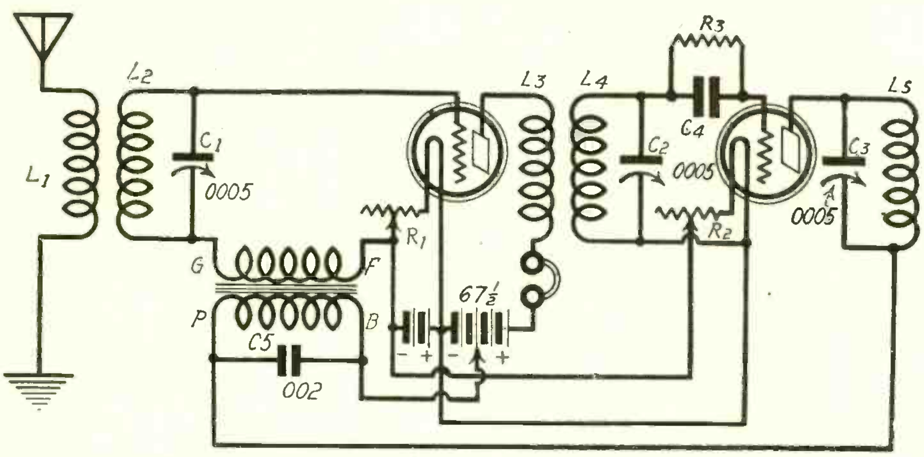


FIG. 223, showing the diagram requested by Mr. Resona.

WILL YOU please give me a diagram of a 2-tube reflex receiver, employing a regenerative detector. I wish to use a coil shunted by a condenser as a means of tuning the plate of the detector tube instead of the conventional tickler.—Q. Resona, Oakdale, Ill.

Fig. 223, shows the electrical diagram of such a receiver. The primary, L1, is wound on a tubing 3½" in diameter and 4" high. There are 10 turns wound on this tubing. The secondary, L2, is wound on the same tubing and contains 45 turns. The primary of the second radio-frequency transformer is wound on a tubing 3½" in diameter and 4" high. There are 10 turns made here. The secondary is wound on the same tubing and contains 45 turns. The plate coil, L5, is wound in a tubing 3" in diameter and 3" high. There are 35 turns wound. The wire used when winding all these coils was No. 22 double cotton covered type. The variable condensers, which tune the secondaries, L2 and L4, and also the plate coil, all have a capacity of .0005 mfd. These are C1, C2 and C3. The grid condenser, C4 is one having a capacity of .00025 mfd. The resistance of the rheostats, R1 and R2, are both 10 ohms. The tubes used are of the 201A type. The audio-frequency transformer used is of the high ratio type. The resistance of the grid leak is 2 megohms. If you find that the set is not loud reverse the secondary of the audio-frequency transformer. If you get too much regeneration take off turns on the plate coil. If you don't get enough, add on turns.

* * *

WILL YOU please give me a diagram of a 2-tube reflex employing regeneration on the first tube and a crystal as a detector?—D. L. Rosen, Fairbanks, La.

Fig. 224, shows the electrical diagram of such a diagram. The primary of the first radio-frequency transformer is wound on a tubing 3½" in diameter and 4" high. There are 10 turns made here. The secondary is wound on the same tubing and immediately adjoining the primary. There are 45 turns made here. The tickler, L3, is wound on a tubing 2½" in diameter and 2" high. There are 35 turns wound here. The primary of the second radio-frequency transformer is wound on a tubing 3½" in diameter and 4" high. This contains 10 turns. The secondary is wound right next to the primary and contains 45 turns. The wire used when winding all these coils is No. 22 double cotton covered type. The variable condenser which tune the secondaries of these coils have a capacity of .0005 mfd. These are known as C1 and C2 on the diagram. The crystal detector is of the fixed type. The ratio of the first AFT is high, about 6 to 1, while the ratio of the second AFT is of a low ratio, about 3 to 1. The success of the receiver depends upon this. The capacities of C3 and C4 are .001 mfd. The both tubes are controlled by one rheostat, and has a resistance of 10 ohms, with a current carrying capacity of ½ ampere. The type of tube used is the UV201A. The jack, J, is of the single circuit type. There are 67½ volts placed on the plates of both these tubes. A 6-volt A battery lights the filaments of the tubes.

* * *

I WOULD be pleased to know the following: (1) Could I use the UX120 tube in Herman Bernard's audio-amplifier? (2) Will a UX120 give more volume here? (3) Will the same tube give more volume in the transformer coupled amplifier?—George O. Snow, 3153 Donner Way, Sacramento, Cal.

(1) Yes, but the voltage that you will have to use will be tremendous. That is, you will have to use a very high B battery voltage, about 250 volts, to get any kind of satisfaction. (2) Yes. (3) Yes.

* * *

IS IT advisable to use the commercial Neutrodyne coils in the new Thordarson-Wade receiver, which was described in the October 3 issue of RADIO WORLD? The one I am referring to has 65 turns on the secondary, tapped at the 15th or 18th turn. The primary has 10 turns.—M. J. Shannon, 1024 Ferwood Ave., Toledo, Ohio.

Yes, they can be used. The tap may be brought to the place where the tap on the other coils went to, or the positive A.

* * *

WHAT SET with 2 stages of AF do you recommend for use as a portable? There should be no more than 3 tubes used.—F. D. Love, Georgetown, Tex.

The Harkness will suit the bill. This is a two-tube set. An extra stage of audio-frequency amplification will make the sets very loud, and can be easily added by taking the output from the plate circuit of the first tube and coupling it to an AFT.

* * *

I HAVE the Goodman Spider-Web coils, which have an inside diameter of 1¾", and an outside diameter of 4". I am going to use a .0005 mfd. to shunt to the secondaries. These coils and condenser are to be used in the Diamond. Would you please give me the specificatoins? (1) What size wire is used? (2) How many turns of wire are there on the primary and the secondary of the radio-frequency transformer? (3) How many turns are on the primary and the secondary of the 3-circuit tuner? (4) How many turns are on the tickler? (5) Would the straight-line frequency condenser be best?—H. K. Mansfield, Barber Block, 15th and Farnam St., Omaha, Neb.

(1) No. 22 double cotton covered wire is used. (2) There are 10 turns on the primary and 45 turns on the secondary. (3) There are 10 turns on the primary and there are 45 turns on the secondary. (4) There are 36 turns on the tickler. (5) Yes.

* * *

HOW MANY turns of No. 24 silk over cotton covered magnet wire should I place on the RFT and 3-circuit tuner 3½" in diameter, to be tuned by a .0005 mfd. fixed condenser? (2) On the primary of the first RFT? (3) On the secondary? (4) What spacing between the windings? (5) On the primary of the 3-circuit tuner? (6) On the secondary of the 3-circuit tuner? (7) On the tickler? (8) How much of the tickler winding should turn in the secondary inductance? (9) Can I use Amperites for all the tubes except the detector and get good results? (10)

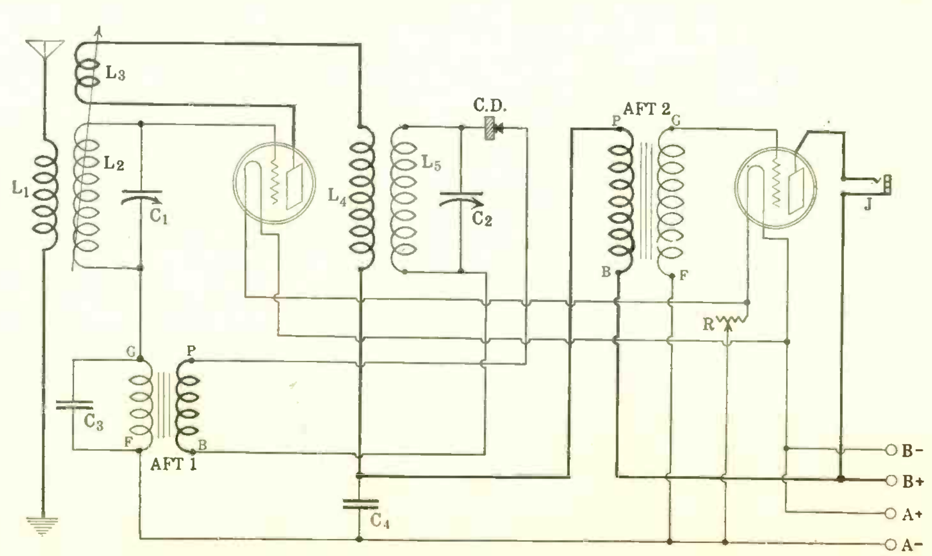


FIG. 224, shows the diagram requested by Mr. Rosen.

How far in should the tickler be from the sides of the outside tubing?—L. A. Bickel, 143 E. 63rd St., Los Angeles, Cal.

(1) Magnet wire should not be used. (2) The primary contains 12 turns. (3) The secondary contains 50 turns. (4) None. (5) The primary contains 12 turns. (6) The secondary contains 50 turns. (7) The tickler contains 40 turns. (8) About ½. (9) Yes. (10) The tickler coil should be ⅜" from the sides. The diameter of the tickler tubing is 2¼".

* * *

WOULD YOU please give me the diagram of a 1-tube regenerative set.—R. Elson, Bacom Point, Fla.

Fig. 225, shows the electrical diagram. The primary, L1, is wound in a tubing 3½" in diameter and contains 10 turns. The secondary is wound on the same tubing, and immediately adjoining the primary. There are 45 turns placed here. The wire used in winding the coil is of the No. 22 double cotton covered type. The condenser which is shunted across the secondary of this 3-circuit transformer is one having a capacity of .0005 mfd. The grid leak, R2, is one having a resistance of 2 megohms. The condenser, C2, is the grid condenser and has a value of .00025 mfd. The resistance of the rheostat is 10 ohms. This is provided the 201A type tube is used. The switch is present to make use of the higher and the lower wavelengths. The tap is brought at the 22d turn. The tickler, L3, is wound on a tubing 2½" in diameter and 2" high. It contains 35 turns. No. 22 DCC wire is used in winding.

* * *

WILL YOU please answer the following questions referring to Fig. 209, page 16, Oct. 3 issue of RADIO WORLD on the Diamond electrical diagram: (1) Please give winding specifications of radio frequency transformer and 3-circuit tuner using them with two 23-plate condensers. (2) What would be the difference in the windings using a straight line frequency condenser? (3) Would it pay to buy new straight line condensers or would satisfactory operation be obtained with the condensers I have? (4) What is the value of condenser C2? (5) What is the value of condenser C3? (6) What is the best amplifier voltage to use? (7) What is the best detector voltage to use? (8) What is the best C battery voltage to use? (9) I have two 5-1 All-American Audio transformers. Will these be satisfactory for loud speaker operation? (10) Is a grid leak advisable in this circuit, if so what value should be used and where is it to be connected? (11) I have three UV201A tubes for amplifiers and one UV200 for detector. Is this all right to use? (12) Should the lower end of coil L2 be connected to A negative as shown; will better results be obtained by connecting it to A positive? (13) Would the above arrangement cover a range of 2,000 miles in winter weather?—O. F. Barklage, 627 Grain Exchange Building, Omaha, Neb.

(1) The winding specifications as given in Percy Warren's article in the present issue may be used for .0005 mfd. (commonly 23-plate) condensers, either single or double. (2) None. (3) You would be able to get the low wave stations with much more ease using SLF condensers, or retaining your present ones, putting an SLF dial on them. With the old type of condenser, the stations will be crowded together on the conventional dial. (4) C2, .00025 mfd. (5) C3, .001 mfd. (6) If you are going to use the 201A type tubes, and you wish to obtain an enormous amount of volume, then use 112½" volts on the plate of the AF amplifier tubes. (7) When using a UV200, use only 22½ volts or less. When using a 201A tube use 45 volts on the plate. (8) The average voltage used is 4½. This, however, depends upon the amount of voltage applied to the plate of the amplifier tubes. (9) Yes. (10) Yes, when using a 201A or 200 tube. The value should be 2 megohms. (11) Yes. (12) When using the 201A, use a positive grid return. When using the 200, use a negative return. (13) This depends upon a great many things such as location, manner in which the set is built, material that the set is built from, person who is tuning the set, etc. If everything is right you will get that distance.

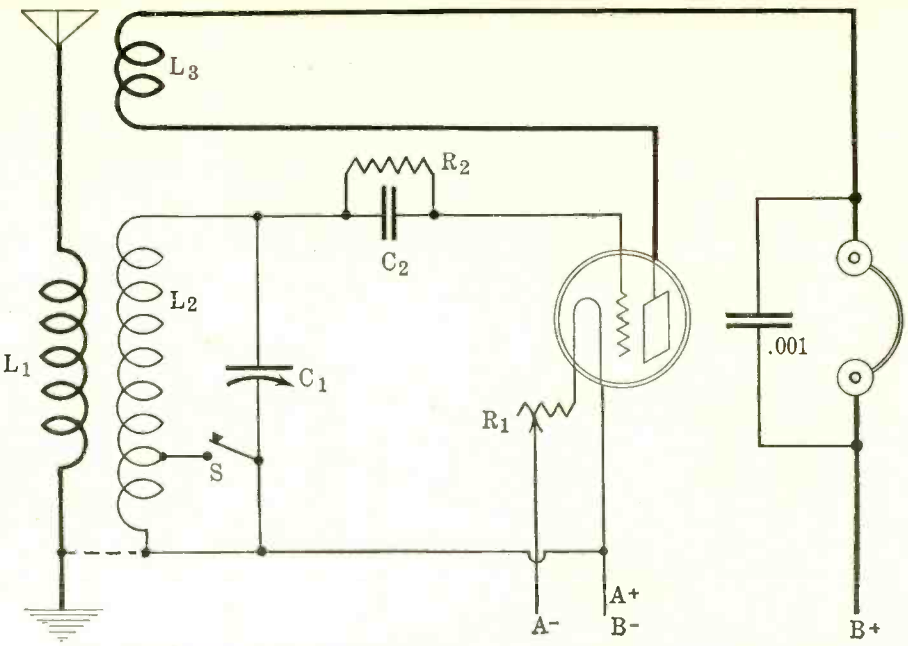


FIG. 225, showing the electrical diagram of a 1-tube regenerative set.

* * *

WILL YOU kindly inform me if any injury to the A battery will take place if the B+ amplifier, is connected to the A positive and B— detector to the A—. (2) I have a pair of AFT. There is rust on the exposed surfaces. Will this impair the efficiency of this receiver any? (3) Can this be removed without injury to the plates?—Charles Reese, McCurdy Hotel Barber Shop, Evansville, Ind.

(1) Yes, you will have short in the A battery. Connect the A+ to the B— of all the tubes. (2) No. (3) There is no necessity for removing this rust. It is very difficult to remove without injuring the plates.

* * *

WHICH IS really the better for DX, two stages of transformer AF or three stages of resistance AF. (2) When I'm receiving a station sometimes the set will break into oscillation. (3) Why is it that the grid leak is sometimes connected across the condenser and sometimes in shunt to the filament? (4) How far apart should the RFT and the 3-circuit tuner be?—Hal. B. Brown, 3332 Abbey St., Oakland, Cal.

(1) AF amplification has next to nothing to do with the actual obtaining of distance. If the first portion of the set, in which the RF tubes and the detector tube, are situated detect the signal, then you will hear it. If, however, this signal is so weak that you can hardly hear it, then the AF amplification will amplify to audibility. If the signal is not rectified, you will not hear it, regardless of amount of the AF amplification. (2) Use a variable grid leak. (3) If you use a double condenser and you wish to have positive bias on the detector tube, while the RF tube has a negative bias, you cannot do so, unless you put the leak to the plus filament side, instead of across the condenser. (4) They should be about 6" apart. However, there is no definite rule about this. If you place them nearer to each other the magnetic field is greater.

* * *

WHAT KIND of transformer should be employed in the AF stages in the receiver described by Capt. Peter V. O'Rourke in the Oct. 10 issue of RADIO WORLD? (2) I have an All-American 10-to-1 AFT. Can I use this?—Wm. Warner, 706 11th Ave., N. Y. City.

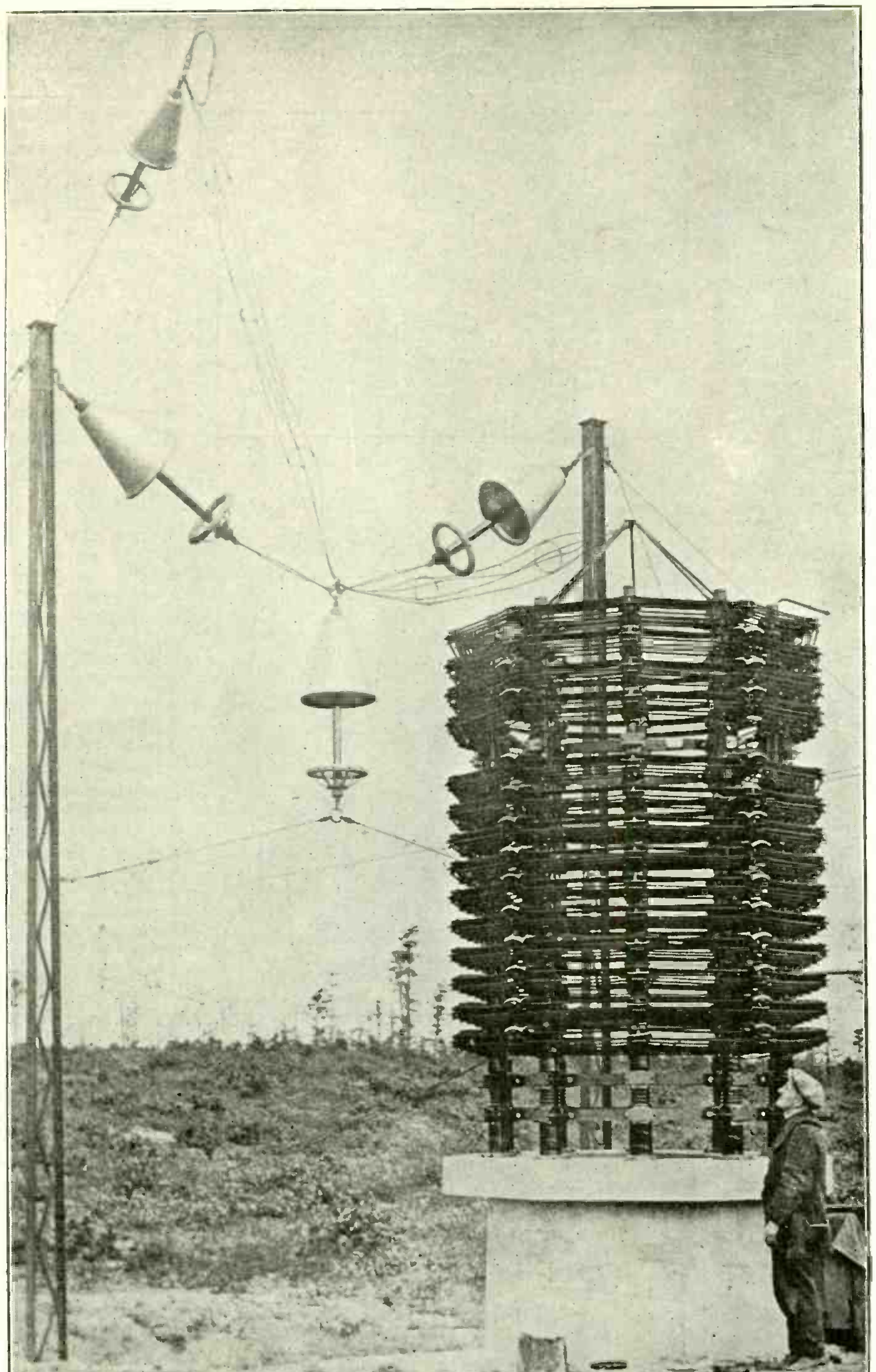
(1 and 2) Since you have the high ratio type, use it in the first stage. Use 3½ or 4-to-1 in the second.

* * *

I HAVE a .001 mfd. variable condenser, some 4" bakelite tubing, and some No. 20 DCC wire. I would like to construct an RFT. (1) How many turns should I place on this form, so that the condenser may be shunted across the secondary of this coil? (2) I have a .0005 mfd. variable condenser, and a commercial 3-circuit tuner. Should any change be made? (3) I have a Ballantine Vario-Transformer. I would like to know if this could be em-

(*Concluded on page* 30)

Radio Telephone from New York to London



THE high power radio telephone station at Rugby, England, which is to be used for transmission to America, is ready for operation. The terminal will be connected shortly with the main London telephone exchange and telephone subscribers then will be able to call New York. The charge for a three-minute conversation between London and New York will not exceed $5. The receiving station at Rocky Point, N. Y., has been getting test messages for some time. Photo shows outdoor multiple tuning inductance apparatus at the Rocky Point Stations. (Fotograms.)

Ship Radiophone

THE new liner Berlin is the first ship to be equipped with radio telephone booths for the use of passengers. Photo shows a passenger, Dietrich Berbeg, talking over phone in booth. It is connected with the ship's radio room, where all the sending and receiving apparatus is located, and is connected much like a regular telephone switchboard. With this radio telephone passengers can talk to other ships within a few hundred miles. (Fotograms).

How the Crystal Oscillator Works for Frequency Tests

In their quest for a frequency governor that will hold radio transmission constant engineers of the General Electric Company are putting the often times troublesome harmonics to work.

Every radio listener has been annoyed by wavering signals. The howl that punctuates an otherwise delightful concert is generally due to the encroachment of a second station which has taken to wandering from its assigned wavelength. Sometimes this departure from the true path is the result of a wind-blown antenna or it may be due to a deposit of ice or sleet on the antenna. Sometimes poor calibration of the transmitter is the cause. Whatever the cause the effect is distressing to the listener and embarrassing for the men who are responsible for the output of the offending station.

A Year's Work

For nearly a year the radio engineers have been delving into the mysteries of crystal quartz in an effort to adapt the peculiar properties of the mineral to the field of radio transmission. It was known that a particular type of quartz possessed what is known as the Piezo-electric effect, that is, that a given piece of crystal will oscillate at a constant frequency when electrical energy is applied to it. For sometime now the crystal has been used as a wavemeter to calibrate signals. The General Electric engineers have gone a step farther and have adopted the crystal as an oscillator to monitor the frequency of a transmitted signal. It is working so well that it is predicted that if all of the nearly 600 broadcasting stations of the country would adopt the crystal as a frequency guide the interference now experienced between stations on neighboring wavelengths would be practically abolished.

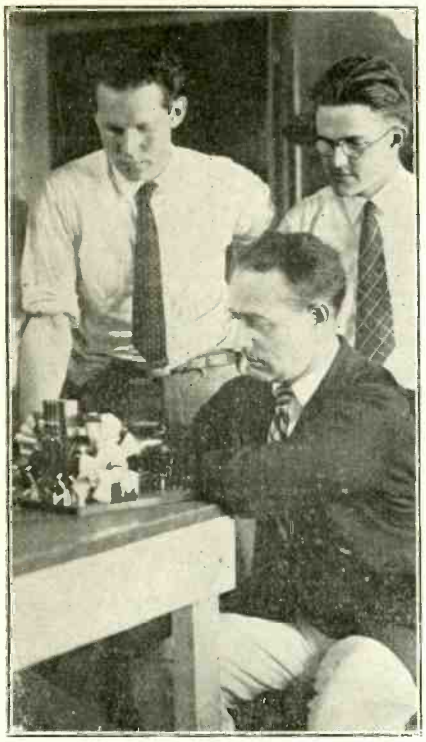
The Department of Commerce has spaced stations ten kilocycles apart. This distance is ample if all stations hold their frequency. The department permits a departure of 2,000 cycles from assigned frequency and regards a station that holds its frequency within 500 cycles as perfect.

The frequency of WGY the Schenectady station of the General Electric Company, is now crystal controlled, in fact it is the first broadcasting station in the country to use the crystal oscillator as a part of its equipment.

A Physical Difficulty

Before the crystal was found to meet all the demands of daily service months of research were necessary. Nearly all of the experimental broadcasting using the crystal oscillator was conducted on the 41.88 meter transmitter. Investigations were made on this wave without danger of interfering with the enjoyment of the listeners. However, before working

Multiplex Radio



JOHN HAYES HAMMOND, JR., seated at Gloucester, Mass., where he conducted a demonstration for Naval radio experts by broadcasting eight telegraphic code messages from one radio transmitting tube simultaneously on the same wavelength and received them on another set. This is the first sending of multiplex radio messages ever accomplished. The general principle of the Hammond system is that a short wave is sent out and the modulation of eight different messages is accomplished. (World Wide).

at 41.88 meters, the engineers have to find a way of getting crystal quartz thin enough for the high frequencies involved. Crystal quartz looks like frosted window glass. The thinner the quartz the higher its frequency and the lower the wavelength. For example, a 209.9 meter crystal is two millimeters thick. A 41.88 meter wave crystal representing a frequency of 7,160,000 cycles, must be four-tenths of a millimeter thick. That means that the quartz, of almost diamond hardness, first must be sawed roughly and then ground down with a slow process until it is a very thin, brittle wafer. It is so thin that it is impractical to handle. To meet this difficulty the engineer decided to put the harmonics to work.

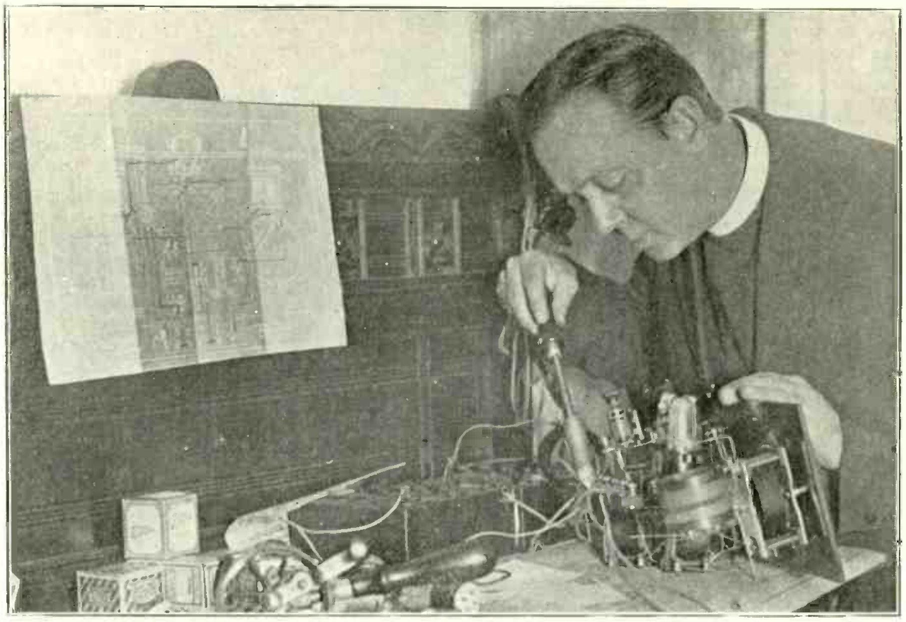
A radio set, in generating a fundamental wavelength generates simultaneously a number of other wavelengths which are fractions of the fundamental. These fractional wavelengths are known as harmonics. The English refer to them as overtones, the same name as is given to the same phenomena in music. Since a 41.88 meter crystal is too thin for practical use the engineer used a crystal ground to give a frequency of 209.9 meters wavelength. He then took the fifth harmonic of the wave, which is one-fifth of a 209.9 meter fundamental, and amplified this harmonic by means of vacuum tubes.

Action of the Crystal

The 209.9 meter crystal is completely enclosed with micrometer adjustment in a brass chamber and brought into the circuit. When the switch is closed the crystal receives a small voltage across its face and at the next instant the crystal expands and delivers voltage to the circuit at very definite and unvarying frequency. This action is cumulative and as the voltage is built up the crystal supplies exciting frequency for the master oscillator or crystal controlled oscillator. This tube excites a second tube which has its circuits so proportioned that it picks out only the fifth harmonic of the crystal frequency. In this particular case 7,160,000 cycle frequency is built up to a sufficiently high value to supply the remaining four amplifiers of the set. In brief the first tube runs at the fundamental frequency of the crystal, and the remaining tubes, making up the amplifying unit, amplify the fifth harmonic or transmitting frequency which goes out on the antenna. This frequency will not vary even with a change of the filament or plate voltage.

In the adoption of the crystal quartz oscillator for WGY, and later for KGO, at Oakland, Calif., and KOA, at Denver, Colo., the engineers are using the most accurate method known for maintaining frequency. The Schenectady station has always been one of a half dozen recommended by the U. S. Bureau of Standards as a frequency standard. This station has been measured by the department 132 times, over a period of 25 months, and the average deviation from assigned frequency has been one-tenth of one per cent. No deviation has been discovered since June 20 of this year.

The Clergy, As Ever, Sets Example



THE CLERGY takes over the radio wiring reins. This photo shows the Rev. William H. Moger at work on his latest radio set in his laboratory. This is the popular Harkness Reflex. The Rev. Mr. Moger hasn't much time, but ever since Radio broadcasting has become popular he has devoted many of his spare moments to developing radio sets, until he has become an expert. He has a complete working knowledge of all the radio sets from a simple 1-tube affair to the elaborate 8-tube Super-Heterodyne. When he started to build this set, it was a 2-tube affair, but now a third tube has been added, and he claims it to be a crackerjack, and his claims none ever dares dispute. Note the ingenious manner in which the Rev. Mr. Moger holds the soldering iron, showing that he can do something which even some experienced builders cannot do well. (Fotograms).

New Frequency Check Devised For Stations

WASHINGTON.

A new type of frequency indicator has just been designed by the Radio Laboratory of the Bureau of Standards which will enable broadcasting stations to keep close to their assigned frequency.

When in action, the indicator will accurately show the frequency upon which the station is transmitting. Under the recommendations of the 1923 National Radio Conference, it is necessary that "every broadcasting station shall be equipped with apparatus such as a tuned circuit coupled to the antenna and containing an indicating instrument or the equivalent for the purpose of maintaining the operating wave frequency within two kilocycles of the assigned wave frequency."

Test Your Tubes for DX, Says Standards Bureau

WASHINGTON.

With ideal radio weather at hand the Radio Laboratory of the Bureau of Standards advises fans to have their tubes thoroughly tested if best results are to be obtained.

"Electron tubes in radio receiving sets eventually lose their sensitivity," says the Radio Laboratory. "This sometimes progresses to the point where the receiving set frequently operates very poorly or not at all, even though the tube filament is not burned out. If the tubes are of the thoriated tungsten (XL) filament type, they can usually be rejuvenated by a simple process and made to serve as well as new tubes. Most of the tubes now in use are of the thoriated tungsten type. The WD11 and WD12 type of tubes are the only ones extensively used which can not be reactivated.

"The Bureau of Standards has found that the reactivation process is quite successful and frequently makes a wonderful difference in the results obtained with the receiving sets."

THE KEY TO THE AIR

KEY

Abbreviations: EST, Eastern Standard Time; CST, Central Standard Time; MST, Mountain Standard Time; PST, Pacific Standard 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 staton s 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.	....

SATURDAY, OCTOBER 31

WAAM, Newark, N. J., 263 (EST)—7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—12:30 PM to 1:05; 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 (EST)—8 PM to 9.
WBOQ, Richmond Hill, N. Y., 236 (EST)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (EST)—11 AM to 12:30 PM; 7 to 9.
WCAE, Pittsburgh, Pa., 461.3 (EST)—10:45 AM to 12 M; 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 (EST)—6:45 AM to 7:45; 4 PM to 5; 6 to 12.
WEEI, Boston, Mass., 476 (EST)—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 (EST)—2 PM to 7:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (EST)—10 AM to 11; 1:30 PM to 3; 6 to 11.
WGCP, New York City, 252 (EST)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CST)—7 PM to 9; 11 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 2:30 PM; 3 to 5:57; 6 to 11:30.
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.
WHAR, Atlantic City, N. J., 275 (EST)—2 PM to 3; 7:30 to 9.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (EST)—2:15 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 (CST)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (EST)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 11:30.
WJY, New York City, 405 (EST)—2:30 PM to 5; 8 to 10:30.
WJZ, New York City, 455 (EST)—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 (EST)—3 to 5 PM; 6:30 to 2.
WNYC, New York City, 526 (EST)—1 to 3 M; 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 (EST)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (EST)—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.
WRC, Washington, D. C., 469 (EST)—1 PM to 2; 6:45 to 12.
WREO, Lansing, Mich., 285.5 (EST)—10 PM to 12.
WRNY, New York City, 258.5 (EST)—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 (EST)—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 (CST)—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, NOVEMBER 1

WBBM, Chicago, Ill., 226 (CST)—4 PM to 6; 8 to 10.
WBBR, New York City, 272.6 (EST)—10 AM to 12 M; 9 PM to 11.
WCCO, St. Paul and Minneapolis, Minn., 416 (CST)—11 AM to 12:30 PM; 4:10 to 5:10; 7:20 to 10.
WDAF, Kansas City, Mo., 365.6 (CST)—4 PM to 5:30.
WEAF, New York City, 492 (EST)—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 (EST)—5 PM to 7.
WGBS, New York City, 316 (EST)—3:30 PM to 4:30; 8 to 10.
WGCP, New York City, 252 (EST)—8 PM to 11.
WGES, Chicago, Ill., 250 (CST)—5 PM to 7; 10:30 to 12 M.
WGN, Chicago, Ill., 370 (CST)—11 AM to 12:45 PM; 2:30 to 5; 9 to 10.
WGR, Buffalo, N. Y., 379.5 (EST)—9:30 AM; 7:15 to 8 PM.
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.
WHAR, Atlantic City, N. J., 275 (EST)—2:30 PM to 3:45; 7:50 to 10; 11:15 to 12.
WHN, New York City, 360 (EST)—1 PM to 1:30; 3 to 6; 10 to 12.
WHT, Chicago, Ill., 238 (CST)—9:30 AM to 1:15 PM; 5 to 9.
WIP, Philadelphia, Pa., 508.2 (EST)—10:45 AM to 12:30 PM; 4:15 to 5:30.
WJZ, New York City, 455 (EST)—9 AM to 12:30 PM; 2:30 to 4; 7 to 11.
WKRC, Cincinnati, O., 326 (EST)—6:45 PM to 11.
WMCA, New York City, 341 (EST)—11 AM to 12:15 PM; 7 to 7:30.
WNYC, New York City, 526 (EST)—9 PM to 11.
WOCL, Jamestown, N. Y., 275.1 (EST)—9 PM to 11.
WOO, Philadelphia, Pa., 508.2 (EST)—10:45 AM to 12:30 PM; 2:30 to 4.
WPG, Atlantic City, N. J., 209.8 (EST)—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 (EST)—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 PM; 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 (EST)—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, NOVEMBER 2

WAAM, Newark, N. J., 263 (EST)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (ESTDS)—12:30 M to 1:05 PM; 7:30 to 12.
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 (EST)—6 PM 11:30.
WCAE, Pittsburgh, Pa., 461.3 (EST)—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.
WDAF, Kansas City, Mo., 365.6 (CST)—3:30 PM to 7; 8 to 10; 11:45 to 1 AM.
WEAF, New York City, 492 (EST)—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 (EST)—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 (EST)—2 PM to 6:30.
WGCP, New York City, 252 (EST)—2:30 PM 11; 1:30 to 3:10; 6 to 7:30.
WGES, Chicago, Ill., 250 (CST)—5 PM to 8.
WGCP, New York City, 252 (EST)—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 (EST)—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.
WHAR, Atlantic City, N. J., 275 (EST)—2 PM to 3; 7:30 to 9.
WHAS, Louisville, Ky., 399.8 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (EST)—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 (CST)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (EST)—7 AM to 8; 1 PM to 2; 3 to 8.
WJZ, New York City, 455 (EST)—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 (EST)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (EST)—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 (EST)—11 AM to 1 PM; 4:40 to 6; 7:30 to 11.
WOR, Newark, N. J., 405 (EST)—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 (EST)—7 PM to 11.
WQJ, Chicago, Ill., 488 (CST)—11 AM to 12 M; 3 PM to 4.
WRC, Washington, D. C., 469 (EST)—9 AM to 10; 12 M to 2; 6:15 PM to 6:30.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (EST)—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.
KWSC, 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.
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, NOVEMBER 3

WAAM, Newark, N. J., 263 (EST)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill, N. Y., 316 (EST)—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.

WBOQ, Richmond Hill, N. Y., 236 (EST)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (EST)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (EST)—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, Mo., 365.6 (CST)—3:30 PM to 7; 11:45 to 1 AM.
WEAF, New York City, 492 (EST)—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 (EST)—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 (EST)—2 PM to 6:30; 11:30 to 12:30 AM.
WGBS, New York City, 316 (EST)—10 AM to 11; 1:30 PM to 3; 6 to 11:30.
WGCP, New York City, 252 (EST)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CST)—7 PM to 9; 11 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 (EST)—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.
WHAR, Atlantic City, N. J., 275 (EST)—2 PM to 3; 7:30 to 9; 11:15 to 12.
WHN, New York City, 360 (EST)—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; 11:30 to 12.
WHT, Chicago, Ill., 400 (CST)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 508.2 (EST)—7 AM to 8; 1 PM to 2; 3 to 4:30; 6 to 11.
WJY, New York City, 405 (EST)—7:30 PM to 1:30.
WJZ, New York City, 455 (EST)—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 (EST)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (EST)—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 (EST)—11 AM to 1 PM; 4:40 to 5; 10:55 to 11:02.
WOR, Newark, N. J., 405 (EST)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7:30.
WPG, Atlantic City, N. J., 299.8 (EST)—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)—9 AM to 10; 12 M to 2; 6:55 PM to 11.
WREO, Lansing, Michigan, 285.5 (EST)—8:15 PM to 11.
WRNY, New York City, 258.2 (EST)—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, Fayetteville, 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.

WEDNESDAY, NOVEMBER 4

WAAM, Newark, N. J., 263 (EST)—12:30 PM to 1:05; 7:30 to 11:05.
WAHG, Richmond Hill, N. Y., 316 (EST)—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 (EST)—6 PM to 11.
WCAE, Pittsburgh, Pa., 461.3 (EST)—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, Mo., 365.6 (CST)—3:30 PM to 7; 8 to 9:15; 11:45 to 1 AM.
WEAF, New York City, 492 (EST)—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.

Radio World Discontinues Advance Programs

When RADIO WORLD started to publish advance programs some years ago it did so as a matter of service to its readers. Since that time the radio publication business has greatly changed. For instance, three years ago only a small percentage of the daily papers throughout the country published radio programs. Today every big Sunday newspaper publishes the advance programs for an entire week. The Saturday papers with radio sections in New York and throughout the country do the same thing. It is estimated now that nine-tenths of the daily papers, large and small, throughout the entire length and breadth of the United States publish programs daily. Even those papers publishing a full week of advance programs also repeat the day's program for the date of issue.

It is fair to assume that newspaper readers preter to get their programs every day, embodying all additions and other amendments, which a weekly publication cannot include.

A questionnaire sent to thousands of RADIO WORLD's subscribers and newsstand purchasers indicates that our readers prefer to have the programs omitted and have the space they would take up devoted to service and news articles and illustrations. This is shown by a vote of five-to-one against the program idea.

Therefore, starting with next week's issue of RADIO WORLD the editors will carry out the express wishes of its readers—no programs. This does not mean that RADIO WORLD will decrease in size, but it does mean that instead of more or less useless radio programs, RADIO WORLD will devote more space to technical and news articles and illustrations. Remember the size of the paper will not be curtailed.

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 (EST)—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, 270.6 (EST)—2 PM to 7:30; 12 M to 1 AM.
WGCP, New York City, 252 (EST)—2:30 PM to 5:18; 8 to 10.
WGES, Chicago, Ill., 250 (CST)—7 PM to 9; 11 to 1 AM.
WGBS, New York City, 316 (EST)—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 (EST)—12 M to 12:45 PM; 2:30 to 4:30; 6:30 to 11.
WGY, Schenectady, N. Y., 379.5 (CST)—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 EST)—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., 400 (CST)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WIP, Philadelphia, Pa., 568 EST)—7 AM to 8; 10:20 to 11; 1 PM to 2; 3 to 4; 6 to 8.
WJZ, New York City, 455 (EST)—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 (EST)—10:45 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (EST)—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 (EST)—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.
WOJ, Chicago, Ill., 448 (CST)—11 AM to 12 M; 3 PM to ; 7 to 8; 10 to 2 AM
WRC, Washington, D. C., 469 (EST)—9 AM to 10; 12 M to 2; 6:25 PM to 7.
WREO, Lansing, Michigan, 285.5 (EST)—10 PM to 11.
WRNY, New York City, 258.5 (EST)—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 AM.
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 715; 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.
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 (CST)—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, Saskatchewan, Canada—8 PM to 11.
CNRO, Ottawa, Ontario, Canada, 435 (EST)—7 PM to 11.

THURSDAY, NOVEMBER 5

WAAM, Newark, N. J., 263 (EST)—11 AM to 12 M; 7 PM to 11.
WAHG, Richmond Hill N. Y., 316 (EST)—12:30 PM to 1:05.

(Concluded on page 23)

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 (EST)—3:30 PM to 6:30.
WBZ, Springfield, Mass., 333.1 (EST)—6 PM to 11:45.
WCAE, Pittsburgh, Pa., 461.3 (CST)—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 (EST)—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 (EST)—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 (EST)—2 PM to 7:30.
WGBS, New York City, 316 (EST)—10 AM to 11; 1:30 PM to 4; 6 to 10:30.
WGCP, New York City, 316 (EST)—2:30 PM to 5:15.
WGES, Chicago, Ill., 250 (CST)—5 PM to 8; 10:30 to 1 AM.
WGN, Chicago, Ill., 370 (CST)—9:31 AM to 3:30 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 (EST)—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.
WHAR, Atlantic City, N. J., 275 (EST)—2 PM to 3; 7:30 to 10.
WHAS, Louisville, Ky., 399.6 (CST)—4 PM to 5; 7:30 to 9.
WHN, New York City, 360 (EST)—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 (CST)—11 AM to 2 PM; 7 to 8:30; 10:30 to 1 AM.
WJY, New York City, 405 (EST)—7:30 PM to 11:30.
WJZ, New York City, 455 (EST)—10 AM to 11; 1 PM to 2; 4 to 6; 7 to 12 M.
WLIT, Philadelphia, Pa., 395 (EST)—12:02 PM to 12:30; 2 to 3; 4:30 to 6; 8:30 to 9.
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 (EST)—11 AM to 12 M; 6:30 PM to 12.
WNYC, New York City, 526 (EST)—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 (EST)—6:45 AM to 7:45; 2:30 PM to 4; 6:15 to 7.

A THOUGHT FOR THE WEEK

The crisp Autumn days are here, the happiest of the year for radioists. Exit Mr. Static. Enter Miss Contentment. Net result, happiness to all!

RADIO WORLD

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

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

TELEPHONES. BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Between Broadway and Sixth Ave.)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
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Paris, France: Brentano's 38 Avenue de l'Opera.
Chicago: A. T. Sears & Son, Peoples Gas Bldg.
Cincinnati Office: Radio World, 304 Provident Bk. Bldg., 7th and Vine Sts. Telephone, Canal 753 and 379.
San Francisco: Lloyd B. Chappell, 656 O'Farrell St.

EDITOR, Roland Burke Hennessy
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SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address also. State whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Times Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

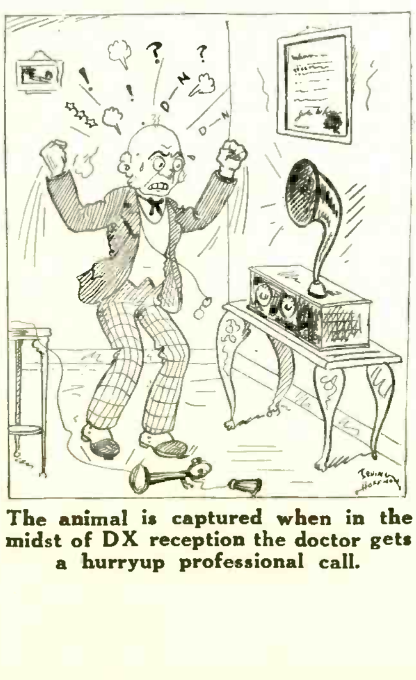
CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum, 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter, March 28, 1922, at the Post Office at New York, N. Y., under the act of March 3, 1879.

OCTOBER 31, 1925

The Doctor's Goat



The animal is captured when in the midst of DX reception the doctor gets a hurryup professional call.

Farmer's Keenness for Radio Rises As His Profits Grow

[The Pennsylvania Department of Agriculture sounded out 343 farmers on their views on radio, set forth in the following report by Geo. F. Johnson.]

Purpose

The increasing farm popularity of radio has advanced to a place where radio reception of market and weather reports, music, singing and other forms of entertainment and instruction is influencing the economic and social conditions surrounding the farmer. To get some idea of this influence in Pennsylvania, to gain insofar as possible the farmers' own viewpoint and estimate of radio and radio programs, and to bring together suggestions for the improvement of these programs for farmers, has been the purpose of a questionnaire survey by the Pennsylvania Department of Agriculture.

The three counties in which this survey was made were:

Bradford, in Northern Pennsylvania, prominent in hay production, poultry raising and dairying.

Bucks, in Eastern Pennsylvania, bordering Philadelphia, prominent in dairying, vegetable gardening and poultry raising.

Westmoreland in Western Pennsylvania, bordering Allegheny County in which Pittsburgh is located, a general farming section.

Farmers Find Radio Satisfactory

The survey revealed that farmers generally regard the radio as a satisfactory investment. This was true in all three counties surveyed. Out of a total of 314 replies to the question, "Do you regard the results you receive as a satisfactory return for your investment in the radio?" 302 or 96 per cent. said "yes" and only 12 or 4 per cent. said "no."

The Size of Farm Radio Sets

That the majority of farmers are not depending upon one-tube or crystal sets for their radio information is evident. Approximately two-thirds of the 340 farmers replying to the question, "How many tubes in your set?" reported two or more tubes and of these 85 per cent. have loud speakers. Of the entire 340 sets, 57 per cent. are reported equipped with loud speakers which means that the entire farm family is able to enjoy the programs. A total of 107 sets were either one-tube or crystal, and, of course, not equipped with loud speakers.

Stations Farmers Hear Best

In answering the question, "What station do you hear best, and next best?" it was evident that the larger stations located within a radius of a few hundred miles were heard best. In Westmoreland County, the Pittsburgh stations, especially KDKA and WCAE, were named with but very few exceptions. WGY was named by some in this county as their "next best" station. In Bucks County which adjoins Philadelphia County, the Philadelphia stations, especially WIP, WOO and WFI, and the New York station, WEAF, were most frequently named as "best" and "next best." In Bradford County, which is at a much greater distance from Pittsburgh and Philadelphia, a more scattered list of stations was given. KDKA, WGY and WBZ (Springfield, Mass.), were named as the "best" stations in the order given. The same three, with WEAF of New York City, were also the "next best" stations.

Farm Families Use Radio in Daytime

The radio is not used on the farm merely for evening entertainment. More than 70 per cent. of the families covered by the survey use the radio in daytime. A total of 329 replies were made to the question, "Does your family make use of the radio in daytime?" and of these 234 or 71 per cent. said "yes."

Permanency of Radio Popularity

In order to gain some idea of the permanency of the radio popularity, the question was asked, "Is your radio used as much now as when first installed?" Since only farmers having their radio sets more than six months were included in the survey, the answers are significant. A total of 307 farmers answered the question. Of these 188, or 61 per cent. said their radio was being used as much as or more than when first installed, and 119, or 39 per cent. replied in the negative.

Farmers Interested in Many Features

If the farm population covered by the survey is at all representative, farm families are interested in a varied list of radio features. In the questionnaire, the following features were listed and farmers asked to check those which appealed to them: popular music, classical music, singing, educational talks, humorous talks, market reports, weather reports, cooking recipes and current news items. Of these, weather reports, popular music, educational talks, market reports and current news items were checked in more than 75 per cent. of the replies.

Radio Market Reports

In an attempt to discover the kind of market reports which were of value to farmers, the questionnaire listed the following reports and farmers were asked to check those which were of value: Live stock, poultry, eggs, fruit, vegetables, potatoes, grain and feed. Out of 343 replies, 234 desired reports on eggs, 225 on poultry, 168 on grain, 160 on feed, 152 on live stock, 148 on potatoes, 126 on vegetables and 120 on fruit. In general, the kind of market reports desired, depends upon the type of farming practiced in the particular locality. For example, raising poultry, and marketing eggs, is a common enterprise in all three counties surveyed. (Bucks and Bradford Counties are both prominent poultry centers.) This accounts for the general popularity of egg and poultry market reports. On the other hand, the live stock and fruit growing enterprises are less specialized in the counties surveyed than in certain other sections of the State, which accounts, no doubt, for less interest in live stock and fruit market reports.

About one-third of the farmers answering the questionnaire reported that radio market reports had either made or saved them money. Out of a total of 208 replies to the question, "Have market reports ever made or saved you money?" 104 said "yes" and 104 said "no." One hundred and thirty-five of the replies did not state an answer to the question. Very few of those who said the reports had saved them money, explained the way in which it came about.

"When is the most convenient time to receive radio market reports?" This question brought forth a great variety of times ranging from morning to after 10 p. m. In general, it seems that the most convenient time is from 7 to 9 p. m. Out of 287 replies, 139 specified "evening" and 79 others stated various times between 7 and 9 p. m. Those desiring reports at noon numbered 39 and those between 6 and 7 p. m., 17. Only four wanted the reports after 9 p. m., and only six in the forenoon.

ground. Separate aerial and ground leads give more volume.

Disposition of Parts

Mount the parts on the panel. They are the two variable condensers, the coil, the rheostat and (if you use one) the A battery switch. No switch is necessary, but if you include one place it in the A plus lead. The idea of mounting the coil on the panel is in keeping with the no-baseboard idea. This necessitates a socket of the panel-mount type, so if you are planning to use the other type, get a baseboard 7" deep and about 1" shorter in width than the width of the panel. This is to allow the baseboard to pass through the front opening of the cabinet, if you are thinking of treating yourself to a cabinet. If you are not going to use a cabinet, and still desire to avoid a baseboard, attach two large angle irons to the ends of the panel, to support it when you stand the set on a table.

Wiring

Wire the filament first. A minus goes to one terminal of the rheostat. Be sure it is that terminal that is closer to the resistance wire. You will find an open space between the winding and the other terminal of the rheostat, and this is the terminal that goes to the F minus post of the socket. Connect A plus to F plus on the socket. Join B minus and A plus.

Connect the aerial to the beginning of L1, the ground to the end. Connect the beginning of the secondary to the rotary plates of C1 and to the rotary plates of C2. This lead is joined nowhere else. Connect the tap to A plus. Connect the end of L2 to one side of the grid condenser C3 and the other side of the grid condenser to the G post of the socket. With some types of grid condensers it is possible to place the one hole over the socket post and screw down the nut. This is sufficient security and electrical contact, but be sure to screw down the nut firmly. The grid leak is connected across the grid condenser, which, if it has two clips on it, enables the cartridge type leak to fit in snugly. If your condenser has no clips you may use a single mounting, connecting its ends to the grid condenser's two sides, and inserting the leak in the mounting. In an emergency solder a 1" piece of bus bar at right angles to the leak, at each metal tip of the leak, and solder the other end of the bus bar to the respective sides of the grid condenser.

The plate or P post of the socket goes to the spring of the jack J and also to the stator plates of C2, while the frame or right-angle of the jack is left unconnected for the moment.

Turn up the rheostat. If it lights the tube properly you may proceed. If it does not light it at all, check back on the filament wiring, for you have made a mistake, else the rheostat winding is broken. If the tube lights suddenly bright, then gets dimmer the more you turn the rheostat, reverse the leads to the rheostat terminals, so that where the battery now goes the F minus of socket will go instead. Now disconnect the A minus lead from the A battery, but leave A plus there. Connect the frame or right-angle of J to B plus, say 45 volts. Turn up the rheostat. The tube should not light. If it does, then check up your wiring, for there is a short circuit in the A or B wiring. If the tube does not light, then you may safely restore the A minus lead to its position on the battery, leaving the B plus where you have it, and prepare to tune in.

RADIO UNIVERSITY

(*Concluded from page* 15)

ployed in the Diamond?—C. Douglas Reid, care The Ritchie Co., Limited, Belleville, Ontario, Canada.

(1) There should be 8 turns on the primary. Leave no space and wind the secondary, 35 turns. (2) No. (3) If you wish to use it, take out the RFT, and the condenser which is shunted across the secondary and place the Vario-Transformer in its place, using the same terminal connections.

* * *

KINDLY LET me know if I can use the Bremer Tully 3-circuit tuner and condenser in the Diamond. (2) Can I use the Bremer-Tully RFT, with the condenser in the Diamond?—Charles Fischer, 337 Second Ave., Garwood, N. J.

(1) Yes. (2) Use .00035 mfd. condensers with B-T coils.

* * *

I BUILT the Powerful Reflex as described by H. E. Wright in the May 23 issue of RADIO WORLD and find that I get wonderful results. I was wondering if I could use a tandem condenser, thereby making it a 2-control set instead of a 3-control set as it is now.—Henry E. Greer, San Rafael, Cal.

Yes, but you would have to use the same grid return for both stages.

* * *

HAVE JUST completed the Diamond, 1926 Model, and am having the following trouble: (1) The tickler has no effect on tuning. That is there is no regeneration present. (2) The set distorts. I am using a Sodion tube. (3) When I place a resistance across the secondary of the first AFT, the volume is cut down at least 30%. (4) The base of the tubes get very hot. Is this anything? I am using two Bradleystats to control the filaments, Bruno Coils, General Radio AFT, and low loss condensers.—C. H. Cort, 20 Ruth Rd., Toronto, Ontario, Canada.

(1) Reverse the tickler leads. Place a .001 mfd. condenser across the tickler coil. Increase the voltage of the detector tube. Test your tube. It may be lifeless, though it lights. (2) Place a 201A tube in the circuit. Also place a grid leak in the circuit. This is shunted across the grid condenser. (3) This is exactly what will happen. Use a variable resistance. (4) This is nothing serious, so long as the rheostats do not get very hot. A proper value ballast will not heat up. See that you use the proper voltage A battery.

* * *

REFERRING TO "The Most Efficient 4-Tube 3-Control Set" as described by Capt. Peter V. O'Rourke in the March 21 issue of RADIO WORLD, a ground lead is not shown. (2) The diagram shows the plus side of the C battery connected to the minus side of the A battery. Is this correct? I ask this because if the battery is connected this way, I get a great deal of volume, but with a lot of noise. However, as soon as I reverse this battery the volume is reduced, but the music is cleared up. The set otherwise works great, but I would like to obtain the most volume possible, so please set me straight with this connection.—F. O. Smith, Hartsville, S. C.

(1) The ground lead goes to the end of the primary winding. This is not absolutely essential. (2) The manner in which the C battery is hooked up, is the correct way. Reduce the C voltage or omit the C battery.

* * *

WILL YOU please tell me the number of turns that are on the coils of the 1-tube set as described by Percy Warren in the May 23 issue of RADIO WORLD?—Wm. H. Marlin, 33 Second St., Providence, R. I.

All the turns are wound on the same form, 3" in diameter and 4" in height. For the antenna coil wind 10 turns. This is wound in the center of the form. The grid coil contains 50 turns. This is wound on either end. The plate coil contains 35 turns. Be sure and see that the Gnd. terminal and the F terminal are kept together. The plate terminal adjoins the antenna terminal. No. 22 single cotton covered wire is used. The condensers that shunt the plate and the grid coils are of the .0005 mfd. capacity type.

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WARREN'S SET

(*Concluded from page 27*)

C3, grid condenser, and to C2 rotor plates. The other side of C3 goes to the grid post on socket No. 2. The arm of the rheostat, R3, goes to the A— post on the terminal strip. The resistance wire goes to the F+ post on socket 2. The tickler remains to be wired up. The beginning of this winding goes to the plate post on socket 2. The end of this winding goes to the top terminal of the double circuit jack J1. The bottom terminal goes to the B+1 post on the terminal strip, normally 45 volts.

The inner terminal touching the upper terminal or plate connection, when the jack is out of the circuit, goes to the P post of the first AFT. The only other remaining jack post goes to the B+ post on the AFT. The grid post of socket 3 goes to the G post on the AFT. The F— post of this AFT goes to the C— post. This same connection goes to the F— post on the other AFT. The P post on AFT2 goes to the P post of socket 3. The B+ post goes to the B+3 post on the terminal strip. The G post on AFT2 goes to the grid post on socket 4. The F— post of both sockets go to the same connection that F— post of the other sockets. The plate post of socket 4 goes to the top terminal of J2. The bottom terminal of this same jack goes to B+3 post on the socket strip, usually 90 to 135 volts. Ballast resistors, R4 and R5, are placed in the negative A lead.

Put the grid leak R1 across the grid condenser.

Tuning the Set

This set is easy to tune. But suppose you have just finished the set and you get absolutely no signals, except the usual B battery click. First turn your tickler coil. See that if by turning this you hear a loud click when a certain point is reached. If you don't, then you have no regeneration. To cure this first reverse the leads of the tickler coil. If this doesn't help, add on more turns to the coil. Add on about five turns for a starter. You may easily get too much regeneration. In that case reduce the number of tickler turns. The next thing to do is to put more voltage on the plate of the detector tube. Then try placing a .001 mfd. fixed condenser across the outside J1 terminals. Instead of adding turns to the coil you may place a .0005 mfd. fixed condenser across the tickler leads themselves. This will automatically increase the fundamental frequency that this coil will respond to. In other words, it will be the same as if adding on truns of wire.

Now suppose you get broad tuning. This can easily be cured, provided you don't live within a quarter-mile of the stations.

A short antenna should be used. By a short antenna is meant one no longer (including lead-in) than 100 feet.

When wiring up the set, use No. 14 or No. 18 rubber covered or No. 18 double cotton covered wireo r bell wire. Try not to use bus bar.

The 201A type tubes were used here throughout.