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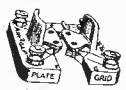

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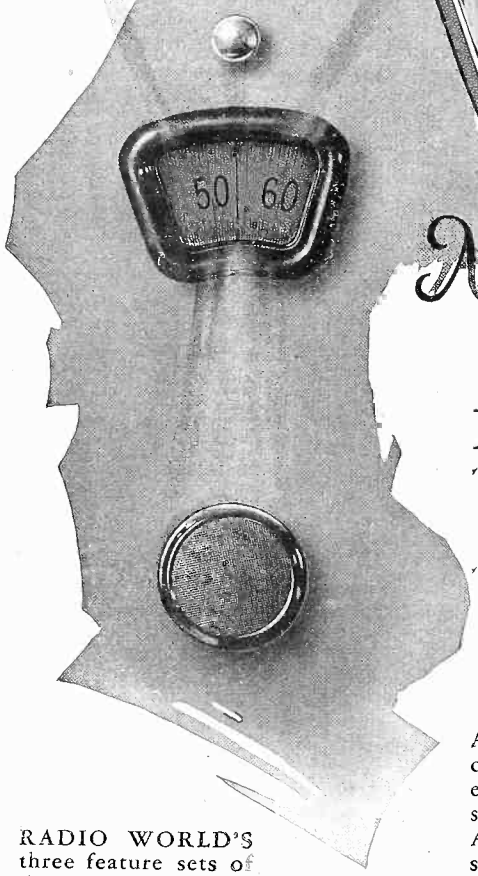

Now dials give place to glowing spots of light

PICTURE a soft, subdued light in the room . . .

, , , your set in the corner ~ with glowing spots of light illuminating its swiftly readable *back panel* scales.

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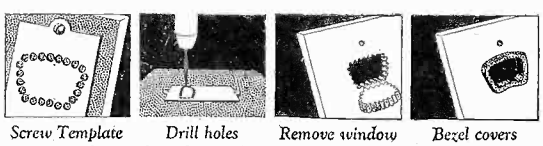

Screw Template to panel — *Drill holes through Template* — *Remove window opening* — *Bezel covers rough edge*

that's ALL *you* CAN'T *go wrong!*

Vol. X
No. 11
Whole No. 245
DECEMBER 4, 1926
15c Per Copy. $6.00 a Year

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REG. U.S. PAT. OFF.

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The Regenerative Equamatic

Capt. O'Rourke's DX Getter

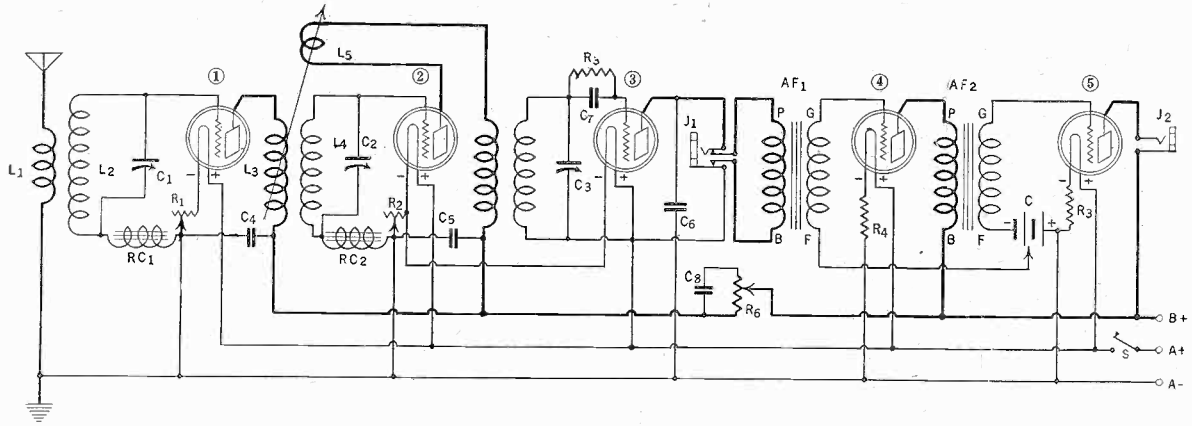


FIG. 1
The circuit diagram of the regenerative Equamatic. L6, L7 is the third Equamatic RFT.

By Capt. P. V. O'Rourke

THE sensitivity of the Karas Equamatic receiver is very high, yet it may be greatly increased by introducing regeneration in the second radio frequency tube. This may be done by putting a tickler winding on the primary form or rotor on which the primary is wound. To get considerable regeneration it would be necessary to put more turns on the tickler than are on the primary, but we want only a little regeneration. Since the winding space on this form is all taken up by the primary it will be necessary to wind the tickler on top of the primary. It is very difficult to wind a larger size of wire over another winding, so if the same size wire is used or less in this case your purpose is served. Put on nine turns of No. 30 double silk covered wire. To wind this over the primary it will be necessary to put a layer of paper or Empire cloth over the existing coil and then wind the finer wire over that. The turns may be held in place by some form of binder, such as beeswax, paraffine, or collodion. If collodion is used the entire tickler coil may be covered with it, but if the others are employed as binders only enough should be used to bind the end turns.

It is obvious that it will be necessary to slip the primary form far out from the secondary to enable winding the tickler coil. But this operation will offer no trouble.

After having put the tickler winding on the rotor form the tickler should be provided with flexible leads several inches long. These leads might well be covered with tinsel cord. They should be soldered to the coil terminals with a non-corrosive solder and flux and secured firmly to the form. They may be twisted around the mechanical support of the coil a few times and then lead to the proper places for connection. It is important that they be left so that they will not get injured while the rotor is turned and so that they will not get tangled up with any other part.

The proper connection of the two extra leads is important if the set is to function correctly. One of the two leads is to be connected to the plate binding post of the second tube and the other to the plate lead of the primary of the next radio frequency transformer. In other words, the terminal connected to the plate binding post of the second tube is removed and the tickler winding is inserted in the break. Of course the leads to the tickler may be connected in two ways in this break in the line, one of which produces regeneration and the other damping.

The simplest way to determine the way which gives regeneration is to try it out. If the first connection increases the signal leave it that way. If it does not, reverse the leads and see if that does the desired work. It could be connected correctly the first time if the direction of the currents in the windings and the direction of the windings were traced out, but to do this takes longer than to try first one and then the other.

The question naturally arises why one should introduce regeneration into a circuit which has great sensitivity as it is—the justly celebrated Karas Equamatic. The answer is that a lot of people ask for it. They want regeneration because when hunting for DX stations they sometimes need just that extra kick to add 1,000 miles to the range.

The DX stations may be pulled in by

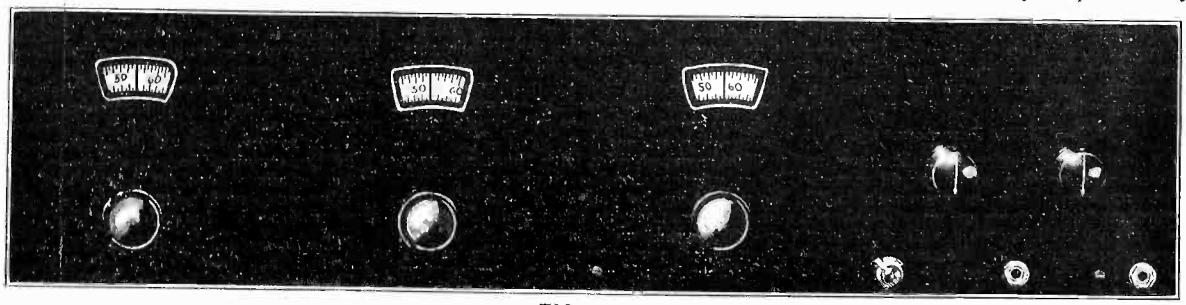


FIG. 2
The panel view of the set.

Through the Locals to DX!

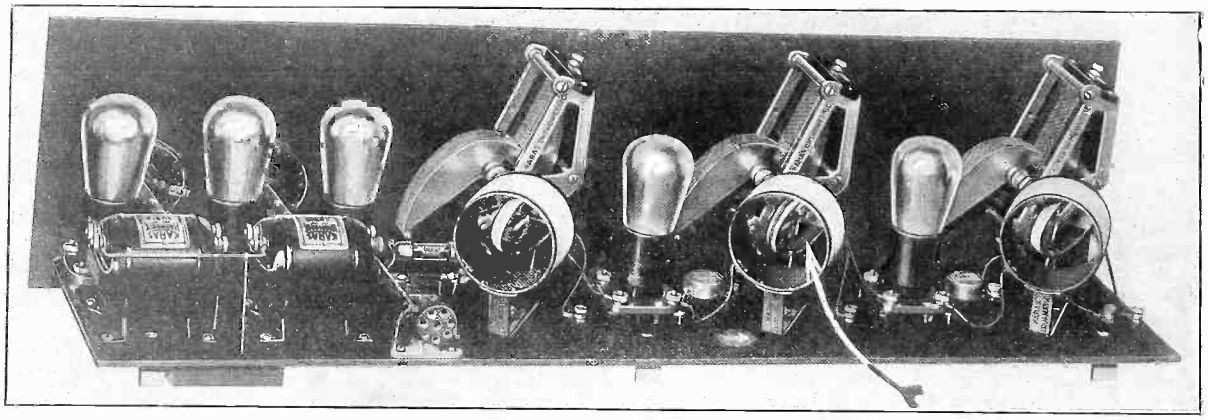


FIG. 3

The location of the special winding on the primary of the second RF transformer is shown on the form to which the arrow points. The location of parts may be followed as shown, except that the Mar-co illuminated controls will cause the coils to be slightly nearer the rear.

operating the set near the oscillating point and the local stations may be enjoyed by operating the set without regeneration.

Why should one not operate the set as a regenerator when one is receiving local stations, but only on the distant stations? Regeneration cuts off the side bands to the extent that quality is impaired and it is impossible to get natural reception when regeneration is forced.

Effect on Sound

Any sharp tuning circuit cuts off the higher tones in speech and music, and this may be carried to such an extreme that only the boom of the brass drum or bass viol may be heard. This extreme limit can not be reached by a simple tuned circuit, nor by a combination of such circuits, but it can be approached by means of regeneration.

Circuits of such extreme selectivity are required to pick out a distant station and at the same time to eliminate the signals from powerful local broadcasters. It is apparent, therefore, that first class quality cannot be expected from distant stations no matter how good their programs may be at the transmitting antenna nor how good the receiver may be. The high notes are simply tuned out. But DX hunters are often interested in the announcements from the distant stations, in order to identify them, or will pardon a little tinniness in the music. Announcements are carried by low frequencies, whether spoken by a basso profundo or a soprano. That is, they are carried by frequencies which are so low that the tuned circuits that are likely to be used in any practical receiver cannot appreciably cut them down.

Spoken sounds are mostly below 1,000 cycles per second, and it requires a very selective receiver indeed to affect this frequency. But music is carried on all frequencies which are audible to the human ear, that is, up to about 15,000 cycles per second. These high frequencies are materially cut down even by circuits of ordinary selectivity.

When DX is Paramount

A good DX receiver would have to possess a selectivity which would materially cut down as low frequencies as 5,000 cycles, and when these are greatly reduced in intensity as compared with the lower ones, the quality of the music suffers noticeably. Sounds from certain instruments and voices lose their characteristics.

When one receives local stations the primary interest is quality of reproduction. The sound that is emitted from the loud speaker should be as nearly as possible a copy of the sound that impinges on the microphone at the broadcasting station. One necessary condition for this is that the selectivity of the receiver should not be excessive. In fact it should not be any greater than is absolutely necessary satisfactorily to eliminate all interference from other stations.

The required selectivity therefore very largely depends on the number of stations operating in the vicinity of the receiver, their frequency separation and the power which they are radiating. A few individuals may be so unfortunate as to be located in the shadow of a powerful transmitting antenna. In that event it may be necessary to have a super-selective receiver to get anything but the station nearby. Then first-class quality is precluded from all stations except the local and that may be received with a crystal set and a stage of audio frequency amplification.

LIST OF PARTS

L1L2, L3L4L5, L6L7—Three Karas Equamatic RF transformers. (L5 is wound by the constructor).

C1, C2, C3—Three special Karas Orthometric extended shaft .000375 mfd. condensers.

AF1, AF2—Two Karas Harmonik audio transformers.

RC1, RC2—Two Karas Equamatic retard coils.

R1—One Yaxley 20-ohm rheostat with dial (gold).

R2—One Yaxley 10-ohm rheostat with dial (gold).

J1—One Yaxley interstage phone jack (gold) for first audio stage.

J2—One Yaxley No. 1 open circuit phone jack (gold) for second audio stage.

S—One Yaxley filament switch (gold).

C7—One Sangamo .00025 mfd. fixed condenser with grid leak clips.

R3—One Amsco 2 megohm grid gate.

R4, R5—Two No. 1A Amperites, mounted. (R5 is marked R3 in Fig. 1.)

R6—One Yaxley 400-ohm potentiometer.

C4, C5, C6—Three Sangamo .001 mfd. fixed condensers.

C8—One Sangamo .001 mfd. fixed condenser.

Three Karas Equamatic subpanel brackets.

One panel 7x28x3/16".

Three Mar-co illuminated controls.

One Jones Multi-Plug with mounting and 8-ft. cable.

Five Benjamin push type cushion sockets.

The Equamatic System

One of the outstanding features of the Karas Equamatic receiver, on which the DX model is founded, is that the coupling between the primaries and the secondaries is varied automatically with the rotation of the condenser, and, what is important, is varied according to frequency. As is well known the transfer of energy from one circuit to the other in a transformer is directly proportional to the frequency of the current provided the coupling remains the same. Hence in an ordinary radio receiver the energy transfer at the high wavelength end of the broadcast band will be very small and the set will be comparatively insensitive to these waves. For the same degree of coupling between the two windings the set would be excessively sensitive on the short waves and overloading of the tubes and howling would most likely occur on all waves below a certain value.

The usual solution of this difficulty is to make the set insensitive to the short waves by introducing a loss which increases in the same ratio as the frequency. This takes care of the volume in a satisfactory manner but not so of the selectivity. Introducing resistance into the tuning system decreases the selectivity and the set will not be satisfactory from that point of view.

Equal Sensitivity

In the Equamatic circuit the higher energy transfer on the shorter waves is taken care of by decreasing the coupling between the primary and the secondary windings in such a way that the transfer of energy is constant over the entire tuning range of the condenser. Thus the set is just as sensitive on the longer waves as on the shorter waves. This variation in the coupling is automatic because the primary coil is coupled mechanically directly to the rotor of the condenser.

In this manner the sensitivity of the set is equalized over the entire band, and it is accomplished without the introduction of losses in the tuning system.

[*The theory and practice of the highly efficient Equamatic system were discussed fully by Capt. O'Rourke in the October 2, 9, 16 and 23 issues.*]

The 8-Tube Lincoln Super

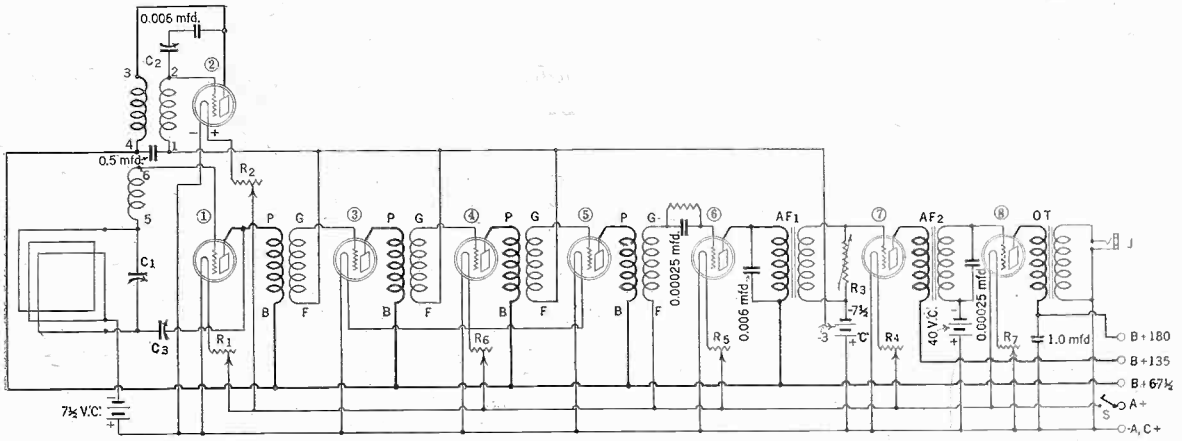


FIG. 1

The schematic diagram of the Lincoln Super-Heterodyne. R1 and R2, 20 ohm rheostats, and R3, a 200,000 ohm variable resistor, are panel mounted, but R4, R5, R6 and R7 are put on the baseboard. A special output transformer may be used at OT or a choke and condenser. The last tube plate potential may be 135 volts, with 27 negative bias, instead of 180 and 40½.

By Sidney Stack

THE DX season is now imminent, and to be ready for it one must have a sensitive receiver. The high-class music season is here now, and to be ready for that, one must have a high quality receiver. There are now about 600 stations operating in this country alone, at no great frequency separation between neighboring ones, and to be able to select any one desired to the complete exclusion of all the rest one must have a very selective receiver. This does not mean that one must have three different receivers, for all the above requirements may easily be incorporated into one, and that one is a Super-Heterodyne.

There is still another requirement which this receiver should have, and that is, it should be simply yet adequately controlled. If it is not simply controlled one will spend perhaps as much time hunting for a station as one does in receiving it. If it is not adequately controlled both as to sensitivity and volume it will either be incapable of receiving distant stations or it will be intolerably loud on local stations.

Let us, therefore, consider the construction of the Lincoln Super-Heterodyne as a set embodying these advantages. The schematic diagram of the wiring is shown in Fig. 1.

When the parts have been assembled the builder is ready to start construction work. First comes laying out of the set. This to some extent is a matter of personal taste and convenience. Innumerable arrangements of the parts may be used without in the least impairing the set, but the uninitiate will find the diagrammed method easiest.

One should begin by laying out the panel, arranging the parts on it in such a manner that the panel gives a sense of balance and symmetry. A suitable arrangement of the panel may be obtained by reference to the caption under Fig. 1.

The next step should be the laying out of the baseboard. Place the subpanel on the mounting brackets and then arrange the various parts on the subpanel or baseboard, giving due consideration to the directness of radio frequency wires, particularly grid leads. Leads carrying audio frequency currents need not necessarily be short, though it is preferable to make them as short as practicable.

You can put the first audio frequency transformer in the right upper corner. Then going toward the left in the upper tier there are two 20-ohm rheostats, the battery plug, then two more rheostats, and finally the second audio frequency transformer. In the middle row are the two power tubes, the four long wave transformers, the oscillating coil or fixed inductance, and the two large by-pass condensers. In the row nearest the panel are the six radio and intermediate frequency tubes and the midget condenser. This is an orderly layout in which the radio and intermediate frequency leads are reasonably short and in which the various parts are well placed.

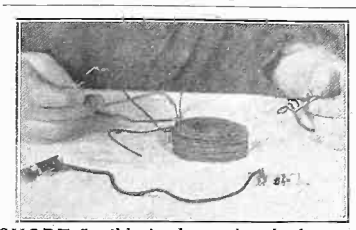
Wiring of the set may best be done in two parts, first making all the connections necessary and possible on the parts on the panel. Then before mounting the baseboard on the brackets, all the connections required on the parts on the subpanel should be made. Usually it is best to wire the filament circuit complete before mounting the transformers on the subpanel, as this leaves more room in which to operate.

Of course it is necessary in running the wires to take account of the parts which have not yet been mounted. As much of the filament circuit wires as possible should be run under the baseboard, where they will be out of sight.

After the filament circuit has been wired, the remaining parts should be mounted and the wiring finished. Then the subpanel should be put in place and the interconnecting leads established.

LIST OF PARTS

One Lincoln fixed Inductance.
Four Lincoln long wave transformers.
Two No. 220 S-M audio frequency transformers.
One OT-SM output transformer (or one SM audio choke and a Tobe 2 mfd. condenser.
C1, C2, Two Remler or Precise variable condensers, .0005 mfd. capacity.
C3, one Chelten midget variable condenser, No. 850.
Two .006 mfd. Tobe fixed condensers.
One .00025 mfd. Tobe fixed mica condenser.
One Tobe grid condenser, .00025 mfd.
One Tobe .5 mfd. by-pass condenser.
One Tobe 1 mfd. by-pass condenser.
R1, R2, R4, R5, R7, five 20-ohm Yaxley rheostats.
R3, one Centralab 200,000 ohm variable resistance.
R6, a 6-ohm Yaxley rheostat.
One Lynch grid leak, 2 meg.
Two No. 801 National Velvet Vernier Type C dials.
Eight No. 510 UX sockets, SM.
One No. 660 Yaxley battery plug and cable.
One No. 701 Yaxley single circuit jack.
Three Yaxley pup jacks.
One filament switch.
One SM loop, with center tap.
UX type tubes, six 201-A, one 112, and one 171.
One cone type of loud speaker.
One 6-volt storage A battery.
Four Eveready 45-volt layerbuilt B batteries.
Grid bias batteries, one 40.5 volt and two 7.5 volt. (See caption under Fig. 1.)
Panel, baseboard, mounting brackets and cabinet.



SHORT flexible leads are handy for making test connections.

(Hayden)

A BENT spring jack is the common cause of amplifier trouble. It is a good plan to place plug in jack and see that good contact is made before installing the jack in the set, thus preventing future grief.

The Big Five

A Discussion of the Most Popular Circuits

By K. B. Humphrey

THERE are about five different types of radio receivers being used at present. While there are others, they are mostly modifications or combinations of one or more of the following fundamental types: the crystal set, the regenerative set, the reflex set, the Super-Heterodyne and the tuned radio frequency set.

The crystal set is the simplest of all radio receivers but is not used much at the present time. It consists primarily of a tuning circuit of some kind, it may be a condenser and a coil or it may be simply a coil ol wire with a sliding contact or taps, and a crystal detector.

Now, it happens that the radio waves are sent out by the broadcasting station in such a form that they cannot be heard by the ear. It is necessary to rectify them or change them in such a way that the electrical currents in the telephones will vary according to the voice and music frequencies of the artists in the studio.

The crystal performs this function and in fact detects the waves and the use of this method gives the name of crystal set to the receiver. This kind of receiver is not very selective and can only be used for very moderate distances.

Tube Amplifies, Too

All of the other receivers mentioned use the vacuum tube in their construction. By connecting the tubes in different ways they may be made to perform different tasks. The tube may be made to function in the same manner as the crystal, that is, to detect, but the tube may also be made to amplify the signal when it is in the radio frequency state or when the current has been changed over by detection to the audio state. There are innumerable combinations which can be used and are being used every day.

One of the earliest form of receivers was the regenerative set. In this type of set the vacuum tube is used as before in combination with some method of tuning. The signal is detected and then the tube performs another function, that is, the signal is made to go through the tube again and act on the input, thus amplifying the signal many times. This explanation makes the effect easy to understand, although strictly speaking the effect is to reduce the radio frequency resistance.

This set usually may be distinguished by its ability to give a great combination of squeals and whistles when it is in oscillation. The oscillation point is usually variable and when the set is in oscillation the signal can not be heard. The regeneration point is just below this.

The RF hookup usually is combined with two or three other tubes to amplify the signal after it is detected, so that a speaker may be used. This type of set is very sensitive, is a good DX set, and even when three tubes are used ample volume is obtained for the speaker. The quality often suffers to some extent when the set is "pushed" and another disadvantage is the fact that in the hands of an inexperienced operator the set causes a great deal of interference to the neighboring receivers. In urban areas the 3-tube set usually is not quite selective enough.

What Reflex Is

The reflex set gets its name from the fact that the tube is made to do double duty in amplification. As mentioned before, there are two main types of current present in the receiver, the radio wave and the audio wave. When the same tube amplifies first the radio wave and then the voice or audio frequency it is said to be reflexed. This type of set is not so popular as it used to be. Its chief asset is tube economy.

The Super-Heterodyne is in reality a combination of several different features. The signal enters through the collector system, in most cases a loop. It is first detected in the usual way, regeneration being used in some types. A separate tube is used in combination with the first detector and is called the oscillator. It is in fact a miniature broadcast station. This tube performs a very important function. It causes the wavelength of the signal to be changed after entry by way of the loop to a higher wavelength. While the theory is rather involved it is only necessary for the reader to regard the system primarily as a wavelength changer. It so happens that it is much less complicated to amplify a radio wave of high wavelength than a lower one. The high wavelength is amplified through what is termed an intermediate frequency amplifier which may consist of from two to four or possibly five tube stages. The signal is again detected in the ordinary way and then amplified in the audio frequency amplifier to get loud speaker volume.

There are in most such sets eight tubes as follows: first detector, oscillator, three intermediates, second detector, and two audio. There may be other combinations, which may add from one to three tubes, or the number may be cut down by reflexing. The Super-Heterodyne is a very selective set, is a good distance getter, is more practically portable because of the loop antenna, and in fact is a good all-round receiver.

The tuned radio frequency set has become very popular in the last few years. It usually consists of five tubes, though six, seven and sometimes eight are used. The first two tubes of the five-tube set are used to amplify the incoming radio signal and what distinguishes it principally is the fact that instead of just the input being tuned by means of condensers and coils, all of the stages are tuned separately. After the amplification of the radio signal the wave is detected and then amplified again as audio frequency in the same manner as previously described.

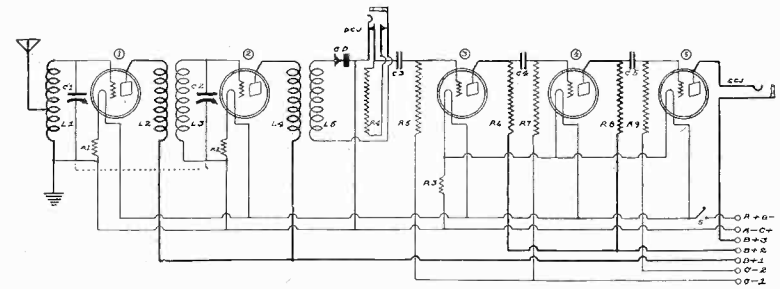
The six-tube tuned radio frequency sets usually have the extra tube because resistance or impedance coupled audio amplification is used. This does not have any effect on the radio end of the set. By proper design it is possible to work effectively more than two steps of radio and the more expensive receivers are using this system.

The Neutrodyne

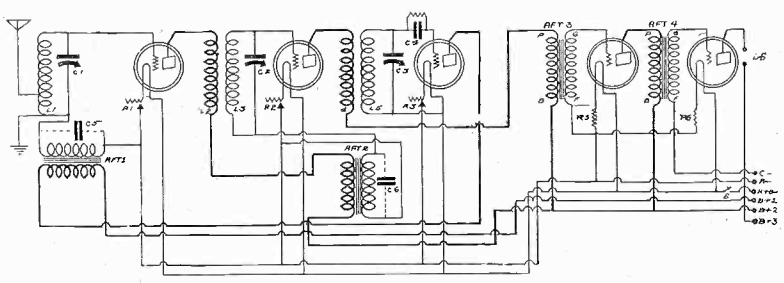
Just a note here in regards the different names by which these sets go by. The Neutrodyne, for instance is a tuned radio frequency set and the name comes from the method of neutralizing the set, that is, balancing out the tendency to squeal. There is no essential difference in the operation.

The tuned radio frequency set is not expensive, is a good DX getter and is easy to handle. The number of controls varies from one to three or four, depending upon the design.

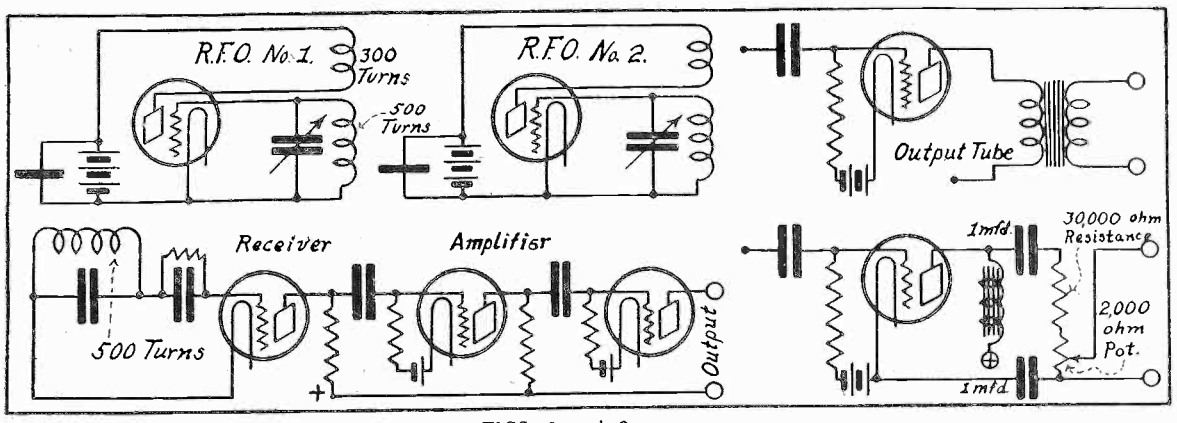
Here are a few general principles which may be considered as a whole in the application of receiving sets. The addition of RF is primarily for getting DX.



A TUNED radio frequency set with crystal detector.



CIRCUIT network of a reflexed receiver. Det. plate lead is continuous.



FIGS. 1 and 2
The fundamentals of the hookup for the beat note audio oscillator, and methods of effecting output.

An Audio Tester

Using the Beat Note System

By John F. Rider

Member, Institute of Radio Engineers

THE possession of an audio oscillator is an essential requisite for experimentally inclined radio fans. It finds a place, an important one at that, in almost every type of radio research work. But the number of audio frenquency signal generators is lamentably small. The reasons for this condition are two. The first is the cost of a completed unit obtained from a manufacturer. The second is the complexity of calibration when the unit is home constructed. The result of these two is the general lack of widespread use of the unit mentioned and the consequent lack of experimental work entailing their use.

Versatility of Tests

In addition, the possession of a generator with a variable audio frequency output permits of tests otherwise impossible. As a solution to the individuals who cannot afford the prices asked for this laboratory unit, and to the individuals who have no means of calibrating home constructed audio oscillators of the conventional type, the following is offered.

This unit is in substance more of a radio frequency oscillator than an audio frequency oscillator. However, the final signal as obtained from the unit is of audio frequency, and the unit can therefore be known as an audio oscillator. The process of obtaining the audio frequency signal is by no means new, having been observed by almost every owner of a radio receiver. The process consists of beating one radio frequency oscillator against another, oscillating at a frequency varying from the first at a predetermined value. The variance between the two produces the desired beat note which is within the audio range. This beat note is picked up on a receiving system arranged for the purpose.

An Easy System

At first glance this system may appear quite complicated, but upon analysis it will be found really simple. The simplicity of the unit is still further increased by the fact that the calibration of the device is easy, requiring the services of equipment readily obtainable. The completed unit consists of three component parts, two of which are identical. These two are radio frequency oscillators of conventional type, utilizing a single thermionic tube, employed as an oscillator. The third unit is a simple non-regenerative receiver and audio amplifier unit of the resistance coupled type. The unit necessary for the calibration work is a wavemeter of relatively high accuracy and adjustable to 7,000 meters and lower.

The detailed method of operation is as follows: One of the radio frequency oscillators is adjusted to 6,000 meters. This adjustment is carried out with care to assure careful resonance at that wavelength with the same wavemeter setting.

Creation of the Note

Now, according to electrical phenomena (and physics phenomena in sound) if another radio frequency oscillator is adjusted to a wavelength differing from the first by a small amount, the resultant beat note, if the frequency variance between the two lies within the audio range, will be audible on a non-oscillating receiver when the receiver is adjusted to the main frequency of either one of the two radio frequency oscillators. As the main frequency of the two radio frequency oscillators is beyond audibility even after mixing, the signal heard in the receiver will be the audio frequency beat note. To produce any beat note, so as to be audible in the reproducer attached to the receiver, we have only to vary the frequency of one of the radio frequency oscillators by the frequency of the beat note desired. In other words, if we desire a beat note of 500 cycles and radio frequency oscillator number 1 is adjusted to 50,000 cycles, we adjust radio frequency oscillator number 2 to 50,500 cycles or 49,500 cycles. The receiving system remains tuned accurately in resonance with radio frequency oscillator number 1. This adjustment remains constant at all times regardless of the beat note being generated.

The key to the entire arrangement is therefore the adjustment of radio frequency oscillator number 2. By calibrating this oscillator at various frequencies differing from that of radio frequency oscillator number 1 by 100 cycles, 200 cycles, 500 cycles 750 cycles, 1,000 cycles, 1,500 cycles, 2,000 cycles and so on up to 4,000 or 5,000 cycles, the beat note can be of the desired frequency from 100 to 5,000. All this of course requires accurate calibration and constancy of adjustment once the calibration has been carried out. Notwithstanding this apparently tedious work, it is by far much easier than contructing and calibrating a conventional audio oscillator.

If the tuning adjustments of the various tuned circuits are accurate, a surprising degree of accuracy will be obtained for the beat note.

In the tests carried out during the construction of the original models for this paper, the calibration of the beat note was effected by matching against a standard 1,000 cycle oscillator on a cathode ray oscillograph was found to be within 3 to 4 per cent, a discrepancy permissible with this type of equipment.

Five tubes are required for the complete installation, two being utilized as radio frequency oscillators and three in the receiver-amplifier unit. In the latter arrangement, one tube is used as the detector and two as audio amplifiers. Resistance coupled audio frequency amplification is used. The type of tubes used as oscillators is optional on the part of the constructor.

The schematic wiring diagram of the complete installation is given in Fig. 1. Special precautions must be exercised when arranging the radio frequency oscillators, to assure absolute ground potential for the oscillator tuning condensers. Otherwise body capacity effects will ruin the system. The elimination of body capacity effects with oscillator number 2 is of particular importance, since this unit is continually manipulated. The oscillator circuits shown herewith need not be followed. Any others in which the tuning condensers are at ground potential may be used, providing the arrangement is conducive to stability and constancy of adjustment.

(*Concluded on page 20*)

The Batteryless Bernard

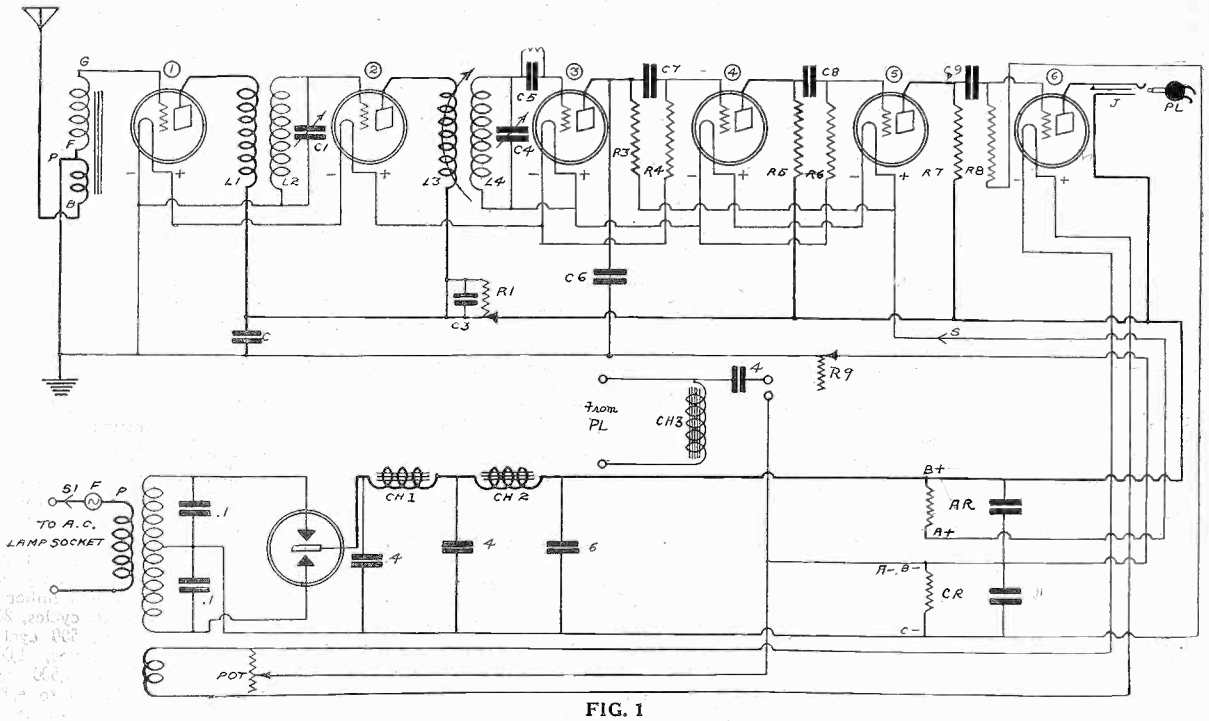


FIG. 1

The Bernard receiver and the total battery eliminator used in conjunction with it. The receiver has five series-connected 299, 199 or CeCo type C tubes in sockets 1, 2, 3, 4, and 5, and a 312, 112 or CeCo type F for the final socket, 6. Note how the negative bias is obtained in the receiver itself for four tubes and the positive potential for the detector plate. The bias for the final tube is furnished by the drop in CR, which has a resistance of 175 ohms. AR is 2,500 ohms. The potentiometer across the filament secondary of the power transformer is 400 ohms.

Five 3 Volt Tubes Connected with Filaments in Series and Heated from DC, While AC Feeds the Power Tube in Last Stage—A, B and C Voltages Obtained

THE design for operating the Bernard without batteries is shown in Fig. 1. On top is the circuit diagram of the receiver and below is the diagram of the A, B and C eliminator. Another part of the C elimination, however, is accomplished in the radio receiver itself, by the manner of connecting the grid returns.

Simply stated, the receiver consists of two radio frequency stages, a detector tube and two audio stages with the tube filaments connected in series, and a final audio tube, the sixth bulb, heated by alternating current. The filament voltage and current for the final tube are supplied from a special winding on the power transformer, lower left, Fig. 1. The eliminator supplies three voltages: the 165 volts, the A voltage of 15 volts, and the C voltage of 15 volts, for biasing the last audio tube.

The Automatic Bias

The series connection of the filaments of the five tubes, which are of the three volt type, is accomplished merely by connecting the positive of the first tube to the negative of the second, the positive of the second to the negative of the third and so on, until the fifth tube is reached. Then you have two unconnected terminals, the negative of the first tube and the positive of the fifth. These are connected to the A minus and A plus. The A voltage is 15 because there are five tubes, the filament of each one dropping 3 volts. Naturally this gives you a working range for obtaining bias. For instance, the grid return of tube No. 1 is made to negative A, which affords virtually no bias. The grid return of tube No. 2 is made to negative A, also, but this is a 3-volt negative bias, because the voltage at the minus post of tube No. 2 is three volts positive in respect to the minus post of the first tube. In like backward connection fashion is the bias obtained for the first two audio tubes, while the plate voltage of the detector tube is 9 volts positive, due to connection to plus 15 as contrasted with plus 6. Notice that you must work to the left to get negative bias and to the right to get positive bias by this system.

Uses Raytheon BH Tube

Obtaining the bias in this manner saves the 15 volts from being extracted from the B eliminator part of the electrified installation. The C voltage for the last tube, being 15, diminishes the actual total plate voltage by that amount, and the A eliminator feature costs another 15 volts, so that 30 volts are used up in this fashion, leaving 150 volts total for the plate of the last tube, as the original starting point was 180 volts.

The A, B and C eliminator system is one using the new Raytheon type BH tube, which passes 85 milliamperes without any overloading. The voltage depends on the characteristics of the power transformer, in this instance the National.

As for the 85 milliampere total current supply, 60 milliamperes (.06 amp.) are consumed by the filaments of the five series-connected tubes, since series connection adds voltages but does not affect the amperage where each unit in the chain draws the same current; 12 milliamperes for the plate of the last tube and 9 milliamperes for the plate current drain of the five series-connected tubes. This totals 81 milliamperes, or four less than the maximum, and affords a working range. Note, please, that this system does not require overloading the Raytheon tube because the set draws less than the rated maximum.

This is due to the use of a power tube with modest plate current drain at 150 volts (312,112 or CeCo type F.).

Constructional Hints

In the construction of the batteryless Bernard installation it is well to have the receiver built in a table model cabinet, and to obtain a matched table. One will find on the market special radio tables that are virtually topless, so that the exit for the cable leads is made through a hole drilled in the bottom of the cabinet, and the cables are dropped into the table interior through the wide open space and connected properly to the eliminator leads

The output of the set may be taken from the jack J, as shown, but if a filtered output is desired, to keep the direct current out of the speaker windings, a suitable audio choke coil and condenser combination may be incorporated in the eliminator and two small holes drilled in the rear of the table to afford outlet for the speaker leads. A phone plug, PL, may be inserted in the jack, and the leads brought to the choke CH3. One speaker cord is connected to minus A, the other to the free side of the filter condenser, 4 mfd., using either tip jacks or connection by clips. A commercial unit for this is the Jaynxon tone bridge.

In regard to the receiver itself, the pilot light shown in the previous models must be omitted, as there is no suitable means

Simplicity In Eliminator

LIST OF PARTS
For the Eliminator

One National power transformer, with 5-volt .5 ampere extra secondary.
One fuse (about 2 amperes).
One fuse socket (porcelain).
One Hart and Hegeman switch, S1.
One Raytheon type BH tube.
One Air Gap push type socket.
Two Tobe .1 mfd. fixed buffer condensers.
Three Tobe filter condensers, 4, 4 and 6 mfd. respectively (BH model).
Two Tobe 1 mfd. fixed condensers, 600 volt test, (one across AR, the other across CR).
Two National or Conner-Crouse audio chokes (CH1 and CH2).
One 400-ohm Electrad potentiometer (pot) across one secondary.
One Ward-Leonard Vitrohm fixed resistor, 175 ohms (CR).
One Ward-Leonard Vitrohm fixed resistor, 2,500 ohms (AR).
One National or Conner-Crouse audio choke (CH3) and 4 mfd. Tobe condenser, optional, for filtered output.

LIST OF PARTS
For the Bernard Receiver

C2, C4—Two Bruno .00035 mfd. straight line frequency variable condensers, which, with two drums, mounting frame, bronze panel plate and screws constitute the Bruno Unitone, Model 2CB.
L1, L2—One Aero fixed primary radio frequency transformer, stock No. WT-40.
L3, L4—One Aero adjustable primary radio frequency transformer, stock No. AX—45.
GFPB—One Acme R3 radio frequency transformer.
R2, C5—One Lynch 4 meg. metalized fixed resistor and one Aerovox .00025 mfd. fixed condenser with clips.
R3, R5, R7—Three Lynch metallized fixed resistors, 0.1 meg. each.
R4, R6, R8—Three Lynch metallized fixed resistors, respectively 1.0 meg., 0.5 meg. and 0.25 meg.
1, 2, 3, 4, 5, 6—Six Air Gap push type sockets.
R1—One Electrad Royalty variable high resistance, Type F, range 0 to 2,000 ohms.
C7, C8, C9—Three Electrad 0.25 mfd. fixed condensers.
R9—One Electrad 400-ohm potentiometer.
J—One Electrad single closed circuit jack.
C3, C6—Three Aerovox .00025 mfd. fixed condensers.
One 7x21" Lignole inlaid walnut front panel, drilled and engraved.
One Birnbach 6-lead battery cable, with forked terminals.
Nine Glamzo cable tags (one A plus, one A minus, one C plus, one B minus, three C minus, one B plus amp. and one B plus det.)
Two American Hardware binding posts (Ant. and Grd.)
Three Lynch double mountings.
One pair of Bruno adjustable brackets.

of lighting it. Also, while the rheostat R9, is included in the present instance, as it was in the original set, it is not to be 2 ohms, but 400 ohms. Also the grid leak, which may be regarded as R2, is fixed instead of variable.

It so happens that not only may the receiver be worked without any batteries, as shown, but also in some locations very satisfactory reception is obtained by omitting the aerial and using only a ground lead, connected to the FP posts.

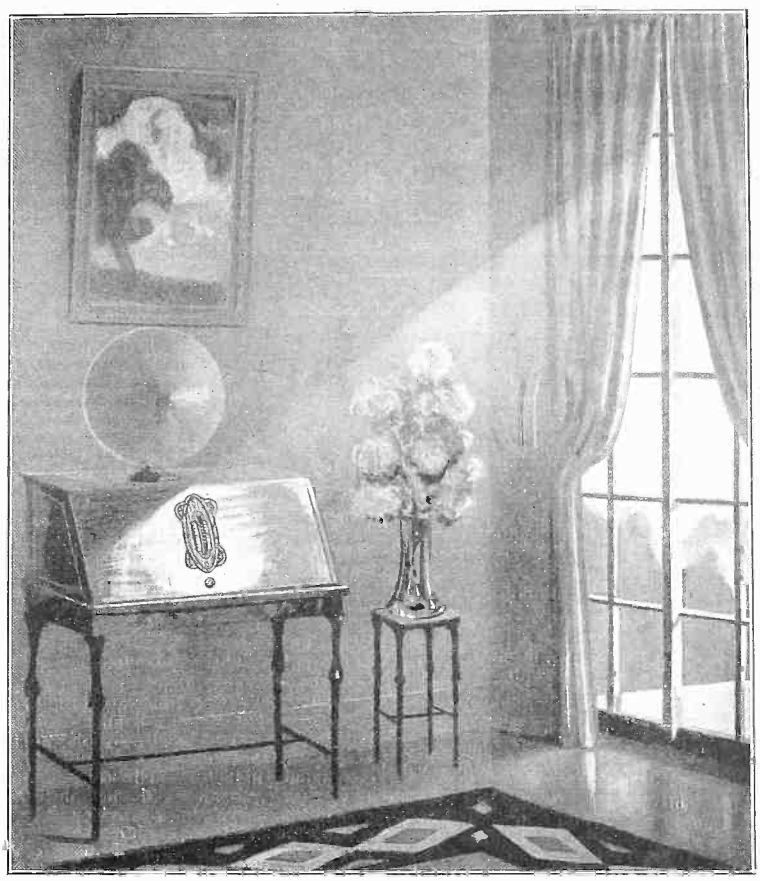


FIG. 2
An artist's conception of the Batteryless Bernard working in a well-appointed home.

Values Determined For CR and AR

Since the filaments of the five 99 type tubes are in series, and since the voltage drop across each one of them is 3 volts, the total voltage drop is 15 volts. But these filaments are connected in series with a B eliminator which delivers 180 volts when the total current flowing is 85 milliamperes. Therefore it is necessary to put a resistance in series with the filaments to account for the difference between 180 and 15 volts, that is, a resistance of such value that the voltage drop in it is 165 volts. AR between the points B plus and A plus is this resistance, and a current of 60 milliamperes flows through it. By Ohm's law the resistance required is obtained by dividing the voltage by the current, or in this case 165/.06 = 2,750 ohms, but this disregards the grid bias through CR.

When it is desired to obtain a negative bias for the grid of the last tube, this may be done by inserting a resistance of appropriate value in series with the eliminator line. CR between the points B minus and C minus is this resistance. To determine its correct value it is necessary to know the current flowing through it and also the required grid bias. The bias is 15 volts for the 112,312 or CeCo type F at the voltage used (150). The current flowing through is the total filament current through the first five tubes and all the plate currents in the receiver, a total current of 81 milliamperes, but let us proceed on the basis of 85. The required value for CR is 15/.085 = 176 ohms, hence the 175 ohm commercial unit is fully satisfactory. It is now necessary to redetermine the value of AR. Since CR as well as AR and the filaments are in series with the line, and since the drop in CR is 15 volts and the drop in the filaments is also 15 volts, AR must have such a value that the drop in it is 180 less 30 volts, that is, 150 volts. Hence AR = 150/.06 ohms, which is just 2,500 ohms. The Bernard system affords this with some leeway. This is just 250 ohms less than that obtained when no grid bias resistance was used, but this does not mean that CR should be 250 ohms. That was previously determined as 176 ohms. The difference between these two is due to the difference in the currents flowing through CR and AR. The rheostat R9 is in series with the filament line and its purpose, of course, is to effect fine variation in the current and to adjust any short comings in AR. R9 should have a range of 400 ohms.

The Hammarlund-Roberts Hi-Q Receiver Theory Expounded

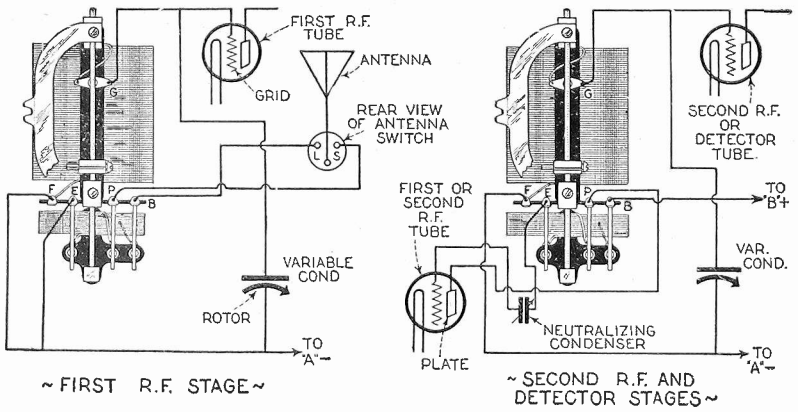


FIG. 1

By Leslie G. Biles

THE new Hammarlund-Roberts Hi-Q is an entirely modern radio receiver, non-oscillating and incorporating the latest approved features. The most important of these includes dual tuning, stage shielding, automatic coupling variation, high detection efficiency and a high power output.

Tried and proven fundamentals have been adhered to, but they are applied in new and different ways that produce greater selectivity, clearer tone, simpler tuning. This new Hammarlund-Roberts is the united achievement of ten of the leading radio engineers in the country, all concentrating on producing the most advanced and efficient receiver—regardless of cost.

Circuit Epitomized

Anyone can build the Hammarlund-Roberts Hi-Q. All the research, the selection of parts, the exact placing of units, have been worked out in advance for you. And you have a receiver that will equal a set that has more tubes. Simplicity of design and operation characterize the set.

Here is a receiver of five tubes, which employs two highly efficient stages of tuned radio amplification, a non-regenerative detector and two stages of high quality transformer coupled audio amplification, the second stage of which is so arranged that the new power tubes may be used.

Tuning has been held down to two major controls.

Scientific shielding of the radio frequency units produces a receiver of unusual selectivity, sensitivity, quality and volume.

Theory of the Hookup

In theory the Hammarlund-Roberts Hi-Q Receiver is comparatively simple. It combines the sensitivity and selectivity of two stages of radio frequency amplification with the inherent stability and distortionless characteristics of a non-regenerative detector. While it is admitted that a regenerative detector provides a considerable degree of radio frequency amplification it is well known that amplification obtained in this manner has many drawbacks. Chief among these is the tendency to cut side bands, a type of tone distortion which has a very disagreeable effect when passed on to the loudspeaker. To avoid this and other types of regenerative troubles without sacrificing sensitivity, the two radio frequency stages have been designed to insure an extremely high degree of amplification.

After providing for a high quality audio output from the detector, a two stage transformer coupled audio amplifier is used to step up the signals to loudspeaker intensity.

Although the receiver has three radio frequency circuits the tuning controls have been reduced to two by placing the second and third variable condensers on the same shaft. A small compensating condenser in parallel with the third variable condenser has been provided to compensate for the small difference in circuit capacity of the third tuning circuit chiefly due to the detector grid condenser. This compensator needs no adjustment after its setting has once been determined.

The Volume Control

A volume control has been provided which is exceptionally smooth and gradual, allowing the operator to adjust for a powerful local or a weak and distant station with equal facility. This volume control is a Carter 10-ohm rheostat regulating the filament brilliancy of the two radio frequency amplifier tubes. To eliminate the possibility of applying more than the rated voltage to the filaments of these tubes, a 2-ohm resistance unit is used in series with the radio frequency tubes and rheostat. The filaments of the remaining tubes are held at their proper operating temperatures by separate Amperites.

Tracing the radio signals, voltages induced in the antenna ground system are magnified by the action of the first stage of radio frequency amplification and passed on to the second radio frequency stage where their intensity is still further increased.

Shielding Helpful

Since the second radio frequency stage and the detector stage are shielded, unwanted signals are weeded out due to the filtering action of the three sharply tuned circuits through which they would have to pass in order to reach the detector tube. This shielding also prevents direct pick-up by the second radio frequency and detector circuits.

The use of stage shielding also eliminates any interaction between circuits, thereby stabilizing the radio frequency amplifier and greatly increasing its overall efficiency.

No shield is necessary on the first radio frequency stage, although the receiver is designed so that a shield can also be used for this stage if desired.

The output of the second radio frequency stage, which is a highly amplified copy of the original signal picked up by the antenna, is then fed to the non-regenerative detector, where it is demodulated or converted into audible frequencies. These audio currents, or electric sound waves, are then further increased in strength by the two stages of transformer coupled audio frequency amplification and passed on to the loudspeaker.

The Radio Side

The two stages of radio frequency amplification used in the Hammarlund-Roberts Hi-Q Receiver present some novel features in the design of the antenna coupling coil and the interstage radio frequency transformers. The design of these coils is based on two fundamental laws of radio engineering that are as old as radio itself. The first of these laws is this: Up to a certain point an increase in the coupling between two coils affords an increase in energy transfer and a decrease in selectivity. The second law is this: The energy transfer between two coils, such as the primary and secondary of an ordinary radio frequency transformer, increases rapidly as the frequency increases. In other words, the energy transfer is much greater at high frequencies (short wavelengths) than at low frequencies (long wavelengths), and the relative selectivity is less at high frequencies and greater at low frequencies. Conversely, a constant transfer of energy and constant selectivity can be maintained by loosening the coupling as the frequency is increased.

A successful broadcast receiver must be capable of receiving wavelengths from 200 meters (1500 kc.) up to 545 meters (550 kc.). This represents two extremes in frequency corresponding to a range of about three to one.

These requirements together with the two laws stated above make it evident that some means of variable coupling must be provided if we are to obtain equal energy transfer and selectivity throughout the broadcast spectrum. Since the trend in modern broadcast receivers is toward simplicity of tuning, the addition of variable coupling controls was not advisable.

Therefore, the engineer-designers of the Hammarlund-Roberts Hi-Q Receiver developed a radio frequency transformer in which the coupling between the primary and secondary coils is automatically varied by the rotation of its associated tuning condenser.

This variation in coupling is smooth and continuous and is accomplished by means of a cam on the variable condenser shaft. At the setting of zero on the condenser dial (which tunes the transformer to a wavelength slightly below 200 meters) the coupling between primary and secondary is minimum.

As the tuning dial is advanced toward 100 the coupling increases gradually until it reaches maximum when the condenser dial reads 100, at which time the circuit is tuned to a wavelength of about 560 meters.

The Antennaless Receiver

Serves Demand for Convenience

[Part I of this article was published last week, issue of November 27, Part II, the conclusion, follows.]

By Dr. Louis B. Blan

A SELF-CONTAINED set is the desire of nearly every broadcast listener, and by self-contained set is meant one which is entirely contained in a single box without any external appliances whatever. That means of course that batteries, speaker and pick-up system should all be enclosed in the one housing. Whatever be the desirability of enclosing the loud speaker in the same cabinet with the amplifier, there is no question about the desirability of enclosing the batteries and the pick-up system.

Now the pick-up system, whether it be a loop or an open circuit antenna, is rarely included in the set for obvious reasons. If a loop is used to pick up the signals, its dimensions are usually much greater than those of the cabinet housing the tuner and the amplifier. It cannot be included, and therefore an external loop is employed.

Antenna Theory

The case of the open circuit antenna is somewhat more favorable from the point of view of convenience. It is rarely in the way and it is not unsightly, provided it has been properly installed and concealed. But there lies the difficulty with the open circuit antenna. It is very difficult to install properly in a vast number of cases, particularly in congested districts.

The majority of persons in such places prefer to use an indoor antenna of the open circuit type.

It may be installed without climbing out on a roof, and it is not necessary to get the landlord's permission to string the wire. It is, however, necessary in most cases to get the permission of the lady of the house. It is entirely against her ideas of a properly decorated home to have unsightly wires strung about in the parlor or living room. It is no more welcome in the kitchen. Something must be done about it if any of the programs are to be received. They are usually welcome, but how can they be received without a loop and without even a small indoor aerial?

Amplification the Thing

The secret of receiving radio programs without any of the conventional systems of pick-up is simply amplification. Every closed circuit in the set acts as a miniature loop; every lead in the set, every wire, acts as a miniature antenna. If there is enough amplification in the receiver the energy picked up from the ether by these miniatures will be sufficient to operate the receiver satisfactorily. This applies to weak signals originating at a great distance as well as to the strong signals originating in the same towns as the receiver.

Now a complication will arise if we attempt to operate a set with the pick-up both by the coils in the set and by the leads, that is, by the miniature loops and by the miniature open antennas. For stations lying in a certain direction with relation to the tuning coil the signals will be fairly strong, but for others they may be absent altogether, due to aiding or opposition of the various pick-ups. To avoid this one of the pick-ups should be minimized, and that may most easily be done with the coil pick-up simply by shielding the tuning system, by placing the coils with their axes vertical, or by placing them they neutralize each other's pick-up. It is not necessary to get rid of this pick-up absolutely, but merely to decrease it so that it is small in comparison with the antenna pick-up.

The pick-up of the miniature antenna remains for the operation of the set. What can be done with it to make it operate the set satisfactorily? Amplify the signal both at radio frequency and at audio frequency. A suitable circuit for this purpose was shown diagrammatically in Fig. 1 last week.

In the grid circuit of the first radio frequency amplifier of this antennaless receiver is a radio frequency transformer of the iron core type. This type is used because it responds to all the frequencies in the broadcast band to almost the same degree. The two windings of this transformer are connecting in series aiding by joining the terminals marked F and B together. The terminal marked G is connected to the grid of the tube and that marked P is connected to the minus side of the A battery. The mid-point on the iron core transformer may either be connected to the nearest grounded pipe, such as a radiator, or it may be plugged into the nearest light socket. In the event the light socket is used it will be necessary to employ a device especially designed for this purpose, in order to protect the receiver from a short circuit.

In the present Antennaless receiver it is unnecessary to connect the mid-tap to either a socket or a grounded pipe unless distant stations are to be received. For the reception of local stations the set is truly antennaless, as there is adequate amplification both at audio and at radio frequency.

The receiver has three radio frequency amplifiers, a detector, and three audio frequency stages of a special type. Three tuned circuits are used in the set to secure the necessary selectivity, and they accomplish this object much more effectively than an ordinary radio frequency receiver having three tuned circuits. This is due to the fact that all the tuned circuits in this receiver are preceded by a tube whereas in the ordinary set the first tube is preceded by an antenna which introduces a high resistance in the first tuner and consequently reduces the selectivity to a great extent.

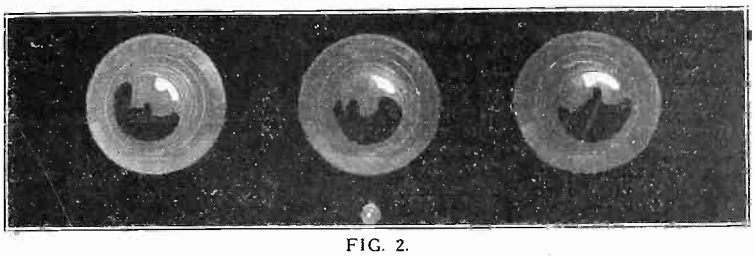


FIG. 2.

The front panel view of the set. Karas Micrometric dials are used.

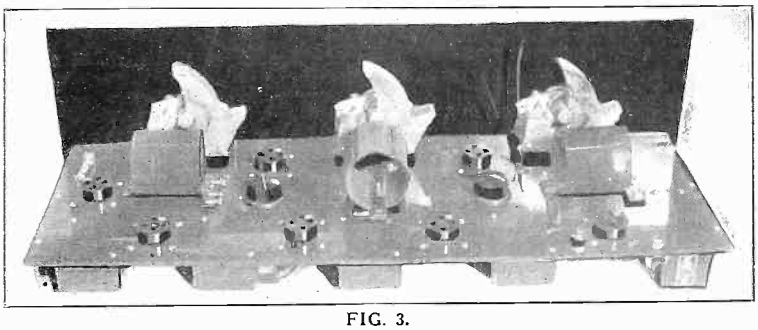


FIG. 3.

The rear view of the Antennaless.

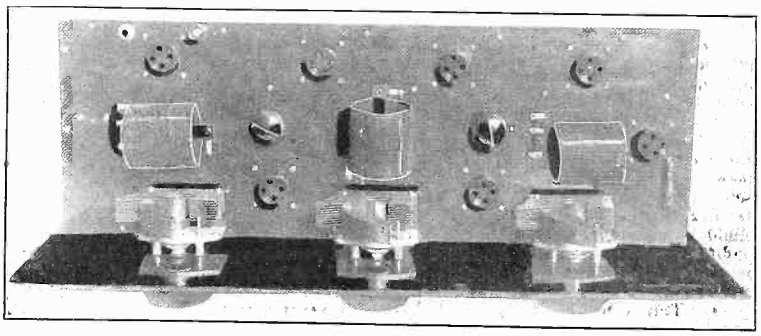


FIG. 4.

The top view of the receiver. Note the Benjamin coils, condensers and sockets.

Winner's DC Eliminator

By Lewis Winner

Technical Editor; Associate, Institute of Radio Engineers

IF you have 110 to 120 volt DC power lines in your home, then the A and B eliminator described herein can be used. Remember this eliminator is for DC only. The average efficiency is 90%, that is 9 volts output for every 10 volts at the source. The DC lines have many advantages in that the unit needed to do away with batteries is very easy to construct and the cost is very small. With the DC line, it is only necessary to employ a filter system and the proper resistances to step down the voltage for the A supply or let it alone for the B supply, or step it down a bit for AC supply, and then filter out the hum. With the AC line, rectifiers must be used, and this fact accounts for the difference in cost.

This DC eliminator will supply A current for sets using from three -99 type to ten -01A type tubes. This is made possible by using varied Ward Leonard Vitrohm resistors. B voltages are obtainable from 10 to about 110 volts (depending upon input). Plate currents as high as 100 milliamperes may be obtained also, without possibility of overloading the eliminator, or abstracting a hum. All that is necessary to find the proper resistors to use is the current load for the entire filaments of all the tubes. Then insert the proper size of resistances. To find the proper current consumption, add up the total drain of all the filaments in amperes. The filaments must be connected in parallel to do this. Suppose, you have four -01A's. The total ampere drain would be 1 ampere, since each of the filaments takes ¼ ampere. The following table will help you select the proper resistors to use.

Filament Drain in Amperes

Amp.	RA1	R2	Amperes	RA1	R2
.75	1 DEB90	1 EB12.5	2	3 DEB90	1 EB10
1.0	2 DEB90	1 EB5	2.25	3 DEB90	1 EB4.25
1.25	2 DEB90	1 EB6	2.5	3 DEB90	1 EB5
1.5	2 DEB90	1 EB7	2.75	3 DEB90	1 EB6
1.75	2 DEB90	1 EB10	3	3 DEB90	1 EB7

When using -99 type tubes, employ these data:—For current drains from .42 amperes (wherein seven -99 type or five -99 and one 120 type are used) to .54 amperes (wherein nine -99 type or seven -99 and one 120 type are used) use 1 DEB90 as RA1 and 1 EB4.25 as R2. If it is found that more than .54 amperes is drawn by -99's, follow the table just given. These data should be followed closely. R2, which may be known as the stabilizing resistance, is very important, in that it balances the voltage flow. These DEB and EB resistors are the heart of the A circuit. They have nothing to do with the B portion.

As a matter of fact, without using the choke coil and condenser, fairly good results were obtained. The resistors step down the voltage to that of the tubes, as well as pass the proper amount of amperes. Where 2 appears before the RA1 resistors, connect the resistors in parallel, where 3 appears before the RA1 resistors, connect the three in parallel. It will be noted that although there is not much of a change in the type of larger resistor (DEB), there is a greater change in the value of balancing resistance (EB). These data on the resistors are given in detail, due to their great importance in the A circuit. The condenser, C1, is a 4 mfd. type.

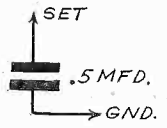


FIG. 2

How to connect series condenser between ground and set.

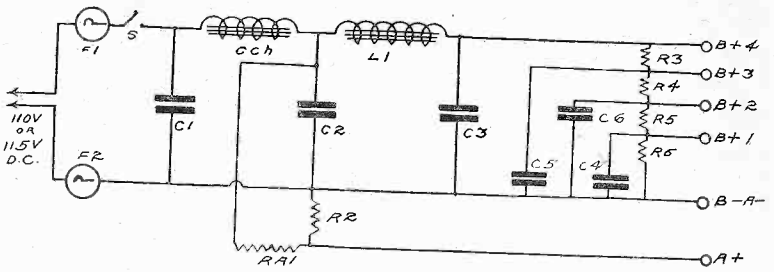


FIG. 1

The circuit diagram of the eliminator.

LIST OF PARTS

C Ch—One Shore power choke, type SCA.

L1—One Shore 30 Henry, 50 milliampere choke coil, type SC50 or One Shore 30 Henry, 100 milliampere choke coil, type SC100.

RA1—Ward-Leonard Vitrohm Resistors (see text).

R2—Ward-Leonard Vitrohm Resistor (see text).

R3, R4, R5, R6—Ward-Leonard Vitrohm Resistor Kit (see text).

C1—One Tobe 4 mfd. fixed condenser.

C2, C3—Two Tobe 2 mfd. fixed condensers.

C4, C5, C6, C7, C8, C9—Six Tobe .5 mfd. fixed condensers (see text).

F1, F2—Two 5 ampere fuses.

S—One indicating snap switch.

One double pole fuse block.

Three porcelain receptacles.

One extension cord and plug (cord about 10 feet).

Four mounting feet.

Binding posts (exact number depends upon number of individual voltages desired).

One brass angle for mounting DEB90's.

Mounting base.

Wire, solder, screws, nuts, bolts, etc.

The choke coil in this circuit is of a heavy duty type and is known as a curernt choke because it has to pass quite a large amount of current. For the information of those who wish to construct this, there are 250 turns of No. 16 double cotton covered wire, wound on an outer closed core, 2⅜ x 3¾". Each lamination is 1½ x ⅞". Full details as to the actual placing of the laminations may be obtained from my article in the Dec. 19, 1925 issue of Radio World. The wire is much heavier than usually used for the B eliminator choke, due to the high current capacity. It is therefore quite a bulky job, so don't get frightened when by the time you have reached half way quite a massive choke has been formed, because when completed it will look about twice the size of the other B chokes. Care should be taken to properly insulate the windings from the core. Also see that the insulation of the windings is not scraped off, so that no short exists anywhere. This can be wholly avoided, if the wire is put on slowly and evenly.

Now as to the B eliminator, which consists of the chokes, condensers and resistors serving to reduce the voltage for the B output. L1 is the choke coil and is the ordinary 30 henry B type. Either a 100 milliampere or 50 milliampere carrying capacity type of the above mentioned number of henrys may be used. The greater the load, the heavier the wire. No. 32 is used for the 50 milliampere, while No. 26 is used for the 100 milliampere choke. In both cases, the enameled wire type of wire is used. The cross section and outer core dimensions of the core are the same as for the A choke. C2 and C3 are both 2 mfd. fixed condensers.

The Vitrohm Resistors

Now as to the output where the Vitrohm Resistor Kit is used. These are resistances used to give a variety of fixed voltages on the ouput. From a terminal of each resistor to the A minus a .5 mfd. or 1 mfd. fixed condenser is connected (C4, C5 and C6, C7, C8, etc.), according to the number of voltages desired. This applies to the resistances used, also; e.g., R3, R4, R5, etc.

The resistances used in both the A and B portion are of a novel construction and deserve discussion. They are made by the Ward Leonard Electric Co. Over a quarter a century ago H. Ward Leonard developed an embedded resistor, now so prominently used. These resistors are vitreous enameled. There is no dead air space between the resistive material and the surrounding insulating material to interfere with the rapid conduction of heat from the wires to the surfaces of the resistor. In this way heat is rapidly conducted away from the resistive conductors to the surface of the surrounding medium.

The resistance units are made by winding a special resistance wire of practically zero temperature co-efficient of resistivity on a porcelain like body. This unit is then coated with a powdered glassy enamel and fired at red heat. This results in a resistor unit covered with a vitreous enamel coating, which is fused tightly to the wire and to the tubing. The unit therefore is a solidified mass with no air pockets between the materials to retard the rapid conduction of heat from the wire to the vitreous enamel. This specific construction insures the rapid conduction of heat from the wire to the vitreous enamel. Therefore, the entire surface of the unit is available for emitting heat energy, instead of merely the surface of the wire. This solidified feature increases the watt capacity of the unit.

Casing Is Airtight

Upon close examination of the joints it will be noted that the enamel completely surrounds them in air tight casing, which prevents corrosion and loosening of parts. The joints between the resistance wire and the terminal leads are made under high pressure, when the parts are clean and bright. The vitreous enamel used is

How to Drop Voltages

known for its perfect insulating material characteristics, also its acid and moisture proof resistive qualities. During the process of enameling, the resistance wire is subjected to a maintained red heat.

In order to live through this enameling process, the resistance wire must be of a very high grade and the fact that this wire survives this treatment proves that the resistance of a unit will not change in service due to molecular variations and aging. This enamel coating is also a protective coating for the wire and is chemically inert with respect to the wire, even at the highest temperatures. The wire is held in place without any mechanical strain and no strains can be set up by heating or cooling, as the wire and the vitreous enamel expand and contract together.

Values of Resistors

The units used in the B eliminator portion have a continuous duty rating of 20 watts. The DEB units used in the A portion have a continuous duty rating of 200 watts, while the EB units have a rating of 60 watts. The resistances in the Vitrohm Kit may be hooked up for various voltages by combining the sets of units. To drop from 110 to 90, use a 5000 ohm unit. To drop from 90 volts to 70 volts use a 1500 ohm unit. To drop from 70 volts to 60 volts use a 5000 ohm unit. To drop from 60 volts to 45 volts use a 1500 ohm unit. To drop from 45 volts to 30 volts use a 3000 ohm unit. To drop from 30 volts to 22 use a 750 ohm unit. To drop from 22 volts to nearly zero, use a 3000 ohm unit. These units are all connected in series.

The photograph shows very clearly the method of placing the parts. Two sockets for holding the large DEB90 units are mounted on an angle iron, 5" high, with a ½" bend and about 2" wide. The other units are mounted flush on a piece of bakelite, wood, or sheet iron, about 9" wide and 13" long. Wooden feet are mounted on the bottom of the base, to prevent scratching. When wiring up, use heavy No. 14 rubber covered wire all the way through. The units become warm enough to warp wood, if placed within very close bounds. Therefore if this unit is placed in a console, drill holes in back for ventilation.

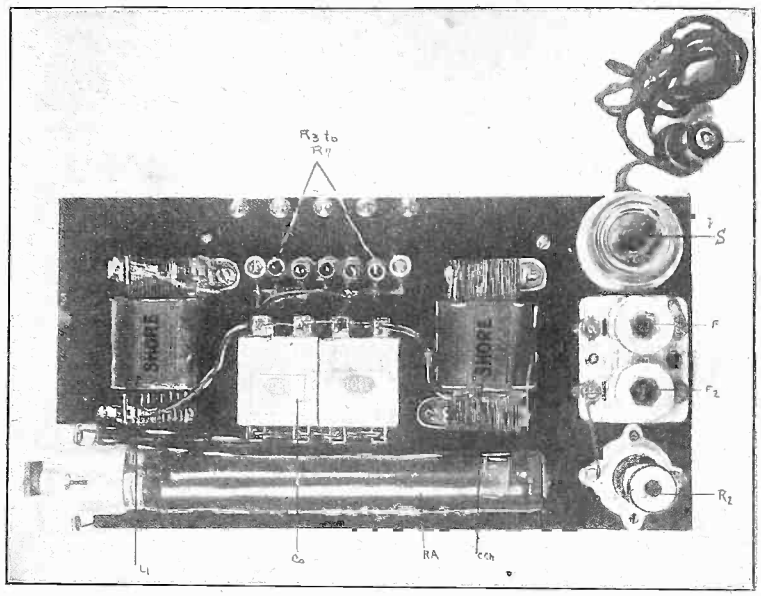


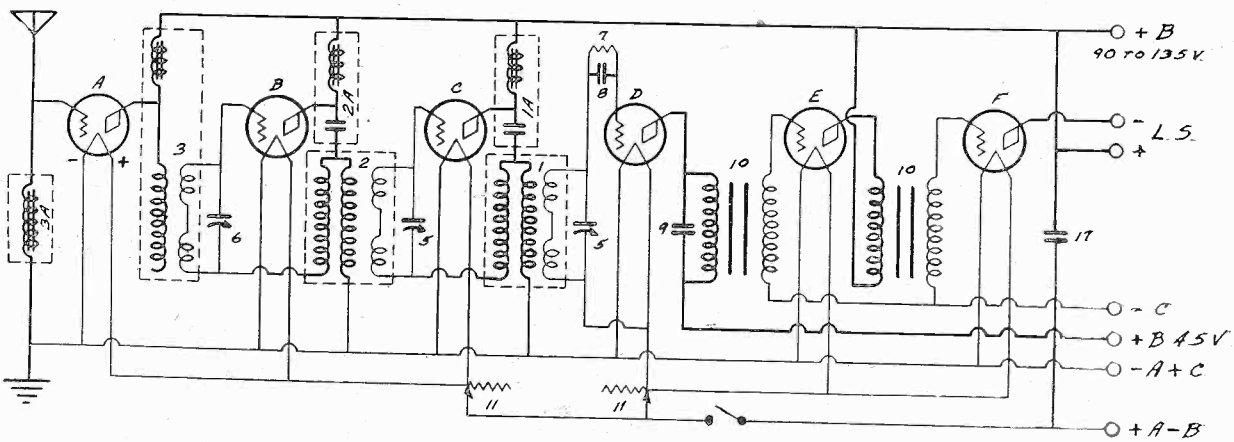
FIG. 3

How to place parts is clearly shown in the above photo. Co are the condensers mounted in stack style.

There are several precautions which should be taken when connecting up the unit. Be sure to place a .5 mfd. fixed condenser in series with your present ground lead. This is done easily, by breaking the ground lead and inserting the condenser between the resultant leads. The B minus is automatically connected to the A minus post in the eliminator. Therefore no attempt should be made to do this in the set.

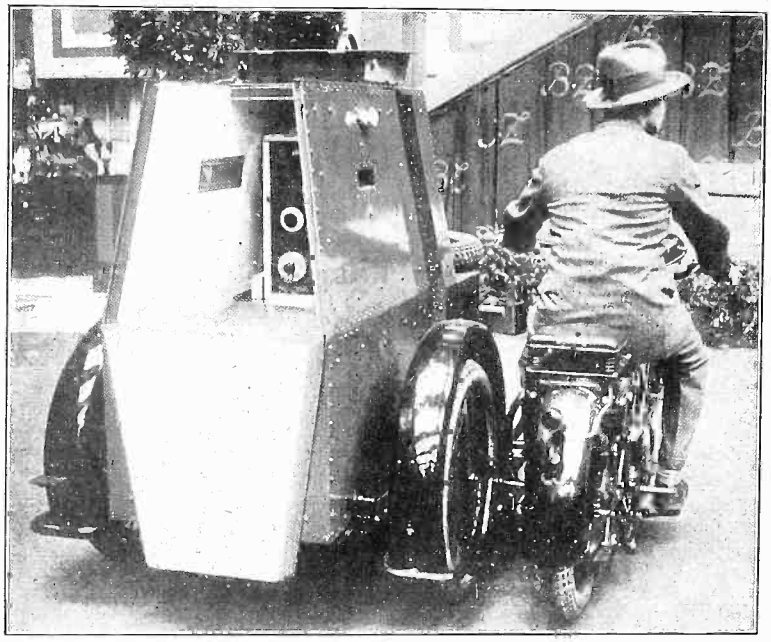
Never connect the eliminator to the set unless each and every tube is in its proper socket since there is a chance of one tube receiving a higher filament voltage due to the surge, when any one tube is taken out. This is, in turn, due to the fact that the balancing resistor, R2, prevents the voltage from rising to more than 14 volts, under no load.

Inductive Bridge Balances Set



THE ELECTRICAL SCHEMATIC diagram of the Alden-Somerbridge receiver, described in the Oct. 30 and Nov. 6 issues of RADIO WORLD. The radio frequency choke coil in the untuned antenna stage, permits reception of stations over the entire waveband. This allows accurate logging of stations on the other dials, regardless of antenna size, since the capacity of the antenna has no effect. By using a specially designed inductance bridge in the grid-plate circuits of the RF portion, the undesirable excess energy from the plate circuits is balanced out, allowing uniform amplification over the entire band. The feedback through the inherent capacities of the tube are, prevented by a small coil in the grid circuit, which is in mutual inductance to the output inductance of each tube.

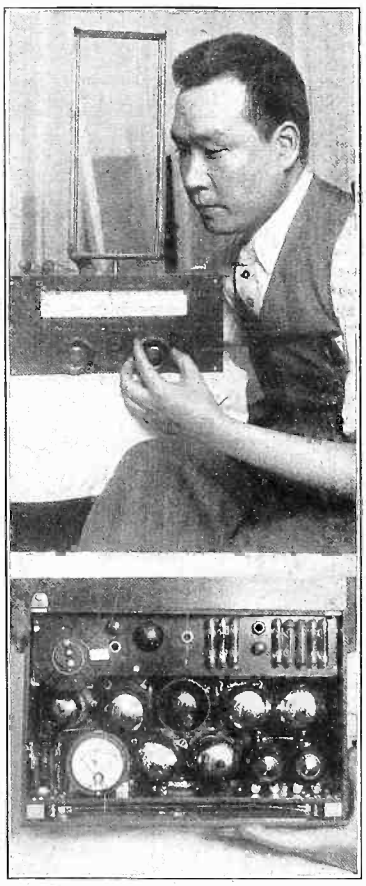
GERMAN RADIO TAKES TO ROAD



(Herbert Photos.)
A SHIELDED transmitter and receiver in a sidecar is the latest radio novelty in Germany.

(Harold Stein)
THE craze for the Black Bottom is so strong in Greenwich Village that the stamping is broadcast. Elaine Arden is the graceful girl.

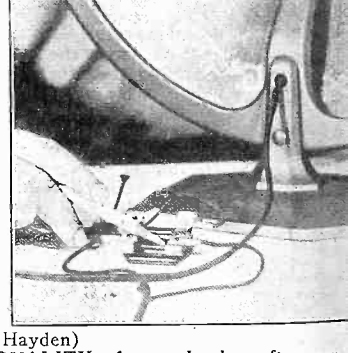
HERE is an actual photograph of aerial leadin. Notice the broken wire. The fabric of the covering keeps the line mechanically intact, but the broken electrical lead makes the set in operative. A leadin strip or tube should have been used, thus preventing the wire from rubbing against the stone sill.



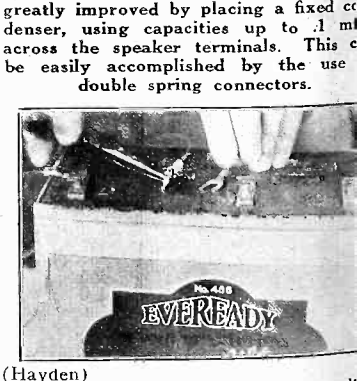
(Herbert Photos.)
A SEVEN-TUBE Super-Heterodyne is the pride of Wei Yoh Wu, Chinese electrical engineer of Brooklyn, N. Y. The tuning is readable in wavelengths and kilocycles. The scale is oblong.

TWO KINDS OF

(Underwood & Underwood.)
TEACHING art over the radio, with Walt Kuhn's newest effort. Sketchin when



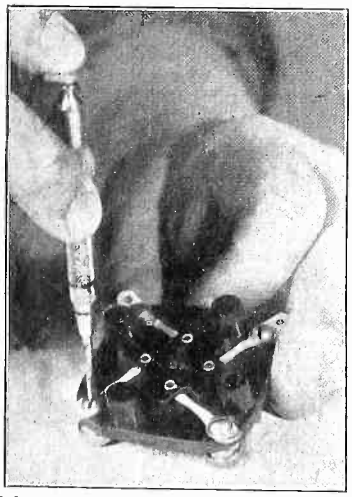
(Hayden)
QUALITY of reproduction often can greatly improved by placing a fixed co denser, using capacities up to .1 mf across the speaker terminals. This c be easily accomplished by the use double spring connectors.



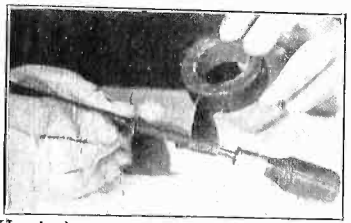
(Hayden)
AN ORDINARY battery cable suppli with spade connectors does not alwa make good contact with spring clips batteries, since the stamped out metal so thin. A good plan is to fold pron over, making a double thickness of met and slipping this reconverted spade in t contact.

TUDIO IN ONE

nt but living model beside the mike, is the subject of the lesson he delivered raphed.

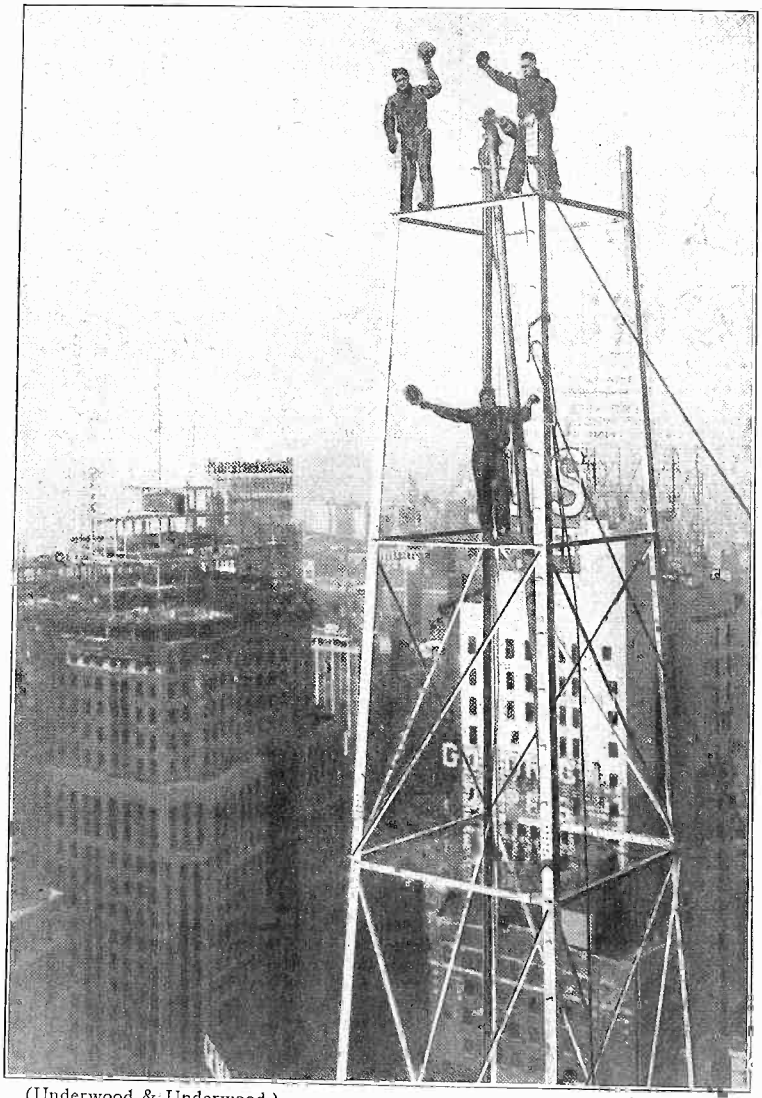


DON'T use a toy screw driver or screw driver so very small that it is easily twisted out of shape by large screw heads. Use proper tools.



(Hayden)
PLACING rubber tape on the entire length of long screw driver will prevent many blowouts, if the finished product is inserted in a set during a trouble shooting campaign. Short circuiting is avoided.

MEN HIGHER UP DISCOVERED



(Underwood & Underwood.)
STEEPLEJACKS working on the radio tower on the roof of the new Park Central Hotel, Fifty-fifth Street and Seventh Avenue, New York, where WPCH will be.

(International Newsreel)
IMITATION of a train—the Midnight Express at WGY—is done as shown.

A THOUGHT FOR THE WEEK

RADIO is said to be still in its infancy, which, though bromidic, may be perfectly true. Naturally, however, one wonders what size collar the youngster will wear when it really grows up.

RADIO WORLD

REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

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

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Many Petition For Broadcasting Reichstag Debates

BERLIN

So that the public may know what goes on during the parliamentary sessions, Paul Loebe, Reichstag President, has been petitioned by many radio fans to allow the broadcasting of the sessions. By sending out the speeches there would be no interfering with the regulation forbidding the use of Government-controlled radio stations for political propaganda by any of the parties. It has been said that if the radio was used parliamentary law would be eliminated.

Recently, during the sessions of the Prussian Diet, when the question of Prussia's settlement with the Hohenzollerns was argued and voted upon, a great tumult was created by the Communists, and it was necessary to clear the galleries and press benches.

HOW TO WIN AN AUDIENCE WITH A TALK

Sam Pickard Sets Forth Rules Based on Successful Broadcasts of Farming Facts—Must Sense Questions and Speak in Answer to Them

The technique of preparing radio copy is one of the fine points in winning and holding the appreciation of radio audiences, according to Sam Pickard, chief of the radio service, United States Department of Agriculture. Certain rules observed by his radio writers in preparing the copy for the department's twenty-two weekly educational programs are responsible, he believes, for the favorable reception of these programs. That they are well received is evidenced by the thousands of letters and telegrams received daily from listeners in every section of the country, and by the enthusiastic endorsement given the program material by radio station managers.

Every department radio program is given a severe test to determine its suitability for broadcasting purposes, says Mr. Pickard. To this end all material must have practical application. It must be timely, concise, and of general interest.

Talk With Teeth in It

"The subject matter," he says, "must have teeth in it—real punch in the form of fresh, new, helpful information. The program maker dare not bore his audience with restatement of old facts. He must sense the questions his audience may be asking, and without waste of words or attempt at oratory, supply the information in a straight-to-the-point fashion. The informaion must be clearly and interestingly presented. Every fact must be dramatized to the fullest extent —be prepared with a friendly tone and ring true when spoken. All scientific terms and difficult words are eliminated in the department programs.

"The radio program maker edits both with his ears and his eyes to determine whether the copy 'speaks smoothly.' He reads it aloud to test its 'ear quality,' for words and sentences easily read may sound awkward when spoken. Difficult consonants are avoided. Construction is simplified. It is the listener's ear, not his eye, that must be made to register. He must be made to feel that he is being 'talked to' or 'visited with,' rather than 'lectured at.' There must be dignity in the program. Cleverness must be genuine."

Pleasant Voice Needed

But all these efforts are of no avail, concludes Mr. Pickard, unless the voice at the microphone is pleasant, friendly, and effective. The microphone artist must show genuine interest in his audience and in his subject matter.

Commenting further on educational programs, he says the best time of day for such features is a matter on which opinions differ.

Jardine Hopes To Reach Every Farmer by Air

The world's largest user of radio for informational purposes is the United States Department of Agriculture. Its daily educational programs of a half-hour or more broadcast from 100 stations, together with the market news service and weather forecasts, make up a grand total of hours on the air not approached by any other single user of radio for non-entertainment purposes.

Already radio has definitely proved its effectiveness as a supplemental agency in spreading the department's educational matter. That the programs are successfully holding their own in dial competition is evidenced by the thousands of letters flowing daily into the radio service office. Stations express their own appreciation of the Government services and that of their audiences as well. Farmers, who ordinarily find little time or inclination for correspondence, write many letters of appreciation and commendation.

He's a Pioneer

Secretary Jardine, himself a pioneer in the broadcasting of farm programs in Kansas, back in the radio dark ages four years ago, believes that within a few years it will be possible for the Deprtment of Agriculture to have the attentive ear of almost every farmer in the United States. A potential million are being reached daily at the present time.

Agriculture can be placed in a strong and secure position through regular and careful guidance by radio, in the opinion of Secretary Jardine. Hitherto, he says, agricultural interests have suffered hardships, directly traceable to lack of unity in thought and action. Radio, he believes, as an added means of distribution of information, is bringing them together. Day by day, each farmer and each group receives the same counsel. Gradually, all agricultural interests can be expected to share more equally correct knowledge of production and marketing principles, thus mobilizing their strength.

Prospects Good

The possibilities for constructive organizaton and concerted action, the Secretary believes, were never so good before the advent of the radio. He maintains that for farmers radio has ceased to be a novelty and has become an important utility.

Curves Are Used For Placing Mike

To facilitate the broadcasting of programs from points outside the studio, KDKA maintains a corps of engineers who determine the acoustics of the program room beforehand and place the microphones for greatest audibility.

Since there are between 40 and 50 places on their itinerary from which programs will be picked up from time to time, the engineers have greatly simplified the work of adjusting and equalizing the relay circuit to the transmitting station by plotting curves of characteristics for each installation.

Whenever a speech, concert or meeting is to be broadcast from a regular pick-up station, the engineers refer to their charts, and know immediately where the mikes should be placed and how to compensate the circuit for stray currents, local disturbances and reactance.

SCIENTISTS SEEK TO HARNESS SUN

Rely on Penetrating the Mysteries of Photoelectric Cell, the Principle Governing Radio, to Capitalize Solar Rays

Scientists may harness the sun when they know more about photoelectricity, the principle governing radio, Dr. Herbert E. Ives of the Bell Telephone Laboratories, New York, declares in a research report to the Engineering Foundation.

"May we look to photoelectricity for direct conversion of the sun's radiation into electrical energy for industrial purposes?" asks Dr. Ives. "As yet efficiency is so low as to offer no immediate promise.

"It is probable that the utilization of the sun's radiated energy by vegetation is primarily induced by photoelectric response. We may, by advancement in knowledge of photoelectricity, master ultimately the utilization of solar radiation, though we may have to resort to the indirect method of nature."

Hertz's Foundation

Heinrich Hertz laid the foundations of modern radio, according to Mr. Ives. "Hertz produced electromagnetic waves by causing sparks to pass between separated metal electrodes in air," he explains.

"In 1887, he observed curious irregularities. With all electrical conditions the same, the sparks would sometimes pass easily, at other times not at all. This behavior excited his curiosity. He sought for its cause, and discovered that when light was falling on the electrodes the sparks passed most easily.

"Ultra-violet light, such as the light from another spark, was most effective, as shown by the great decrease in influence when a clear plate of glass was interposed.

"Other experimenters soon found that the effect of light on a metal electrode was to make it require a positive charge, or lose a negative charge. Later, after J. J. Thomson had discovered the electron, it became clear that when a metal is illuminated it gives off electrons.

Lenard's Discovery

"Lenard, pupil of Hertz, who first systematically studied photoelectric effect, found a peculiar characteristic of the emitted electrons, which has kept the greatest minds in physics guessing.

"He found that the number of electrons emitted was proportional to intensity of illumination, as one would expect, but the energy with which they were emitted was quite independent of the intensity of the light, depending merely on its frequency, or color.

"Whether we get our light from an arc lamp a foot away, or from a candle a mile way, or from a star ten light years away, the electrons shoot out from the illuminated surface with the same initial energy—that is, the metal plate must be charged to the same positive potential to prevent their escape.

The Shot Upward

"Sir William Bragg has pictured the phenomenon as follows: Suppose a plank dropped from a ship at sea. Waves would spread outward, ever diminishing in height. Another ship would intercept a minute section of the wave front. Instantly a plank would be exploded from the side of this ship, and fly to the height from which the original plank fell.

"To explain this extraordinary effect, Einstein formulated his first revolutionary physical theory, of light quanta. Light, said Einstein, consists not of electromagnetic waves in the ether of uniform intensity along their whole fronts, but of bundles of energy. The wave front is 'speckled.'

"This quantum is the same quantum of energy turning up wherever radiation and matter interact. There is no doubt of its reality, and of its importance in the explanation of the physical universe.

"Practical applications center around the development of highly sensitive photoelectric cells. Best conditions are obtained by putting the metal in a glass or quartz enclosure, and controlling both the kind of atmosphere and its pressure.

The Photoelectric Cell

"The typical photoelectric cell is a glass bulb, with one electrode, the cathode, usually a layer of alkali metal on the inner surface, with a wire leading out through the glass, and another electrode, the anode, a loop of wire, likewise carried out.

"Connect these two wires through a galvanometer and let light shine in the bulb; the galvanometer will show electric current flowing. The current starts and stops instantaneously; it is proportional to the illumination.

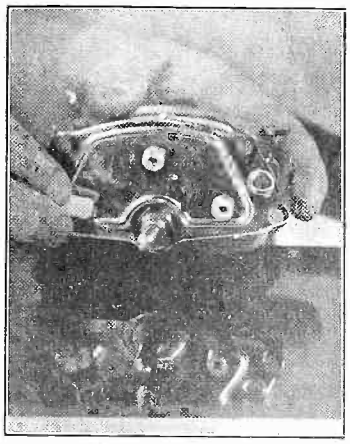
"It is quite small, but with proper instruments, it may be used to measure light from such faint objects as sixth magnitude stars. In electrical transmission of pictures, photoelectric cells do exactly what is required. They transform the light and shade of a picture, as traced by a tiny beam of light, into an electric current, varying exactly with the picture values, and without lag or distortion.

"To be used, some means had to be found to increase the minute photoelectric currents for transmission over telephone or other lines. This has in recent years been made possible by development of the thermionic vacuum tube."

Circuits Surround the Walls of KDKA

More than a score of electrical circuits encircle the walls of KDKA. They are composed of a dozen different kinds and sizes of wire. Through them the microphone plugs are connected, so that mikes can be cut in at almost any point in the room; electric lights are controlled; signal lights are operated, indicating start or stop to a speaker or player, and communication held with the station operator, warning him when to cut the mikes in and out. The work of wiring KDKA required nearly five months.

CHALK TEMPLATE



(Hayden)

RUBBING white chalk on the mounting lugs of a variable condenser makes it easy to locate the mounting holes, when a template is not available. Drill the hole for the center shaft, press the condenser against the panel and the white mark will result.

Music Broadcast From Fast 'Plane Is Retransmitted

A three-piece orchestra broadcast a short musical program from WCCO, one recent afternoon, while flying over Minneapolis-St. Paul, in a Simpson Detroit cabin air mail plane piloted by Charles "Speed" Holman. The first number played was "Breezin' Along With the Breeze," which in this case was about 100 miles an hour.

Besides the pilot, the plane carried Hugh McCartney, WCCO operator, who handled the set in the plane and acted as announcer, Harry Schaefer, banjoist, Harold Smith, saxophone player, and Joseph Peyer, violinist. With the exception of the saxophone player losing his wind power when the plane dipped and a little fading as the ship turned in the air, the program came through in very good shape.

The broadcast was handled by means of a 40-meter transmitter installed in the plane. The waves from this were picked up by a short wave receiving set installed in the House of Hope Church, Saint Paul, where WCCO has remote control wires. From there the broadcast was sent over the wire to WCCO's 5,000-watt transmitter at Anoka, where it went on the air.

Prior to this flight, Waldo Grover, another operator at WCCO, made a test with the plane, and after playing "The Prisoner's Song" on his harmonica, decided it was safe for the orchestra to go on.

Holman acted as pilot of the plane when the aviator who was to have piloted the plane failed to show up. Holman had just arrived with the air mail from Chicago.

Sayres Is Promoted

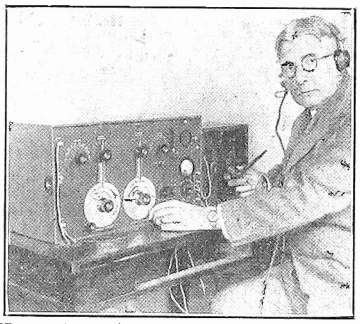
Grant & Wadsworth, Inc., New York advertising agency and creative merchandisers, announce the election of Ralph A. Sayres as Vice-President. Mr. Sayres is devoting his entire time to the radio and its accessories, in which line he is a leading trade analyist and counsel.

RADIO STRESSED BY SIGNAL CORPS

Saltzman, in Annual Report, Cites Work on High Frequencies as Evidencing Keeping Abreast or Ahead of Commercial Work

Maj. Gen. C. McK. Saltzman, Chief Signal Officer of the Army, in his annual report to the Secretary of War, lists the accomplishments of his branch of the Army for the fiscal year ended June 30, 1926.

Among these he includes developments in radio comunication, in which, he says, the Signal Crops has not only kept pace with commercial advances, but has led in many important phases. Radio apparatus developed by the Signal Corps sent a message on short wavelengths from the Philippines to Washington. The radio beacon, which guides airships 200 miles away, has added to the safety of aviation, General Saltzman points out, and these and other advances have been originated or materially aided by work of the Signal Corps. The report follows in part:



(Henry Miller)

MAJOR GENERAL Charles McK. Saltzman testing a type of receiver to be installed at army posts.

For many years past the Signal Corps has felt a keen interest in the amateur radio operators of the country. These enthusiasts have many times aroused the admiration of the nation by their contribution to radio development and research, by the tremendous distances they have frequently bridged, using their low-powered, inexpensive, home-built sets, and by the devotion they have displayed in transmitting important information when normal channels of communication have been destroyed by flood, storm, fire or wind.

It was felt that a closer association would be mutually advantageous to the amateur operator and to the Signal Corps. Through the hearty cooperation of the American Radio Relay League and the unceasing efforts of the Corps area commanders and the signal officers, close and cordial affiliations with the amateur operators have been established. As a result there has been opened up a new and vast network of radio channels of communication which will be of great potential value in time of emergency.

And there has been made available to the Signal Corps a large reservoir of radio operators who will have received most valuable training in time of peace and who can be more quickly adapted to military needs in time of emergency. It is believed that the establishment of such close contact with the radio amateur is a real step toward a better national preparedness.

One of the most useful constructive services rendered the country by the Signal Corps during the year has been the training of young men in technical occupations. During their Signal Corps service these young men become competent radio, telegraph or cable operators, or acquire proficiency in installation, operation, and maintenance of telephone equipment or other communication apparatus. This training is a tangible asset to the country because, aside from its military value, it is useful and lucrative to them in future commercial professions.

Money Saved

The savings of the Signal Corps during the fiscal year amounted to nearly one-fifth of its appropriation. During the year the Signal Corps was the recipient of appropriations amounting to $2,259,446. It turned into the Treasury of the United States the sum of $325,349.37 and made, in addition, a saving of not less than $136,485.11 on the 290,405 dispatches sent over Signal Corps communication nets for various departments of the Government.

The most important duty of the Signal Corps is that of providing suitable means of signal communication for the Army. The advance in the art of communication has been most rapid during recent years, and each year has brought forth certain outstanding developments and accomplishments.

The past year has been no exception as exemplified by the development of a short wave, high frequency transmission and reception in radio, the use of carrier currents on wire lines, and so on through a long list of achievements.

The Signal Corps has not only kept pace with commercial developments, but leads in many important phases, having turned over to the commercial field many ideas of great benefit to the communication system of the nation.

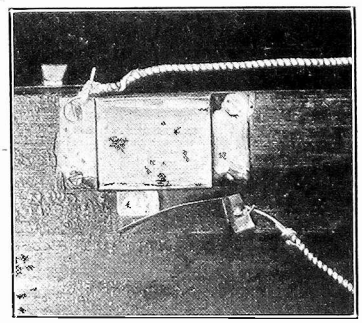
Another outstanding accomplishment in useful and constructive work has been the research work of the Signal Corps in the development and improvement of communication apparatus. This operates as a contribution to the public as well as to the Army. In this work might be mentioned the progress made towards the utilization of short waves, or high frequency, of radio transmission and reception.

Beacons Guide 'Planes

The Signal Corps, in close cooperation with the Navy and civil authorities has been in the forefront of this development. A noteworthy example of what can be done with a very small short wave improvised radio set was the transmission of dispatches from the Philippine Islands to Washington, D. C.

It must not, however, be concluded that the development of high frequency radio sets is completed. It is difficult to say at this time how far the use of short wave sets will go and how they can replace or will form only an adjunct to the present types of radio apparatus.

VERSATILE LOCK



(Hayden)

IF an ordinary door lock is fitted to the back of the cabinet or in some other place, and suitably connected in the line of the battery supply, with a piece of metal bent and connected in the circuit as shown in the photograph, an A battery lock results that can be either closed or opened to complete the circuit. The bar on the lock slides on both sides.

AUDIO TESTER

(*Concluded from page 9*)

The two oscillators and the receiver can be located in one cabinet. If it is so desired only the two oscillators need be in one cabinet, the receiver being a separate unit, since by the substitution of the tuning inductances the receiver can be utilized for regular reception. In this case it will be necessary always to adjust critically when employing the receiver for the reception of the beat note.

To preclude the possibility of erroneous tuning and discrepancy in the beat note frequency, the receiver should be an inherent part of the complete system; once it is adjusted to the frequency of oscillator number 1, it should remain constant at that adjustment. Since the location of the oscillator coils with respect to each other governs the intensity of the beat note, as picked up by the receiver, it is important that the oscillator coils be close to each other. But in this respect it is also necessary to observe precautions so that the proximity of the coils will not affect the tuning of the indivdual circuits. The same applies to the location of the receiver inductance with respect to the oscillator coils.

In Fig. 2 are shown two methods of applying the audio frequency signals from the receiver amplifier to any sources desired, such as audio amplifiers under test, capacity or inductance bridges, etc.

The use of the audio oscillator with bridge measurement devices provides a combination of great utility and convenience, as it will permit bridge measurements at various audio frequencies.

List of Parts

Three 500 turn honeycomb coils.
Two 300 turn honeycomb coils.
Three .001 mfd. variable condensers.
One 100 henry choke.
One .00005 mfd. vernier condenser.
Five sockets (type governed by tubes used.)
Four Amperites. (One for each oscillator; one for the detector and one for the two audio amplifiers.)
Three .1 bypass condensers.
One .0003 mfd. grid condenser and 3 meg grid leak
Two .1 megohm coupling resistors.
Two .5 megohm grid leaks.
Two 1 mfd fixed coupling condensers.
Two 1 mfd. fixed coupling condenser.
Baseboards or panels, connecting wire, etc.

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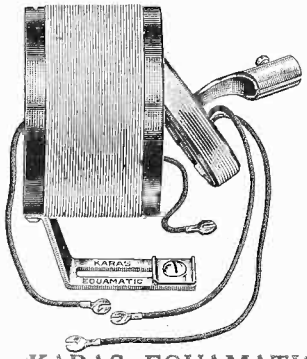
They will make it work better—look finer—last longer

GET the very utmost efficiency out of the radio set you build by using Karas Parts. Have it as fine in appearance as any factory-built set ever made. Build it of parts that will give years of trouble-free service. To accomplish this three-fold aim USE KARAS PARTS. No matter what circuit you use, Karas Parts will improve the results you may expect from your receiver. Thousands of enthusiastic Karas users have told us what these famous parts accomplished for them. Use these parts in your set and they will give YOU the same gratifying results.



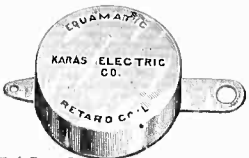
KARAS EQUAMATIC INDUCTANCE COILS

A revolutionary development in the design of a scientific inductance that was perfected by Karas especially for the Equamatic System. When these coils are used with the Karas Special 17 Plate Variable Condenser in the Equamatic Receiver the radio frequency tubes operate at their highest possible peak of efficiency—just below the oscillation point—because there is an absolutely constant and equal transfer of energy between the primary and secondary inductances at every wave length setting of the dials. THIS HAD NEVER BEFORE BEEN ACCOMPLISHED. No other receiver does it today. **The Equamatic System is the only circuit in existence which gives this remarkable efficiency.**

Karas Equamatic Inductance Coils are made of Bakelite. The 2½ inch secondary has a slotted bracket which is mounted on the subpanel and which may be adjusted for tight or loose coupling or turned about the spring clip to give any desired rate of coupling. The 2 inch primary coil is designed to mount on the extended shaft of the Special Karas Condenser, and it, too, may be adjusted to the precise angle for most efficient operation. These two coils are entirely separated from each other.

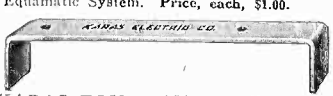
The Equamatic System does away with all looser methods—is wonderfully selective—has tremendous volume——and great clearness.

Three Karas Equamatic Inductance Coils are packed in a box with a complete manual of simple diagrams and full instructions for building the Karas Equamatic 5-tube Sensation. Included with the coils are all necessary nuts, screws and binding posts for assembling the entire receiver. **Price, set of three coils, $12.00.**



KARAS EQUAMATIC RETARD COILS

So efficient is the Karas Equamatic Circuit that when used with present day radio tubes it becomes necessary to place a small retard coil in the grid circuit. This compact coil contains 50 turns of No. 36 wire on a ¼ inch laminated iron core housed in a brass shield. Two of these coils are required in the Equamatic System. **Price, each, $1.00.**

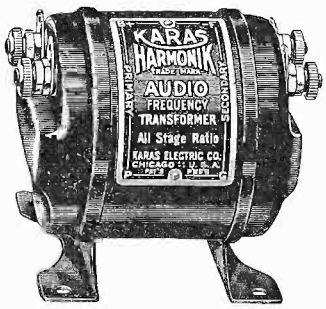


KARAS EQUAMATIC SUBPANEL BRACKETS

These brackets make it possible to center the primary coils exactly within the secondary coils in the Equamatic Receiver inductances, and also to have the pivot of the adjustable primary directly above the spring clip of the secondary—two important details in the construction of the Equamatic. Three of these brackets are required. **Price, set of three brackets, 70c.**

Better Results Because Karas Parts Are Precision Built Throughout

There is no secret about the reason for better reception when Karas Parts are used. EVERY KARAS PRODUCTS IS BUILT WITH THE SAME PRECISION AS A HIGH GRADE WATCH. We work within ten-thousandths of an inch where others consider hundredths of an inch close enough. We never place a Karas Part on the market until it has been given thousands of tests, under actual conditions found in building radio receiving sets. Down to the last minute detail Karas Parts are engineered in strict accordance with the very highest requirements of the latest and most scientific radio knowledge. Karas Parts are the finest you can possibly secure. They are well worth their slight extra cost because of their superb quality.



KARAS HARMONIK ALL STAGE RATIO AUDIO TRANSFORMERS

Every tone—every shade of tone—every vital harmonic—every overtone—is amplified with greatest volume and unvarying clearness by Karas Harmonik Audio Frequency Transformers. We designed these transformers to combine the greatest possible VOLUME with maximum clearness. Result: When Karas Harmoniks are used there is no muffling of words or sounds—no distorted tones—just clear, pure, sweet, natural reproduction with surpassing volume.

Karas Harmoniks are all stage ratio transformers. They have extremely low losses, high impedance and minimum distributed capacity. Many thousands of turns of wire finer than a human hair is wound on the large, iron core to insure high inductance and ample magnetic field for influencing the secondary windings. Karas Harmoniks have a controlled air gap which gives an extremely high amplification of low frequency fundamental harmonics. They are scientifically shielded, perfectly matched, and will outperform any other audio transformers ever made. **Price, each, $7.00.**

KARAS ELECTRIC CO.

1149 Association Bldg.

CHICAGO

All Good Dealers Everywhere Handle Karas Parts

We have made it possible for every radio set builder to secure Karas Parts easily and quickly. These parts have national distribution. They may be secured from all good radio dealers everywhere. However, there are times when the demand for Karas parts for popular circuits depletes some dealers' stocks, with the result that your particular dealer may be out of certain items you need. If you are in a hurry and do not wish to wait until your dealer secures a new stock from his jobber you may order direct from us, if you wish to do so. Simply fill out and mail the coupon below, telling us which parts you need, and we will send these to you by mail. SEND NO MONEY. Just hand the postman the price of the parts plus a few cents postage.

KARAS ORTHOMETRIC STRAIGHT FREQUENCY LINE VARIABLE CONDENSERS

Called by experts the most perfect variable condensers ever produced. They possess features you will recognize as vital in condenser design. First, Karas Orthometrics have no measurable losses. Their resistance cannot even be ascertained by the most delicate instruments. As Karas dielectrics are made of hard rubber and placed well outside of the effective electrostatic field, absorption losses are done away with.

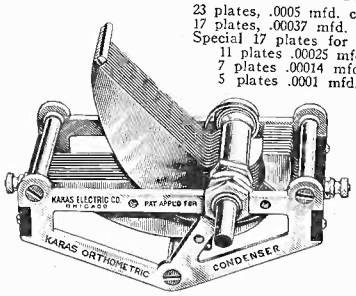
Second, Karas Orthometrics are absolutely straight frequency line condensers. The "curve" of a Karas Condenser is a perfectly straight line at every wave length setting of the dial. This result is accomplished by the scientific eccentric form and position of Karas Orthometric Rotor Plates. There is a uniform separation of all adjoining wavelengths by equal distances on the dial. Every station is equally separated from its nearest neighbor in either direction by a ten kilocycle spacing—one division of the dial.

Result: NO CROWDING whatever of stations at ANY part of the broadcast waveband.

Karas Orthometrics are of highest possible efficiency both electrically and mechanically. Die-stamped high quality brass frames and plates are used, both rotor and stator plates being soldered at every point of contact. Rotor plates and frame are grounded eliminating body capacity effect. Scientific cone bearings allow rotor plates to turn easily and smoothly, yet hold the shaft firmly and in perfect alignment.

Sizes and Prices

23 plates, .0005 mfd. capacity	$7.00
17 plates, .00037 mfd. capacity	6.75
Special 17 plates for Equamatic	7.00
11 plates .00025 mfd. capacity	6.50
7 plates .00014 mfd. capacity	6.50
5 plates .0001 mfd. capacity	6.50



KARAS ORTHOMETRIC Variable Condensers

FOR THE DX GETTING 5-TUBE SET DESCRIBED BY CAPT. O'ROURKE IN THIS ISSUE YOU WILL REQUIRE ALL OF THESE KARAS PARTS EXCEPT TRANSFORMERS.

KARAS ELECTRIC CO.,
1149 Association Building, Chicago.

Please send me the following Karas Products, for which I agree to pay postman $..... upon delivery, plus postage.

( ) Set of 3 Karas Equamatic Inductance Coils, $12.00.
.....Karas Audio Frequency Transformers, each, $7.00.
.....Karas Orthometric Condensers, as follows:
( ) 23 Plate ( ) 17 Plate ( ) Special 17 Plate
( ) 11 Plate ( ) 7 Plate ( ) 5 Plate
.....Karas Equamatic Retard Coils, each, $1.00.
.....Karas Equamatic Subpanel Brackets, set of three, 70c.

Name .....

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(If cash accompanies order we will ship postpaid.)

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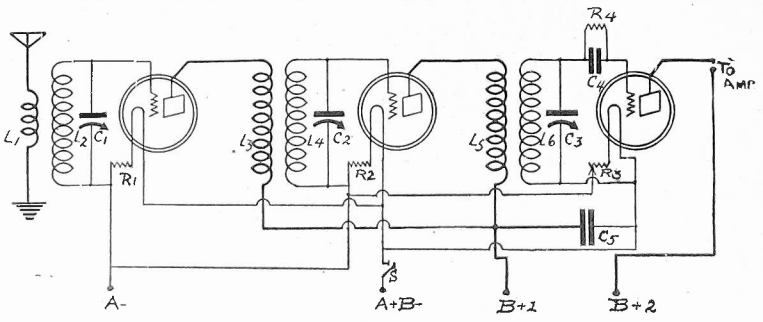

FIG. 478

The circuit diagram of the tuned RF and detector unit requested by Thomas Rougher

I HAVE three tuned radio frequency transformers, which have 10 turn primaries and 73 turn secondaries, wound on 2¾-inch diameter tubings with No. 22 double cotton covered wire. I would like to place these in a tuned RF and non-regenerative detector unit, with no audio amplification. Can I have the circuit diagram of such a unit, using ballast resisters to control each of the filaments of the RF tubes and a rheostat to control the filament of the detector tube? Please state what capacity condensers these coils are to be used with, also the size of the cabinet to house the unit and how to place the coils. I am going to use —O1A tubes throughout.—Thomas Rougher, Newark, N. J.

Fig. 478 shows the circuit diagram of such a unit with the requirements you request. The coils you have are for variable condensers, having a capacity of .0003 mfd. The grid returns of the RF tubes are to A minus and those of the detector to the A plus. A filament switch is used for cutting the filament circuit in or out. The plates of both RF tubes are fed with a single plate voltage, e.g., 67½. The plate of the detector tube is also fed with a single B voltage. The exact voltage at this point is dependent upon the type of audio amplification used. That is, using transformers will require a lower voltage than when using the resistors or impedances. e.g., 45 for transformer and 67½ for other type. C5 is a .006 mfd. fixer condenser. The grid condenser is a .00025 mfd fixed, while the grid leak is of the 3 megohm type. R1 and R2 are the ballasts, each of the ¼ ampere type, e.g., 1-A Amperite. R3 is a 20 ohm rheostat. A 7x18-inch panel and cabinet may be used. All the parts may be mounted on a baseboard, which is 6 inches wide and 17 inches long. The first RF coil should be placed horizontally. The second coil should be placed erect. The last coil should be placed with a circumference facing the panel. Be sure that the centers of all the coils are on one line.

* * *

I HAVE a 33 turn coil, wound on a 3-inch diameter form, using No. 24 double cotton covered wire; a .001 mfd. variable condenser; a 35 turn coil wound on a 3-inch diameter tubing using No. 22 double cotton covered wire and a .0005 mfd. variable condenser. Please give the circuit diagram of a 4-tube receiver, using these parts. I wish to use transformer coupled audio frequency amplification, with a double circuit jack at the first AF output, a single circuit jack at the total output, and 20 ohm rheostats in the filament circuits of each tube.—Henry Morris, Oakland, Cal.

Fig. 479 shows the circuit diagram of the 4-tube receiver The 33 turn coil is used in the antenna circuit. The 35-turn coil is used for coupling and tuning plate of RF tube. The .001 mfd. variable condencer C1 is used to tune the antenna. The .0005 mfd. variable condenser C2 is used to tune the 35 turn winding. The 33 turn coil is tapped at the 5,15 and 25th turns. These taps are brought to the switch contacts, while the switch's arm is brought to the rotary plates of the .001 mfd. condenser and to the G post on the first socket. C3 is a .00025 mfd. fixed condenser. R5 is a 2 megohm grid leak. You will note that the grid return is not connected in the conventional manner, eg., across the condenser. Instead it is brought to the plus post of the A battery. This is to give the proper bias to the grid, since no coil is connected directly in this circuit. The grid condenser acts as a transferer of energy and is also used to keep the direct plate voltage off the grid. AFT1 and AFT2 are the audio transformers, both of which are of the low ratio or all stage type. The rheostats that control the filament circuits of each of the tubes are indicated as R1, R2, R3 and R4 respectively. DCJ is the double circuit jack. SCJ is the single circuit jack. (1) is the radio frequency tube, (2) is the detector tube, while (3) and (4) are the audio frequency tubes. B plus 1 equals about 67½ volts. B plus 2 equals about 45 volts. It is suggested that a separate 90-volt connection be made to the plates of the AF tubes instead of to the RF tube also, if this voltage is to be used for greater volume. Note that the ground is connected to the A minus post. Use the —O1A type tubes throughout.

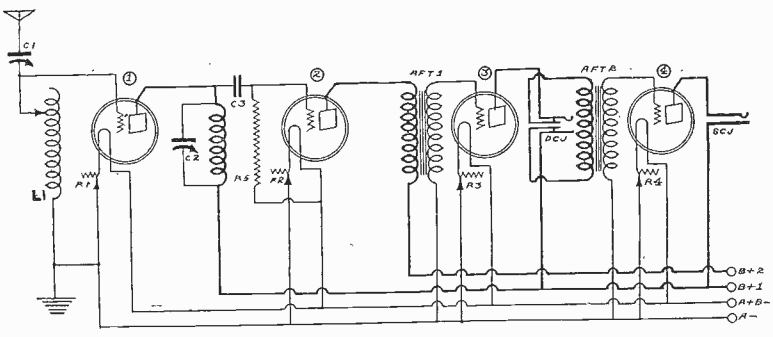

FIG. 479

The circuit diagram of the 4-tube set requested by Henry Morris.

* * *

IN A 4-tube receiver, which would give the better results: (1) two stages of tuned radio frequency amplification, a regenerative detector and one stage of audio amplification or (2) one stage tuned radio frequency amplification, a regenerative detector and two stages of audio amplification?—Chas Giddings, 230 Eccles Building, Ogden, Utah.

No. 2 would be better of the two.

* * *

I EXPECT to build a 4-tube Hi-Power receiver described by Herbert E. Hayden in the Nov. 13 issue of RADIO WORLD and would like to have the following queries answered. (1) How many volts are applied to the plate of the amplifier tube? (2) How many volts are applied to the plate of the detector tube? (3) Where is the B minus connected to? (4) I have two Acme A-3 audio transformers. Can they be used? (5) Are the two Sickles coils identical? (6) Will a power tube help? If so what C battery bias should be used? (7) What size C battery should be used when the power tube is not used? —N. W. Halsey, Kew Terrace Apts., Kew Gardens, L. I.

(1) Dependent upon what type tube is used. Suggest you see the July 10 issue for tube chart. Use either the 171 or 112. (2) 45 volts. (3) A plus. (4) Yes. (5) Yes. (6) Yes. Louder signals will result. See answer to question (1) for C data. (7) See the chart suggested in answer (1).

* * *

HOW MAY I connect two tapped 22½ volt B batteries so that I may obtain minus 40½ volts for use as C bias on the 171, using 180 volts B and minus 4½C for a —O1A, using 90 volts B? (2) How may a 4½ volt standard C battery be connected to a tapped 22½ volt B battery to obtain minus 16½ volts, using 90 volts B on a 171 and minus 4½ C for a —O1A, using 90 volts B?—Charles Monte, Butte, Mont.

(1) The plus 22½ volt post of one B battery is connected to the C plus post. The 18 volt plus post of the same battery is connected to the minus 4.5 volt post. The minus of this battery is connected to the plus 18 volt post on the other battery. The minus of this battery is then connected to the C minus 40½ volt post. (2) The plus 16½ volt on the large 22½ volt battery is connected to the C plus post. It is also connected to the plus post on the small 4.5 volt C battery. The minus 4.5 volt post on this battery is connected to the minus 4.5 volt post on the set. The minus post on the large B battery is conneced to the 16½ volt post on the set.

* * *

I HAVE read a great deal about placing pieces of metal foil on the window pane for use as leadin, instead of drilling

a hole or using a strip, etc. How is this done?—Walter Kule, Arlington, Va.

On the outside window pane, toward the upper portion, glue or cement a piece of tin foil about one foot square. Solder to top end a lug and connect the antenna leadin. Now on the inside of the window pane, directly opposite the piece just glued on, place another piece of tin foil. Also solder a lug to the bottom portion of this foil. This is connected to the wire going to the antenna post on the set. The soldering may be done before or after the foil is placed on the window. Be sure that the pieces of foil are directly opposite each other. The regular 100 foot antenna can be used with this scheme.

* * *

I HAVE three .0005 mfd. variable condensers, mounted in a rack and pinion style, so that a single dial turns the three condensers at one time; a 2,000 ohm non-inductive resistance; a .00004 mfd. variable condenser; a 10 and a 20 ohm rheostat; three 2½" diameter tubings, each of which contains 5 turns, and three brass shafts 2" long, ¼" in diameter. What I would like to do, is to build a set using these coils mounted on the brass tubings and turned at the same time that the condensers are, for balancing. Please give the circuit diagram of such a set, wherein two stages of tuned radio frequency amplification and a non-regenerative detector is used, without audio frequency amplification. I wish to experiment with varous types of AF amplification. State the coil data.—Franklyn Millison, Newport, R. I.

A diagram of a receiver employing those principles which you suggest, is shown in Fig. 480. A tapped antenna winding is used. This is indicated as L1. It contains 40 turns and is wound on a 3" dameter tubing, which is 5" long. It is tapped at every 5th turn. This method is used so that either a long or short antenna may be used, the greater number of turns being used with a short antenna and the smaller number of turns being used with a long antenna. L2, L5 and L7 are the variable coils. Instead of all these coils containing 5 turns, L2 should contain 3 turns; L5 should contain 4 turns, while L7 may contain the same number of turns already on it, e.g., 5. L3, L6 and L9, the secondaries, contain 44 turns, wound on 3" diameter tubings, 5" long. The tubings should be the length specified or longer, since it is necessary to place another winding on this tubing and still allow a space between the windings. The tapped antenna winding is placed on the same tubing as the secondary winding L3. The plate winding L4 which consists of 10 turns, is wound on the secondary winding tubing, L6. The plate winding L8 which consists of 7 turns, is wound on the secondary tubing winding L9. No. 22 double cotton covered wire is used in all these cases. A ¼" space is left between the plate and secondary windings. This applies to the antenna-secondary winding also. R3 is the 2000 ohm resistance. It controls the B voltage and also the oscillatory action of the tube. This B voltage may be brought to that point, where the C voltage will act as a balancer. R1 is the 10 ohm rheostat, which controls the filaments of both RF tubes. The 20 ohm rheostat controls the filament of the detector tube. The -O1A tubes should be used. C5 is the .0004 mfd. condenser and is used for compensating purposes. C4 is a 1.0 mfd. fixed condenser, used for bypassing. R4 is a 3 megohm leak. This may be lower or higher, depending exactly upon the tube used. It is best to experiment here. The C battery is of the 4½ volt type. Various voltages should be tried for best results. Each of the

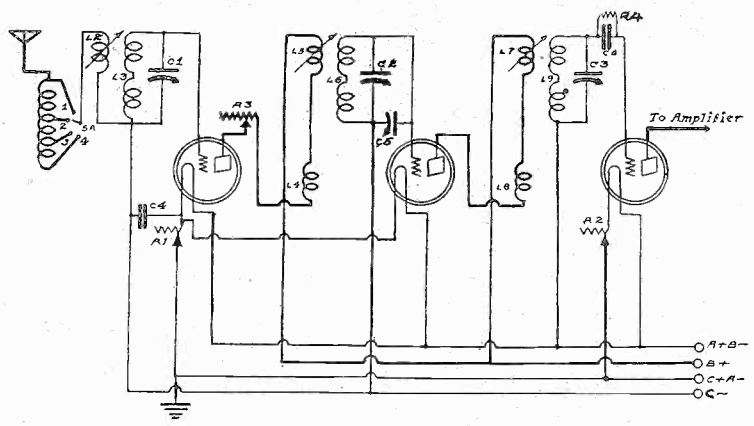

FIG. 480

The circuit diagram of the 1-control receiver, requested by Franklyn Millison.

secondary windings should be placed at right angles to each other or at angles, such as used in the Neutrodyne receivers, e. g. 57.3°. This receiver will give excellent results if built with care. Each lead should be checked up. The variable coils should be held tightly in place and evenly placed, so that the same position is obtained with each movement of the condensers. The control of the filaments is not critical and should not be made a portion of the tuning. Ballast resistors can supplant these rheostats, with as much satisfaction. A standard tuned RFT, containing a primary and secondary winding, without the taps may be used. Using the ballasts will necessitate the use of a filament switch connected in series with either one of the A leads.

* * *

PLEASE GIVE a simple method of knowing when a receiver is transmitting. —Hugo Floyd, Port Jervis, N. Y.

Disconnect the antenna post from your set. Set your receiver to that point where you think the tube is oscillating. Now moisten one of your fingers and place on this post. If the receiver is transmitting, you will hear a dull thud. The louder the thud or break, the greater the strength of this oscillating note. If the generation is very great, it will sound like the familiar break and make of the telegraph key, when listening to pure continuous wave signals.

* * *

IS IT possible to rubberize a wood, so that it may be more desirable for use as a panel?—Leonard Crawford, Fullford-By-The-Sea, Fla.

Yes if you have some old phonograph records or tubings. Break some records or tubings into small pieces. Place in a tin can or pot and add ½ pint of denatured alcohol. This should be allowed to stand for a day or so, until the pieces have been completely dissolved. Now dry your wood. Apply a fine coat of varnish or shellac. Allow to dry and apply three or four coats of the rubber solution.

* * *

WHEN RESISTANCES, having like values, are connected in parallel, is the total resistance divided by the number of resistances in the circuit, e.g., two 90 ohm resistance in parallel gives a 45 ohm total resistance?—Herbert Henrie, Lockport, N. Y.

Yes. This applies to like values of resistance only. Using unlike resistances, the reciprocal is used.

* * *

I HAVE a 5-tube receiver, using storage battery tubes, which worked wonderfully, until a short while ago. Now, as soon as I pull the filament switch, the signals come in strong, but after a few moments, it dies down. I have tested the battery, both A and B and both show up to be full. What could be the trouble? The tubes are new and the coils, condensers, etc. are O.K. Could the trouble be in the storage A battery? I have had this two years and charge it every week?—Max Hull, Pittsfield, Mass.

The trouble lies in the A battery. The battery delivers the full voltage after it has stood unused for a while, but after it is in use, the voltage dies down. Therefore the filaments of the tubes are not supplied with their proper voltage. This will be noticed by the variation of the brilliancy of the tubes. When you test the battery, you get a full voltage check, due to its stand, also. The plates are probably worn.

SHORT WAVE LAW ASKED BY TAYLOR

Ban on Harmonics and Over-Radiation Should Be Decreed by World Agreement, Says Naval Research Chief—Experiences Cited

WASHINGTON

Aiming a radio message at a place thousands of miles away soon will be an everyday matter, according to Dr. J. Hoyt Taylor, Chief of the Naval Research Laboratory at Bellevue.

Dr. Taylor's statement is based on recent developments in the high frequency band. The "skipped distances" theory is responsible and it has been confirmed by actual operating conditions during the last year.

Dr. Taylor learned some time ago that when the radio signal leaves the high frequency transmitter it travels almost diagonally to the roof of the earth. When it reached the Kennelly-Heaviside layer it is deflected back to earth again. The point at which the signal comes down depends on the height of the layer and the angle at which the signal goes out.

Short Waves Charted

Dr. Taylor has charted most of the short wavelengths and knows pretty well at what angle the signals travel on each. During the Summer he made a number of measurements of the height of the Heaviside layer and believes he has it established accurately.

In addition to the signal that goes up to the roof of the earth there is also a ground wave which travels a short distance, depending on the power of the transmitter. Otherwise, the only signal that can be heard at any great distance is the one that is deflected back to earth.

For this reason, it is common for stations thousands of miles away to pick up high frequency signals while stations only hundreds of miles away cannot get them at all.

It is a mathematical possibility to determine in advance where the signal will come down.

Height Varies

The average midnight height of the Heaviside layer is about 175 miles, Dr. Taylor has found. Around 2 a.m. the height increases to 225 miles, and in the day time it varies between 100 and 120 miles. There is a hangover of night conditions in the early morning, he adds.

Most important among high frequency developments during the last year is the construction of a special transmitting tube for use with the piezo crystal, Dr. Taylor says.

There is sometimes a missing angle of radiation in use of high frequencies, Dr. Taylor adds. In other words, when the signal leaves the antenna there is a small

angle from which there is no signal. Great care must be taken in sending out high frequency signals to prevent their going up at too sharp an angle, else they will pierce the Heaviside layer and continue upward, never returning to earth.

No DX Below 10 Meters

Distance transmission and reception may never be possible below 10 meters, Dr. Taylor fears. On this wavelength the signal leaves the antenna at so low an angle that ground absorption soon dissolves it.

Directivity is uncertain in the high frequencies, says the Navy radio chief. Sometimes when the transmitter is pointed at Balboa, it is heard quite well in San Francisco but does not reach its intended destination. The same things have happened in other directions.

Harmonics and too much radiation in the high frequencies must be banned by international agreement, Dr. Taylor contends. When using high frequencies, a number of foreign stations send the same signal out on two or more wavelengths.

Good Here, Bad There

When this is done, if there is fading on one wavelength, the signal generally is good on the other, and vice versa. In addition, there are harmonics, which means that sometimes as high as a dozen wave lengths are occupied by one transmitter.

"The more we work with high frequencies, the more complexities we find," Dr. Taylor concludes. "But we are not discouraged and we hope to increase our knowledge with experience and experiments."

ONE STATION SKIPLESS ON SHORT WAVES

The Bellevue Naval Research Laboratory of Bellevue, D. C., in studies of radio wave propagation to determine the average height of the Kennelly-Heaviside layer, found that short waves are subject to a skip-distance effect—that is, radio signals can not be received at certain distances from all transmitting stations.

"There is one station in this country, however," Dr. A. Hoyt Taylor, Superintendent of Radio at the laboratory, said, "which does not appear to show a skip at all, or at least not at all in line with that shown by naval transmitters observed at this laboratory. That station is 2XS of the Radio Corporation of America, whose signals are received at points from 200 to 600 miles distant, which theoretically they should not reach at all."

"A number of observations has been accumulated upon this station by this Laboratory, and practically without exception the observations show this anomaly.

"Several possible explanations have been advanced and they are given for what they are worth. First, that the signals travel entirely around the globe. This seems unlikely, because the signals are too strong. Second, that there may be an effect near 2XS due to ionization from various sources which are known to exist in the neighborhood of large manufacturing cities. There is little doubt that such ionization effects do exist, but that the electron density is sufficiently great to account for the refraction and production of another skip wave."

CHAOS IS HERE, HOOVER FINDS

Litigation Among Stations May Solve Interference Problem, Says Secretary — He Expects Many Suits Among Broadcasters

WASHINGTON

Secretary of Commerce Hoover foresees the possibility of extensive litigation between radio stations arising out of the demand of one Chcago broadcaster for an injunction against interference from another station.

In an oral statement Secretary Hoover, who had just returned from a western trip, asserted that the bringing into the courts of the question of interference may solve an extremely complicated problem.

Various stations changed wavelengths assigned them by the Department of Commerce when the Attorney General's recent opinion divested that department of regulatory control.

"There is no question about chaos having arrived," said Secretary Hoover.

Hoover Will Send Congress Message

WASHINGTON

Secretary of Commerce Herbert Hoover is planning a message to Congress when it meets in which he will give a resume of broadcasting conditions since last July. Mr. Hoover will outline the reasons which influenced him to discontinue efforts to regulate broadcasting and the results of that step.

Although he will not recommend anv particular kind of government control, Mr. Hoover will stress the necessity for legislation particularly in view of the congestion of stations at present and the fact that nearly a hundred new stations are under construction.

MAKES CONDENSER

The Furnell Variable Air Condenser, a radical change in condenser design, is to be constructed for the Furnell Manufacturing Corporation by the I. R. Nelson Company of Newark, New Jersey, owners of W A A M.

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Subscribers will note that the end of their subscriptions is indicated on the labels on wrappers. If your wrapper shows a date earlier than the current issue, please send payment for renewal. Changes in expiration dates on wrappers appear two weeks after receipt of renewal.

RADIO WORLD, 145 West 45th St., New York City. (Phones: Bryant 0558-0559.)

RADIO LAW DUE AFTER CHRISTMAS

Dill Believes That Senate and House Conferees Can Iron Out Differences Arising Over Choice Between Hoover and a Commission

By Thomas Stevenson

WASHINGTON

Success or failure of Congress to pass a radio regulatory measure this Winter will depend on whether the Senate and House can compromise on the question of an independent commission versus Department of Commerce control.

This is the opinion of Senator C. C. Dill, of Washington, author of the Dill bill, and chief proponent of radio legislation in the Senate. Senator Dill has returned to Washington for the Winter session of Congress and is holding a series of informal meetings with Representative Wallace White, of Maine, author of the White bill which passed the House.

"All other matters are dwarfed into insignificance compared to this major problem," Senator Dill says. "If the Senate and House conferees can get together on it, legislation is not only probable but certain."

Senator Dill says he has heard a lot of criticism of his bill and particularly the provision which authorizes the government stations to accept messages from the public for transmission by wireless.

"The necessity for legislation this Winter must impress all of us that it is our duty to give it very serious consideration. Another year of uncontrolled broadcasting might either kill public interest or result in a monopoly of the air."

Senator Dill believes the conferees will be able to get together on some kind of measure, although he does not expect a bill will be passed before late in January.

PRIORITY TO STATIONS IS TRADE PLEA

National Coordinating Committee of the Radio Industry Takes First United Stand on Interference—Wants Emergency Law and Seniority Protection

WASHINGTON

The National Coordinating Committee of the Radio Industry has announced that Congress should pass an emergency measure which will prevent further confusion in the ether if it is impossible to obtain the enactment of permanent legislation in the immediate future.

The announcement was made after an executive session lasting throughout an entire day and was signed by Walter A. Strong, chief of the Radio Section of the American Newspaper Publishers' Association; Paul B. Klugh, executive chairman of the National Association of Broadcasters; R. W. Demott, president of the Radio Magazine Publishers' Association; Charles H. Stewart, vice-president of the American Radio Relay League, and Harold T. Wrape, president of the Federated Radio Trade Association.

The National Coordinating Committee is an outgrowth of a meeting in New York of the entire industry in September. The purpose of the committee is to unite the industry on legislation and other matters of national importance.

Industry's Record

The meeting held in Washington was the first time in history that the radio industry has acted for itself without the guiding hand of Secretary Herbert Hoover, of the Department of Commerce.

Temporary headquarters have been established in Washington by the Coordinating Committee and a series of conferences will be held during the next few months.

The announcement follows:

"Radio legislation which will establish Federal control over broadcasting is highly essential. If it is impossible to secure the enactment of permanent legislation in the immediate future Congress should pass an emergency measure which will prevent further confusion in the ether.

"In the enactment of legislation it is the recommendation of the committee that whatever authority is placed over broadcasting should be required to make determination of who shall broadcast by giving consideration to the length of time stations have operated; the character of service rendered by them, and the requirements of their states and communities for radio service. This principle is not intended in any way to create a vested right as against the United States, but asserts that there is a distinction between vested rights and the rights of individuals against each other.

For Public Service

"The decision of the Chicago courts in the case of WGN vs. WGES sheds a ray of hope. The local court held that a separation of 50 kilocycles is necessary between stations in the same community. Confirmation of the Chicago decision in other State courts will do much to check the invasions of the ether channels, which are being planned by more than seventy stations which are now under construction."

WRIT BARS WGES FROM WAVE GRAB

CHICAGO

For the first time in the United States a court of equity declared that property rights may be created in the air, and that the rules of common law may be applied to them. The conception of the air as a free commons was declared unsound in a decision given by Judge Francis S. Wilson in the State Circuit Court, in the suit brought by The Tribune Company, operating WGN and WLIB, against the Oak Leaves broadcasting station, owned by the Coyne Electrical school, and J. Louis Guyon, dance hall proprietor. (WGES).

This decision enjoins the Oak Leaves station from broadcasting over a wavelength sufficiently near to The Tribune stations to interfere with programs. A motion to dissolve the temporary restraining order was denied, and pending appeal and the hearing of the permanent injunction case the court stated that fifty kilocycles in frequency from the wavelength of The Tribune stations safely might be used by the Oak Leaves station, and that if it came any closer it would be at the risk of hurting its defense.

The new principle set up is that priority of time in the use of a certain wavelength in broadcasting, the building of property on this basis, and the education of the receiving public to it creates a superiority of right in that particular part of the ether.

Congressional action in control of the air was forecast in the judge's ruling when he stated:

"It appears to this court that the situation is such from the past development of the industry of broadcasting and radio receiving and from the apparent future, as indicated by the past, that, unless some regulatory measures are provided for by Congress or rights recognized by State courts, the situation will result in chaos and the great detriment to the advancement of an industry which is only in its infancy."

Better Service Is Rule for '27

By R. L. Eichberg

With the radio stations adding to their power it is supposed that the nuisance of static will be overcome to a large extent. Reports sent in by listeners regarding the reception of broadcast entertainment from high powered stations would indicate that this is actually the fact.

Manufacturers are improving their apparatus constantly, making refinements rather than any radical changes. The power tubes, power amplifiers, cone speakers and truly humless B eliminators have done much to add to the enjoyment of the listening public. In fact, radio equipment as sold today is very highly developed and satisfactory apparatus. I startling announcements were made during the past year, and it is not expected that any will be forthcoming this Winter, although minor improvements will be announced.

The service that dealers are giving to their customers is being constantly improved, and it is expected that 1927 will mark still greater advance along these lines. The days when neither the purchaser nor the dealer knew what radio was all about are passing as the fact that a radio service man must have a thorough radio education makes itself more and more manifest.

Many radio trade associations have made rulings that a dealer selling radio apparatus cannot be classed as a radio dealer and is not eligible for membership in any such association unless he either maintains an adequate service department or has made arrangements with a recognized radio repair shop. This insures the purchasers of radio equipment prompt and expert service when and if it is needed.

This ruling brought to light the fact that a shortage of competent radio service men exists. It was found that there were plenty of positions open, but that there were not enough men sufficiently educated along radio lines to meet the wants of the dealers. Good jobs went begging.

Then the Federated Radio Trade Association decided to open a school in Detroit that would take men with little or no radio training and teach them radio service work. The result of this decision was the Federated Radio Trade School, which opened a year ago and now occupies 10,000 square feet of floor space in Convention Hall at 4464 Cass Avenue.

Among the instructors and lecturers who will appear at the school this term are Professor Warner of the University of Detroit, Professor Williams of the University of Michigan, Mr. J. C. Hoover, Mr. Merle Duston, the director, and author of a number of radio books, Mr. G. Corwin and myself.

The Federated Radio Trade School is operated without profit by the Radio Trade Association of Michigan of several states. Its fees are sufficient to cover the cost of running the school.

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WFI—*Philadelphia*	WCCO—*Minneapolis, St. Paul*
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