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RADIO WORLD

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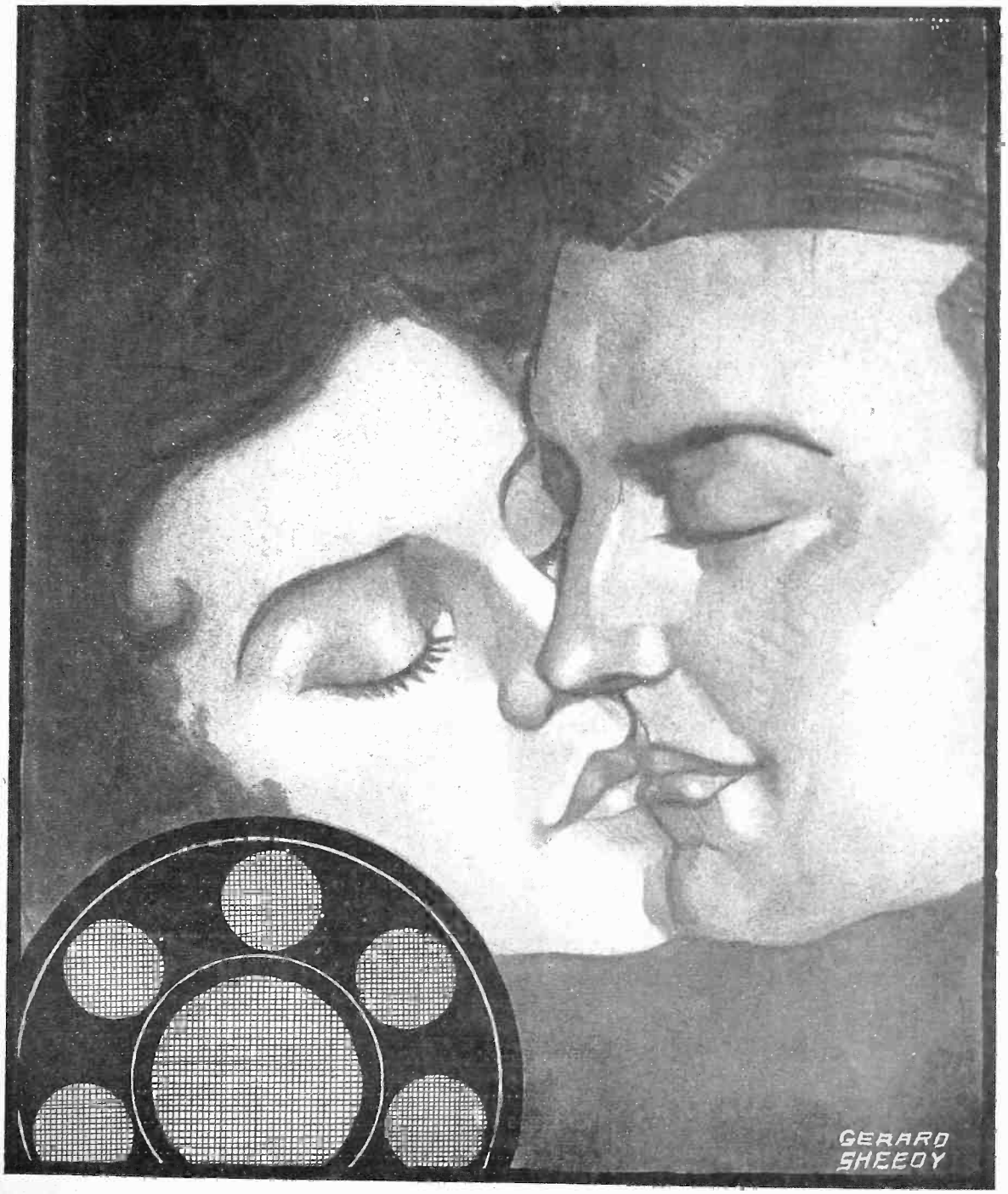


CAN YOU TELL When It's a Kiss? See Page 4.

Kiss Baffles Listeners

They Fail to Identify Sound In Broadcast

"Slap on the Cheek," One Calls It, While Another Writes; "It Sounded Like Pulling a Cork Out of Bottle"

By Dwyer Fawcett

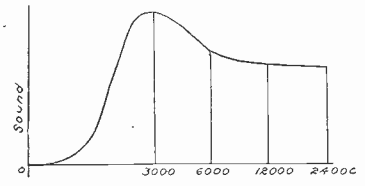


FIG. 1

The approximate frequency distribution of the sound of a kiss. The plop occurs at a medium frequency, here indicated at 3,000 cycles, while the characteristic hiss is made up of frequencies between about 6,000 and 20,000 cycles. A poor radio transmitting-receiving system suppresses the hiss and lets through the plop only.

RECENTLY the engineers of a British broadcasting station tested the fidelity of transmission and reception of sounds. They selected sounds with which everybody was familiar but which were rather difficult to transmit and reproduce. The listeners were invited to communicate with the station and tell what the various sounds were. The letters received by the station revealed a great diversity of opinion as to the origin of the various sounds. Some of the most familiar sounds were unrecognized by the majority of the listeners. The cause of this failure was obviously lack of fidelity of the transmission and reception equipment.

A few examples of the responses with reference to one particular sound will illustrate the diversity of judgment.

"The sound was that of a slap on the cheek," wrote one, because it was a dull thud accompanied by some static-like noise."

"Like Pulling a Cork"

Another wrote: "It sounded to me like pulling a cork out of bottle. There was a little hissing and then a sharp pop."

A man who was evidently a devotee to the game of fisticuffs thought that the sound originated from "a sharp blow to the body." He gave no reasons for thinking so.

"The sound was produced by the bursting of a toy balloon," wrote still another, "because it was a clean, sharp pop."

"The sound was produced by holding a piece of calico between the hands and suddenly straightening it out with a snap." This judgment must have come from a seamstress or a housewife. One man of wide experience in the matter said that "sound was that of a kiss." And the sound of a kiss it was. This man was in charge of the tests.

Few Guessed Right

Few of those who sent in their judgments guessed correctly. What are the reasons that so many Britishers failed to recognize the sound of a kiss? One reason was that the broadcasting equipment did not faithfully impress the kiss on the ether waves. Another reason was that the majority of the receivers used in listening to the test did not reproduce faithfully what had been impressed on the ether waves. Still another reason was the great diversity of kisses. The listeners could not think of all the various types of kisses at the same time. Was the test kiss of the brother-sister variety, which usually is nothing more than a light-pressure osculation? Or was the kiss of the maternal variety, which is characterized by a lusty smack? Or again was it one of those long, silent soul kisses between lovers in which the participators come up for air now and then? The type of kiss was of the quick, maternal kind, and to judge from the responses it must have duly smacking.

The Acoustic Analysis

Now, what is the acoustic composition of a kiss of this variety? It consists of a little hissing, which is high audible frequency, and a little of medium frequency. The hissing sound is of heterogeneous composition and may range in frequencies from 8,000 to 20,000 cycles per second. The medium frequency sounds might center around 3,000 cycles. The medium frequency is produced by resonance in the two mouths. The hissing is produced by the friction of air against the lips, in exactly the same way that a hissing sound is produced by a leaky bicycle valve.

A good example of an artificial kiss can be produced in the laboratory with the aid of Magdeburg hemispheres. These are two hollow hemispheres of metal, provided with handles. One of the half spheres is also provided with a nozzle and a stop cock. When the two hemispheres are placed face to face, separated by a rubber gasket, they form an air tight sphere which may be exhausted of its air with the aid of a pump. After exhaustion the stop-cock is closed and this prevents the air from rushing into the vacuum when the pump is removed.

The air pressure on the outside of the sphere holds the two halves firmly together. However, by pulling hard on the two handles the two halves can be pulled apart. The sound produced is like that of a kiss, and is produced in the same way. There is more resonance when the Magdeburg hemispheres break apart than when kissers break, and therefore the sound is sharper and freer from hissing. The sound of the breaking spheres is more like the sound of a kiss after it has been transmitted and received by a poor quality radio system.

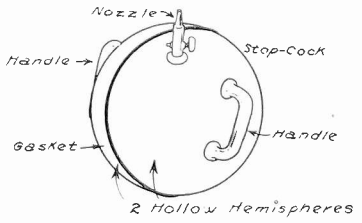


FIG. 2

A sound similar to that of a kiss can be produced with the aid of a pair of Magdeburg hemispheres such as these. The air is first pumped out and the vacuum secured by stopping the valve. The two halves can be pulled apart by pulling hard in opposite directions on the two handles. At the beginning of the break the characteristic hiss is heard, and this is followed by a loud pop.

Suppression Causes Distortion

What causes the distortion in the radio kiss which makes it unrecognizable? Mainly the suppression of the hissing or of the high audio notes. Up to a few years ago there was no effort to reproduce any frequencies above 5,000 per second. Hence a kiss transmitted and received by one of the old systems would contain nothing of the characteristic hissing, but only the resonant part of the kiss, and this would be like the dull thud or the sharp pop reported, depending largely on the fidelity of the receiver.

With modern transmitting and receiving equipment the fidelity is much greater than it was a few years ago, and if a test were conducted in the United States a much larger proportion of the listeners would form the correct judgment. If the receiver is capable of reproducing sh, s, z, v distinctly, it will also reproduce a kiss with fidelity, at least as far as the sound goes.

[Other Illustration on Front Cover]

That Portable Set

WHAT sort of a portable set would you like to build for the coming Summer? If you will state your one preference the favorite type of portable will be described and also the second and third choices of the fans.

Everybody wants a portable set, not only for his vacation but also for those periodic jaunts that sprinkle themselves along the whole long, joyous trail of Summer.

Get busy with your pen and ink now and write full details of what you want.

Address Portable Set Editor, Radio World, 145 West 45th Street, New York City.

MARTINELLI SINGS

Giovanni Martinelli, Metropolitan Opera Company tenor, will give a short recital over WPG, the Municipal station, in Atlantic City, N. J., on Easter Sunday, beginning at 9:10 P. M., through the courtesy of the Hotel Traymore.

The Schoolboy's Set

17-Year-Old Describes Favorite One-Tuber

Tuning the Primary Circuit Increases Both the Sensitivity and the Volume In Inexpensive Earphone Receiver Built With "Dad's Money"

By Wally Frost

I AM 17 years old. For the past three years I have built every type of one-tube set that has come to my attention. After a fair trial of all of these I have selected the one shown in Fig. 1 as affording the most for the least money, and as one that assures full satisfaction. It gets distance for me, and will for you, I feel certain. It is not hard to tune. Its upkeep cost is low. In all, it should prove attractive to fellows like myself, who go to school, have only a moderate amount of money to spend on radio—dad's money, at that—but who are real radioists at heart.

Those adult fans who have built and manipulated super-heterodynes and power amplifier receivers may think that one-tube receivers are out-of-date and that no one would be interested in such receivers at this stage of radio development. But they forget the younger radio generation. The youngsters did not stop growing just because radio has grown up. There are countless boys, now in the same boat I was in when I was 14, just entering the mysteries of radio, and many of these have more experience in things radio than most folk imagine. These boys want simple radio receivers with which they may experiment, and like to be aided to their goal by somebody else's experience. There are also many who have had a great deal of experience with complex radio receivers who could learn much by playing around with simpler sets.

Even those who are novices in radio and who would start with the simple radio receivers to learn the principles of radio from the ground up will find a tried and true one-tube set just the thing.

A Survey of Expectations

We used to read of single tube receivers which were as sharp as a razor and which were so sensitive that they could operate a loud speaker. The critics of such claims would point out the fact that there are different degrees of sharpness of razors and that sometimes the volume from these sets could be heard on a loud speaker provided that listener would "wear the loud speaker horn as a hat." No claim of razor-like selectivity nor of loud speaker volume is made for this set. We side with the critics in this respect.

All that should be and can be expected from a one-tube set is that it be selective enough to discriminate among stations without having one station spoil the program of any other and that the set be sensitive enough to bring in stations up to about 100 miles with good volume in the headset. The set does get distance, but nobody can safely guarantee distance. When a set can get 100 miles consistently, it will at times reach out as far as 1,000 to 1,500 miles.

The Antenna System

The first requirement of a good one-tube receiver is a good pick-up system. That is, the antenna must be very good and there must be a first-class ground connection. The antenna may consist of

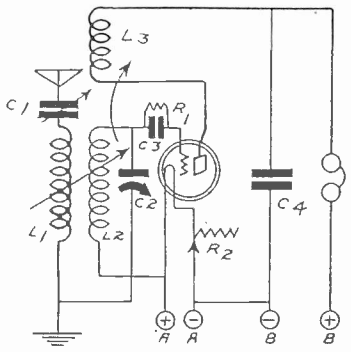


FIG. 1

Circuit diagram of a one-tube receiver. This may be built inexpensively and operated for a year for a few dollars. As an introduction to practical radio this circuit is hard to excel.

150 feet of copper wire, counting from the set to the farthest end of the antenna. This, therefore, includes the leadin. The wire should be of about No. 12 copper, and it may be bare or covered. It should be placed as high as practicable. That is, the horizontal portion should not be any longer than necessary to get the proper length. The vertical portion of the antenna is much more effective in picking signals out of the air than the horizontal.

It is also important that the antenna wire or leadin be kept as far from trees, walls and metallic structures as possible. The insulation at the far end and at the various supports should be of the highest type so that there will be no leakage, particularly in wet weather. If at all possible there should be nothing between the antenna wire and the ground, as any objects under it will decrease the effective height and hence the signal. The ground lead should be connected to the nearest cold-water pipe or other good ground that is available. All connections on the antenna and the ground should be soldered for best results.

LIST OF PARTS

C1, C2—Two variable condensers, .0005 mfd.

C3—One grid condenser with mica dielectric, .00025 mfd. or less.

C4—One mica by-pass condenser, .0005 or .001 mfd.

R1—One grid leak, variable, or, if fixed, 2 megohm.

R2—A rheostat 50 to 60 ohms for —99 or 10 to 20 ohms for —01A.

L2, L3—Two windings of a three-circuit tuner, as described.

L1—Antenna coil about 75 turns on a 3-inch diameter tubing.

One socket.

Eight binding posts (two for antenna and ground, two for headset and four for batteries).

One 7 x 12-inch front panel.

One 8 x 11-inch baseboard.

Antenna wire, 150 feet No. 12 copper.

One ground wire, 10 to 50 feet, preferably insulated.

One ground clamp, and three antenna insulators.

Three vernier dials and one knob for tickler.

Coil Data

Now for the set proper. Since the amplification in a one-tube receiver is quite limited it is important to take advantage of every detail that will help to increase the volume without sacrificing selectivity. One valuable detail is tuning the primary, or the antenna circuit. For this purpose a variable condenser C1 is put in series with the antenna. This should be of the .0005 mfd. size, or .001 mfd. may be used if you have that around the house.

A rather large inductance is required in the antenna circuit. In fact, the inductance of the coil L1 should be about twice as great as that of the secondary L2, that is, it should have from 50% to 75% more turns if the two coils are wound with the same size of wire on the same size tubing. The exact size required cannot be predetermined, because it depends very largely on the capacity of the antenna. If the coil first used is not large enough, indicated by low volume on high waves, the simplest remedy is to put another coil in series with it. This second coil need not be so large.

The secondary coil L2 should have an inductance of about 165 microhenrys. This is obtained by putting 43 turns of No. 24 double cotton covered wire on three-inch diameter tubing. The tickler coil L3 should have about 35 turns of wire on two-inch diameter tubing and it should be mounted so that it can be turned inside L2. The size of wire on the tickler is immaterial, but fine wire is preferable. Any size between No. 40 and No. 24 may be selected.

Commercial Coils

If it is not desired to make coils L2 and L3 they may be purchased in the form of a three circuit tuner. There are many good commercial coils that can be obtained. The main condition is that the secondary fits the condenser C2 to be used with it.

When the ready-made coil is used the third winding or primary, is disregarded, or if it is used it should be connected in series with L1. The coupling between L1 and L2 should be made variable. This may be accomplished either by turning L1 with respect to L2 or by moving it linearly. The selectivity as well as the volume may be controlled by varying the coupling.

The tuning condenser C2 should be .0005 mfd. because with this size the broadcast band can be covered much more easily than with a smaller size. There is even some tuning space left for some of the amateur stations below 200 meters.

Coils for Receivers

How to Wind and Place the Inductances

Solenoids Described for .0005 and .00035 Mfd. Tuning and Directions Given for Connections That Afford Right Phases

By J. E. Anderson

Contributing Editor; Consulting Engineer; Associate, Institute of Radio Engineers

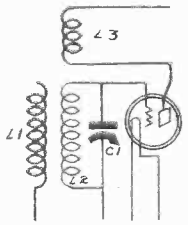


FIG. 1

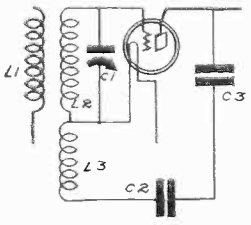


FIG. 2

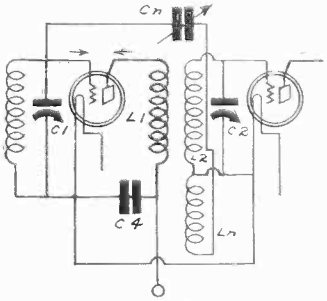


FIG. 3

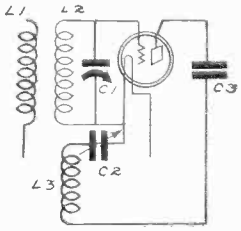


FIG. 4

IN designing radio frequency tuners to cover the broadcast band it is the custom to employ either .00035 or .0005 mfd. condensers for tuning. Coils must be designed to match the size condenser used.

The usual procedure is about as follows: The maximum capacity of the condenser is known and a certain capacity is added to this to take into consideration the capacity of the tube and of the various leads. This sum is then taken as the maximum capacity in the circuit when the condenser is set at maximum.

Suppose that the maximumu capacity of the condenser itself is .0005 mfd. and that it has been found by measurement that the average capacity of the tube and leads is .000075 mfd. The total capacity in the circuit when the condenser is set at maximum is .000575 mfd. This value is then used in conjunction with the maximum wavelength it is desired to reach to calculate the required inductance, or rather the lowest frequency it is desired to reach.

Now, the lowest frequency in the broadcast range is 550 kilocycles, and since it is well to have a factor of safety we take 540 as the limit. In previous issues of RADIO WORLD it was shown that the frequency is given by the formula $f = \frac{1}{2\pi\sqrt{CL}}$. In this formula we know that the capacity is .000575 mfd. and that the frequency is 540,000 cycles. Substituting these values in the formula and simplifying we have 151 microhenrys. This is probably too low a value properly to cover the broadcast band with the average condenser in the average circuit. A value of 160 microhenrys is usually better, although commercial coils average 170. They are purposely made a little too large so that a few turns can be removed for final adjustment. The 160 microhenry value is obtained approximately if the total capacity in the above formula is .000550 mfd., that is, if the stray capacity is taken as .00005 mfd. instead of .000075.

Coil for .00035 Mfd.

If the tuning condenser is .00035 mfd. and if we take the value of the stray capacity as .00005 mfd., the total capacity in the circuit at maximum is .0004 mfd., and this substituted in the formula gives 217 microhenrys as the required inductance to cover the broadcast band with ten kilocycles to spare at the lower frequency end of the band. In designing coils, however, it is always well to make the coil a little larger than calculated to allow for the possibilities that the stray capacity is not as large as assumed and that the condenser itself is not as large as it is rated. It is always possible to remove a few turns from a coil that is too large and thus adjust the circuit.

The designing of coils to given inductance values using different sizes of wire and insulation and different size and shape of forms requires the use of rather complex formulas and tables.

When the winding is on a three-inch diameter tubing and when No. 24 double cotton covered wire is used, 43 turns will give an inductance which is just about right for a .0005 mfd. condenser. This is a good winding to keep in mind as an average and as a ready reference. If the size of wire is finer a turn or two less will suffice, but the exact number of times may be obtained by trial. If the size of wire is greater than No. 24 DCC a few more turns will be required, and the heavier the wire the greater the number of turns that must be used. When winding with No. 20 and No. 22 then 47 and 45 turns respectively will be about right in the majority of cases. These are for .0005 mfd.

When the insulation is different from that of No. 24 DCC the turns required will also be different, but not if the number of turns per inch is the same.

When the condenser is .00035 mfd., the size of the tubing on which the coil is wound is three inches in diameter, and the size of the wire is No. 24 DCC, the number of turns should be about 60. This winding should be remembered as a reference as suitable for a .00035 mfd. condenser. As before, when the wire is thinner or when the insulation is thinner, fewer turns may be used and, conversely, when the wire is heavier or when the insulation is heavier more turns should be used to get the same inductance. Space winding is equivalent to making the insulation thicker or the wire heavier.

Size of Wire to Use

The size of wire to be used depends on the requirements of the circuit. When there is only one tuner in the circuit it is best to use heavy wire on a large diameter. When there are two or more tuners in the circuit then thinner wire on smaller diameters may be used. It is of little avail to use heavier than No. 20 wire and perhaps No. 30 is the finest that should ever be enjoyed in a tuning circuit. When there are three tuners in the circuit No. 28 wire will give good results. One of the advantages of using fine wire is economy of space. Coils of adequate inductance can be very small and such coils can be placed fairly close together without serious interaction.

Windings which are used in the plate circuits, such as primaries and ticklers, and which are not intended for tuning, may be made of fine wire. In fact, fine wire is superior to heavy. The question of the resistance of the winding does not enter because this resistance, even if the coil is wound with the finest wire available for radio purposes, is entirely negligible in comparison with the plate-to-filament resistance of the vacuum tube. If the winding is of heavy wire it will introduce a resistance into the secondary or tuning coil which may be serious as far as sensitivity and selectivity are concerned. Also, if the coil is wound with heavy wire it will have a greater capacity with respect to the secondary and with respect to the grid of the tube. This would make the set less stable and it would decrease the sensitivity. Economy of space is also an important consideration in choosing wire for the primary and the tickler coils.

A Rule for Ratios

In Fig. 1 coils L1 and L3 should be of fine wire while coil L2, the tuning coil, should be made of heavier. The number of turns that L1 should have depends on many things. The first is the size of the

(*Concluded on page* 25)

The Melo-Heald

An Eleven-Tube Super-Heterodyne

Novel Method of Pickup for Oscillator Is Used In Conjunction With Efficient Coil System Throughout

By Herbert E. Hayden

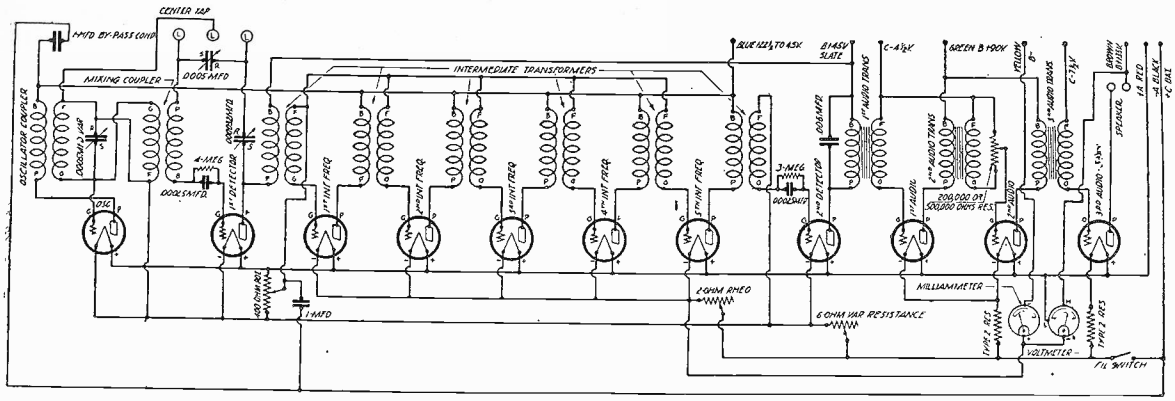


FIG. 1

The Melo-Heald Super-Heterodyne, shown in schematic form, uses eleven tubes, as follows: one oscillator, one first detector, five intermediate frequency, one second detector and three transformer-coupled audio. A center-tapped loop is used for pickup. The loop circuit is regenerated by means of a midget variable condenser.

PART 1

IT is entirely unnecessary to offer any introductory apology for describing a Super-Heterodyne possessing the merits of the present eleven-tube receiver. It will suffice to name the essential features that a good receiver of this type should have and then see to what extent the designers have met the requirements.

A good Super-Heterodyne should have a simple pick-up system capable of high selectivity in the radio frequency level. It should have a reliable oscillator and a frequency control which is not subject to body capacity effects. It should have a good frequency mixer and modulator. It should have an intermediate frequency amplifier free from oscillation, and an intermediate frequency filter capable of giving the receiver adequate selectivity without cutting off sidebands. It should have a detector which will handle the volume without introducing an excessive amount of harmonics. It should have an audio frequency amplifier capable of high quality amplification. It should have simple and adequate volume control in the three frequency levels, and this must not be such as to mar the quality of the signal. The receiver should be easy to construct and it should present a pleasing appearance when completed.

Loop Plus Regeneration

Now let us see how the designers of the eleven-tube Melo-Heald set have met the requirements, starting where the signal first enters the set and ending up where it emerges from the loud speaker as delightful sound.

It is the consensus of all who have given the Super-Heterodyne a thorough trial that the loop method of pick-up gives the greater satisfaction. While more signal strength may be obtained with an antenna it may make the set uncontrollable and pick up so much extraneous noise that the output of the set cannot be enjoyed. With a suitable loop a good pick-up can be obtained on the frequency desired without any interference from noise or other signals. The selectivity of the set in the radio frequency level is greater with the loop than with the antenna, and this is a prime condition for a successful Super-Heterodyne. The effective selectivity of the set is also enhanced by the directional properties of the loop. These advantages more than justify the use of a loop in this receiver.

As a means of enhancing the selectivity in the radio frequency level, regeneration has been introduced into the loop. This also increases the sensitivity of the set and its distance-getting property. The only practical method of regenerating in the loop is by tapping the loop as shown in Fig. 1 and then controlling the volume by a throttling condenser, which in the present case has a value of .000032 mfd. For most purposes regeneration is not needed, and then the throttling condenser is simply set at maximum. The regeneration is a kind of reserve sensitivity and selectivity.

Oscillator Is the Heart

The loop is tuned with a .0005 mfd. variable condenser which is connected across the entire loop. As a means of minimizing body capacity effects the rotors of the throttling and tuning condensers are connected to that terminal of the loop which is the farther away from the grid. This point should be scrupulously observed.

The oscillator is the heart of the Super-Heterodyne, that which makes the circuit pulsate. Without it the circuit is simply not a Super-Heterodyne. The tuned grid type of oscillator is highly satisfactory because one side of the tuned circuit can be grounded, or connected to a point which is nearly at ground potential. This stabilizes the circuit and removes the effect of that most annoying phenomenon—body capacity. To take full advantage of this the rotor of the oscillator condenser should be connected to the grounded or low potential side of the circuit, as has been done in the present design. The condenser is of the .0005 mfd. size. As a further means of stabilizing the circuit and to keep the high frequency oscillations out of the batteries a 1 mfd. condenser is connected from A minus to B plus as near the oscillating coil as practical. This condenser also by-passes the intermediate frequency currents around the supply battery.

A suitable oscillation pick-up is an essential which must receive full consideration in designing a Super-Heterodyne. In this case this has been solved by employing a special mixer coupling transformer, the primary of which is connected across the oscillator condenser and the secondary of which has been connected in series with the grid lead of the modulator tube, that is, on the high potential side of the loop tuner. This usually gives the better results.

Novel Pickup Method

The mixing proper of the signal and oscillator high frequencies is done in the radio frequency tube by what is known as grid modulation. This method is almost universally approved. The usual value .00025 mfd. of grid condenser is employed together with a 4 megohm grid leak. While it is customary to connect the grid return in this type of modulation to the positive side of the filament, in this case it is connected to the negative. This is necessitated by the fact that the oscillator requires a negative return for best operation and the novel method of pick-up between oscillator and modulator calls for the same bias on both tubes. This deviation from customary practice does not involve any loss in detection

(*Concluded on page 27*)

The Value of a Defect
An Interesting Theory of AF-RF Matching

Transformer With Falling Characteristics Favored by Rider in First Audio Stage to Compensate for Effect of Sideband Suppression

By John F. Rider
Member Institute of Radio Engineers

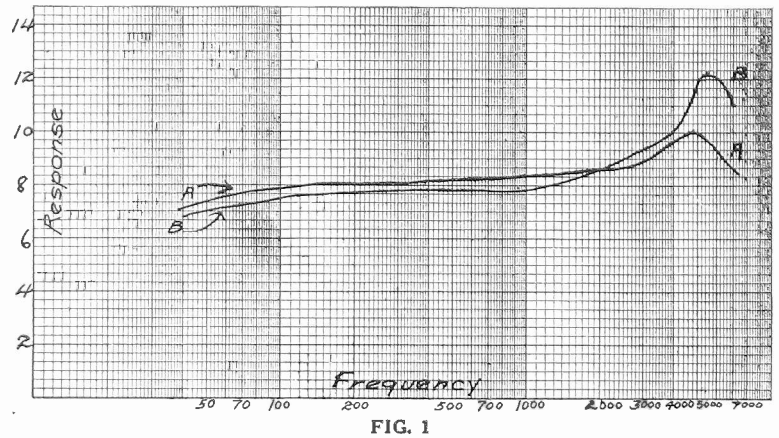


FIG. 1

Curves of two audio transformers. Ordinarily one would prefer transformer A, because it has a flatter curve. But the author states why he prefers a falling characteristic for the first AF stage.

IF the demand of the radio public for quality reproduction and distortionless amplification is to be complied with, it will be necessary either to change the design of radio frequency equipment in use today, or to "match" the audio units to the radio unit. To some fans, if not many fans, this idea is far-fetched, nevertheless, it is the writer's contention that it will materialize at a very near date. If not, radio fans will have to be content with the degree of quality reproduction they are obtaining at the present time, which, while satisfactory, is removed from what really can be accomplished.

Design of radio broadcast receivers has undergone an era of improvement since the first year of commercial broadcasting and wholesale interest in radio. The design of individual parts and accessories has materially improved, but when the units are utilized and considered collectively, there is still room for great improvements necessary regardless of any changes made in the transmitting equipment or wavelength allocations.

The Four Requirements

Take, for example, a conventional receiver, comprised of two stages of tuned radio frequency, non regenerative detector, and two stages of transformer coupled audio frequency. In the design of such a receiver it is necessary to consider four factors.

The first is, selectivity in the radio frequency circuits.

The second is minimization of sideband suppression in the radio frequency circuit.

The third is the minimization of distortion in the detector tube, due to overloading of that tube.

The fourth is minimization of frequency distortion in the audio frequency circuits, i. e., attainment of uniform frequency operating characteristics in the audio frequency circuits.

Of these four factors, only the first is definitely associated with the transmission problem, since a certain degree of selectivity is necessary to satisfactorily separate stations with the present wavelength allocations and frequency sidebands.

The designer of a radio receiver must develop a system wherewith the proper degree of selectivity is obtained with the minimum suppression of sidebands. The relationship between the suppression of side bands and selectivity is the paramount factor in the design of the radio frequency circuit, since it not only manifests an effect upon the general operation, but also governs to a great extent the type of equipment permissible in the audio frequency circuit.

Two Don't Go Together

As has been frequently stated selectivity and non-suppression of side bands with the present type of radio frequency tuning and amplification are not compatible. Every radio frequency receiver which utilizes conventional methods of tuning, and obtains satisfactory selectivity. cuts sidebands. In other words, every such receiver distorts in the radio frequency circuit, the amount of distortion being dependent upon the amount of regeneration in the radio frequency circuits. The greater the regeneration, the greater the sideband suppression.

Now, reference to regeneration in radio frequency circuits should not be construed as meaning that radio frequency circuits in which interaction and oscillation has been balanced is free of sideband suppression. Such is not the case. The only difference between the two systems is that the regenerative RF circuits are more selective and cut a greater portion of the alloted sidebands.

Admitting that every selective receiver is a prolific source of distortion in the radio frequency circuit, what can be done to remedy the situation?

Two methods are available. One is to change the type of tuning utilized in the radio frequency circuits; to adjust the various stages to possess a much higher decrement, that is, to tune more broadly. This will normally bring the 5,000-cycle sideband on the resonance curve to within 10 or 15%, if not less, of the peak. Such a small variation would be permissable. Broader tuning, however, will interfere with selectivity, especially when the receiver is located in a city wherein are operating several powerful broadcasting stations. With broadly tuned circuits it would be mightly difficult to separate these stations, and the receiver signal would sound like the conversations in the Tower of Babel. The use of a certain number of trap circuits advantageously located would greatly alleviate the situation, but the operation of such a receiver would be beyond the average person.

The other method of compensating for the frequency distortion in the radio frequency circuits is to select the proper audio amplifier for the radio frequency amplifier. Fans who have followed the frequent discussion of audio amplifiers may be surprised to hear the writer's contention that audio amplifiers are not fully comprehended by the radio public. The discussion of audio amplifiers did not take into consideration the operation of the audio amplifier in normal practice, but solely as an amplifier, which method of procedure is not the correct one. The various operating characteristic curves, while of great importance in the selection of the audio amplifier are not being interpreted correctly.

Let us take two audio transformer curves such as shown in Fig. 1, A and B. If we were to consider audio amplifiers only and seek the one with the most nearly uniform characteristic, we would cast out vote for Curve A, since its operating curve is flatter than that of B. But do we want a transformer with a flat operating curve for the audio amplifying transformer to be used with the tuned radio frequency described by Mr. So and So?

The requisite for the perfect trans-

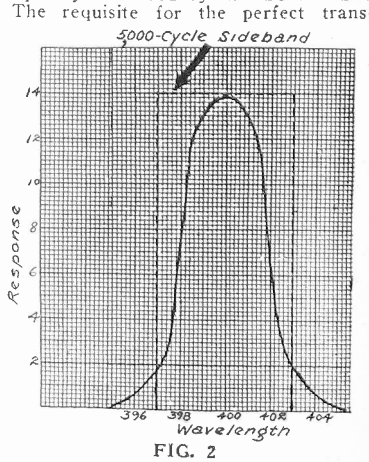


FIG. 2

Resonance curve of tuned RF. The dotted lines show ideal response, the full lines actual response, the difference being due to sideband suppression.

former is a flat operating curve. That is granted. But is it the proper requisite, or rather, the correct requisite? Considering audio amplifiers only, and operating with an unit which is free of frequency distortion, the answer would be yes. But since in normal operation every audio frequency amplifying transformer made is utilized with a tuning system, which is not free of frequency distortion, the demand for a flat operating curve is erroneous. The operating curve required is one which would compensate for the faults of the radio frequency amplifying system. The loud speaker at this time must shift for itself. What we desire is a balance between the radio frequency system and the audio frequency system.

The RF Resonance Curve

The attainment of this balance is worthy of discussion. To arrive at a definite understanding and a basis for our audio frequency discussion we will have to consider for a few moments a resonance curve of a radio frequency amplifier. Such a curve is shown in Fig. 2. The dotted lines indicate the required characteristic and the solid lines the actual characteristic. Since the abscissa shows frequency and the ordinate response, it is evident that uniform response is obtained only if the response curve assumes the shape shown by the dotted lines, but since the actual response curve is that shown by the solid line, it can be easily seen that the frequency response is most non-uniform. If the curve were that shown by the dotted lines all the modulating frequencies which make up the sidebands would receive equal response in the circuit. But since the curve is that shown by the solid line, the suppression of the sideband frequency is equal to the difference between the peak of the dotted curve and the same frequency point on the solid line.

What the Curves Show

As is shown in the curve the suppression of the 5,000 cycle note is approximately 89%, that of the 4,000 cycle note approximately 70%, etc. The response of the carrier frequency and sidebands up to 1,000 or 1,500 cycles is practically uniform, on a non regenerative circuit.

If we now wish to add a stage of audio amplification and to obtain the original balance or uniform frequency response, it is necessary to add a system which will show a gain in response at the frequencies where the radio frequency stage shows a loss. To make this most comprehensive we plot the sideband frequency operating characteristic of the tuned circuit as we would an audio unit, and obtain the curve A in Fig 3. This curve represents the frequency operating characteristic of the tuned stage, just as the curve B represents the frequency operating characteristic of an audio stage. The audio frequency values shown in the curve for the tuned stage are the sideband frequencies. The curve shows a falling characteristic as the frequency is increased.

If we now add the audio unit, which possesses a flat characteristic, the final result will be an amplified reproduction of curve A, since the variations in input to the amplifier will be uniformly amplified by the audio amplifier. Hence, in this case, the uniform audio amplifier is not what is required.

Deliberate Search for "Defective"

If our radio frequency amplifier possessed an operating characteristic such as that shown by the dotted lines in Fig 2, the audio amplifier with the flat operating characteristic would be the thing. Such, however, is not the case, and we deliberately search for a system which is generally considered to be defective, as its frequency operating characteristic is not flat. We find an amplifying unit with

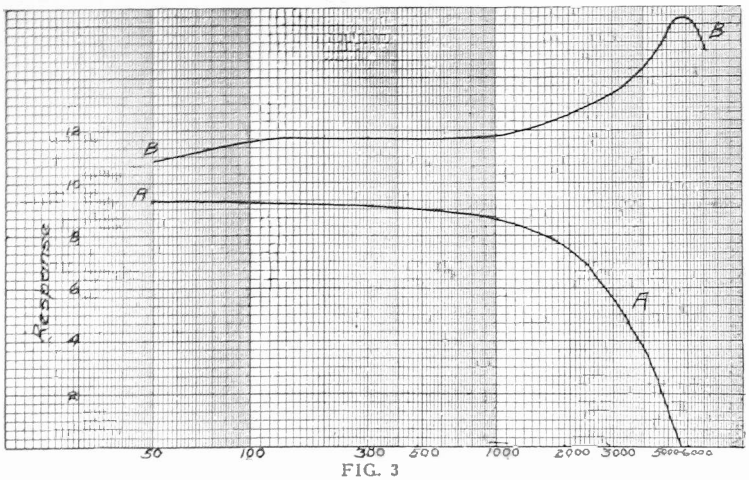


FIG. 3

In the rising curve at top (TRF) the author would compensate with a falling curve (AF) as shown at bottom.

at operating characteristic such as that shown by B in Fig. 1. We note in this curve that the gain between the lowest frequency, 50 cycles, and the 1,000-cycle point is very little, just about balancing the same band in curve A, Fig. 3. We further note a rising characteristic from 1,000 cycles to 5,000 cycles.

The loss above 5,000 cycles means nothing to us, since for all practical purposes 5,000 cycles is the highest audio frequency registered in the radio frequency side of the receiver, and, furthermore, only 5,000 cycle sidebands are allotted.

If we now plot curve B, Fig. 1, onto Fig. 3, to make curve B we can better compare the operating characteristics of this unit and the radio frequency stage. We find that the loss of the upper frequencies in the radio frequency unit is slightly greater than the gain in these frequencies in the audio unit, but we have obtained a fairly uniform balance, that is, a fairly flat cumulative curve, with only a slight loss on the higher frequencies with the audio unit. The final result would be most satisfactory.

Flat Curve for Second AF

We now have the radio frequency unit, the detector and one stage of audio frequency (transformer coupled), and the output is fairly uniform on all frequencies with the audio band. In other words, assuming perfect transmission, we are now obtaining amplification, as far as the output of the first stage audio. The time has arrived when we must seek the audio amplifier with the flat characteristic, additional amplification being necessary if we desire sufficient volume to operate a loud-speaker, and produce the necessary signal output. We must now use a flat characteristic audio amplifier if we desire to retain the operating conditions. Or, as an alternative, we can use an audio amplifier with a slight gain on the higher frequencies, to compensate for the difference between the radio frequency unit and the first stage of audio. The selection of this unit is only one of discrimination between various systems until one is found which possesses the desired characteristics.

Thus we find that the selection of an audio frequency amplifier for a receiver is not the haphazard choice of two or three stage system of identical units, whether they consist of transformers, resistences, or impedances, but rather, the systematic selection of units which best fill the existing needs. For instance, an audio combination such as we selected in preceding paragraphs would not be unsatisfactory with a radio frequency unit with perfect characteristics, because of preponderance of high notes in the final signal. Nor would it be satisfactory with a regenerative detector preceded by a single stage of radio frequency amplification, for this combination if incorrectly operated, would result in a great loss of the higher audio frequencies, which could not be compensated for with the audio combination we selected. With this regenerative detector and RF unit it would be necessary to use an audio unit with a higher gain on the upper frequencies.

Grid Leak Values Cited For Proper Detection

The first and probably the most common use of high resistance is to be found in detector circuits as grid leaks. In order that the vacuum tube may function at its highest efficiency, it is necessary that the grid leak shall be of proper value, and, moreover, that is shall remain constant under all conditions both operating and climatic.

There is much loss of energy and considerable distortion of the reproduced sound if the grid leak is not of the proper value at all times. Furthermore, if the grid leak varies in resistance value, which has heretofore been the case with the inked paper type, there is danger of considerable noise in the reception. Fortunately, when once the correct leak has been found, it may be left permanently in circuit since there is no need with present day detector tubes of altering this value due to the uniform tubes. The following table, prepared by the engineering staff of the International Resistance Company, gives values of metallized resistors employed as grid leaks with the usual detector tubes:

Tube	Average Meg.	For Weak Signals
200	.5-2	2-5 megohms
199	2. -5	5-9 megohms
WD 11 or 12	2. -4	4-7 megohms
201A	2. -5	5-9 megohms
200A	1. -3	2-5 megohms

Since the plate voltage has something to do with the value of the grid leak, the higher the plate voltage of the detector tube, the higher the grid leak value. However, it is well to have several resistors of different values on hand to experiment for the best efficiency.

The Nine-in-Line

A Sensitive, Selective Super-Heterodyne

By Lewis Rand

(Part I, giving a general discussion of the receiver, was published in the April 2 issue. Part II, giving a detailed discussion on the mounting of the parts, was published in the April 9 issue. Part IV, the conclusion, next week.)

PART III

THE High Frequency Laboratories' coils are all similar in external appearance. The means of identification are small pasters, at the bottom, and of course when the coils are mounted these pasters cannot be seen. Therefore be sure you read the number on the coils before mounting them. Then either place a piece of paper underneath with number face up or scratch the number lightly on the inner side of the coils with a scriber.

The small by-pass condensers are mounted during the wiring of the set. Before tackling the wiring be sure that all the parts are rigidly held in place. The lugs on the P and G posts on the HFL coils should be placed so that they face the P and G posts of the sockets in front.

Textual Wiring Directions

The P and G posts on the intermediate frequency and second audio frequency transformers are soldered to the P and G posts on the respective sockets, with the aid of the lugs. These are the only actual connections above the subpanel. The filament wiring is done next. Use a piece of wire which will run from the F plus post of one socket at one extreme end to the F plus post of the socket at the other extreme end. At every F plus post on the socket, drop some solder between the wire and the screw on the socket. Now bring a wire from either end of this lead to one terminal of the filament switch. Bring a wire from the other terminal of this switch to the plus A minus B post on the plug.

The F minus side is next wired. A piece of wire is connected to the F minus posts of all the intermediate frequency tube sockets. From the F minus post on the first socket, bring a wire to the resistance wire post of the 6-ohm rheostat, R3. Bring a piece of wire from the arm post of this rheostat to the minus A post on the plug. Now connect the resistance post of R1, the 25-ohm rheostat, to the F minus post of the oscillator tube socket. This socket comes after the second detector. The arm post is then connected to the minus A lead, not to the plug post. If you attempt to do this, it will short other posts, since there is only room for one lead on plug. One terminal of R2 is connected to the Minus F post on the first detector socket (first socket you hit, on the left, looking from the rear). The other terminal of this Amperite is connected to the minus A lead.

Resistor Wiring

Now bring a lead to one terminal of R4, R6 and R7. This common terminal is then connected to the minus A lead. The other terminal of R4 is brought to the minus F post of the second detector socket. The other post of R6 is brought to the minus F post of the first audio socket. The other post of R7 is finally connected to the F minus post of the second audio socket. This completes the filament wiring. Procure a single tube. Attach the plug to the set and the A leads of the cable to the battery. Now insert the tube in the oscillator socket. Turn on the switch, then the rheostat. Of course the tube should light. Test the rest of the filament circuit, in the same way, inserting this one tube in each socket.

(International Newsreel)

ERNST TYRMAN, president of the High Frequency Laboratories who manufacture the coils employed in the Nine-In-Line Super-Heterodyne, and which he designed. Mr. Tyrman is a prominent electrical engineer. He received his education in Germany.

The oscillator is next hooked up. The B post on the pickup coil L3, is brought to the G post on the first detector socket. The F post on this coil is brought to loop phone tip jack on the extreme left. The center phone tip jack is brought to the minus A lead. The G post on L2 is brought to the G post on the oscillator socket. The P post of L2 is brought to the G post on the radio frequency choke, C4L1. The P post on this choke is connected to the P post on the oscillator socket. This connection is made via a lug on top of the sub-panel. The B post on this choke is connected to a B plus post on the plug.

Oscillator Connections

The stationary plate post of C3 is brought to the G post of the oscillator socket. This connection is made through a hole drilled in the subpanel. The rotary plate post of this condenser is brought to the P post on the choke coil. You will find that you will have plenty of room between the panel and the subpanel to run this lead and the rotary plate connection of the other condenser. The tapped lead on this oscillator coil is brought to the plus A lead (not to the plug, but before the filament switch is connected to the A battery).

To conclude the first detector wiring, bring a lead from the stationary plate post of the General Radio 50 mmfd. microdenser to the other loop phone tip jack and to the stationary plate post of C2. This latter lead is made through a hole drilled in the subpanel. The rotary plate post of C2 is brought to the F post on L3. The rotary plate post of the microdenser is connected to the plate post on the first detector socket. It is also connected to the P post of the iron core transformer H210, through the lug on the top of subpanel, and to one terminal of a .0005 mfd. fixed condenser, C5. The other terminal of this condenser is brought to the minus A lead. These connections should hold the fixed condenser in place. You will note that the grid return for the first detector tube is made through the center tap on the loop. It may be well to remind you, therefore, that without the loop inserted, you will have an open grid circuit, and consequently receive no signals.

C Bias Leads

Connect a piece of wire to the F posts of all the intermediates and first audio transformer. Solder an eight-inch long flexible lead to this lead. Place a C minus cable marker on this lead. Run another eight-inch long flexible lead from the F minus post of the last audio transformer. Attach another C minus cable marker to this lead. Run a piece of wire to the B posts on all the intermediates and the second audio transformer. This lead in turn, should be brought to a B plus post on the plug. The B post on the first audio transformer should be connected to a separate B plus post on the plug. The G post on the first audio transformer is connected to the resistance post of the variable high resistance R5, and to the G post on the first audio socket and to a terminal of C9. The F post on this transformer is connected to the arm of this resistance. This post has already been connected to the minus C lead. The P post on the first detector tube socket is also connected to a terminal of C8. The other terminal of this condenser is connected to the minus A lead. The two 1 mfd. condensers are next tackled. One terminal of C6 is connected to one terminal of C7. This common connection is then brought to the minus A lead. The other terminal of C6 is brought to the B plus lead connected to the plates of the intermediates and first audio. The other terminal of C7 is connected to the minus C lead of the intermediates and detector.

There are only two remaining connections to make, these being on the output. One phone tip jack is connected to the plate of the last tube. The other phone tip jack is connected to the only remaining B plus post on the plug.

Tests to Make

Each and every connection should now be tested for continuity of circuit with a battery and phones, connected up in series. So as to be able to identify the proper B voltages to be placed on the plates of the tubes, procure some gummed paper and cut up into four small pieces, marking them 45, 67½, 90 and 135. Place the 45 on the oscillator lead, the 67½ on the second detector lead, the 90 on the intermediate frequency and the first detector lead, and the 135 on the last plate lead. The C bias for the intermediate frequency and second detector tube is 6 volts. This is obtained by connecting the minus 4½-volt post on one C battery to the minus three-volt post on the other battery. The minus 4½-volt post is then brought to the minus C lead. The C bias for the audio tube is 9 volts. This is easily obtained by connecting the batteries in series. This data is for —01A type tubes.

DRIVE AGAINST INTERFERENCE

Plattsburgh, N. Y.

The Plattsburgh Radio Association is now waging a campaign against all types of radio interference in and around the city.

WGY Clearing Decks For 500,000-Watt Tests

New 100 KW Tube, Seven and a Half Feet High, Used For First Time, Opens Up Super-Power Possibilities Broached Last Summer

For several weeks the high-powered transmitter of WGY, at Schnectady, N. Y., has been using a 100-kilowatt vacuum power tube. This marks the first practical use of a tube of this size by any broadcasting station. The tube, which takes the place of eight 20-kilowatt tubes in WGY's transmitter, is a development of the General Electric Company. Engineers are now obtaining data on its performance. With its water jacket the tube stands seven and one-half feet high and weighs 100 pounds, or one pound per kilowatt.

With such a tube available radio engineers of the General Electric Company will be able to carry on their investigations in broadcasting on higher powers than have heretofore been possible. Up to the present time 50 kilowatts in the antenna has been known as "superpower," but with tubes of an output of 100 kilowatts at hand investigations will be possible up to 500 kilowatts or even more.

Used for RF WORK

The 100-kilowatt tube is used by WGY as a radio amplifier fulfilling in the transmitter a use comparable with the radio frequency stages in most radio receivers. In the receiver a very weak, high frequency oscillation is picked up by the antenna. This excites the radio frequency amplifier tube which amplifies the power or signal. In the transmitter the output of one 20 kilowatt tube is amplified by the 100 kilowatt tube.

In the development of the 100 kilowatt tube the vacuum tube department and research laboratory engineers had to devise an entirely new structural design to provide necessary strength and durability. Outside of its water jacket the tube is five feet high and two-thirds of this height consists of the copper envelope, four inches in diameter. The envelope serves a double purpose, for it not only contains the elements of the tube but is, itself, the anode or plate of the tube.

Uses Heavy Cable

The upper third of the tube is made of glass through which the filament leads and the grid lead find insulated entrance. The glass bulb is twenty-two inches long and four inches in diameter and it is sealed to the spun out end of the anode cylinder of copper envelope by a machine process in such a way as to make the junction of glass and copper mechanically strong and vacuum tight.

Two copper cables of a size capable of carrying a current of several hundred amperes act as leads and are connected to tungsten rods which in turn pass through a pinch seal terminating as inner filament leads at the filament ends. Three lengths of tungsten wire, each roughly sixteen inches long, connect to each of the inner leads forming six parallel filament spans. These pass within the grid and meet at a common point at the filament spring suspension in the lower end of the tube.

The grid, within the copper envelope, is cylindrical and has an overall length of three feet five inches.

The grid frame is a most ingenious structure of molybdenum and tungsten. Bracing, such as is common in steel bridge and tower construction, is used in the design to provide maximum strength with a minimum of metal. Sufficient rigidity and strength are necessary in this construction to prevent short circuiting from swaying or sagging. A minimum of metal in the grid structure facilitates exhaust and minimizes the possibilities of gas evolution. The grid connection inside the tube is brought out through an arm part way up the high tension glass bushing to a flexible outside grid terminal.

The degree of vacuum within a vacuum tube is as important, in its way, as the steam pressure is to a steam boiler. The effects of relatively large pressure increases are as disastrous in a unit as large as the 100 kilowatt tube, as large pressure increases are in a steam boiler. To guard against failure due to large pressure increases in the tube, a pressure gauge or, more properly, an ionization gauge is used on the 100 kilowatt tube. This gauge takes the form of a special three element vacuum tube, in appearance much like an ordinary receiving tube. It is sealed to the large tube.

Uses Ionization Principle

Connections to filament, grid and plate are made from the pressure indicating device at the operating panel. This gauge operates on the principle of the ratio of ionization by collison with electrons, to the pressure or amount of gas present.

Uniform water flow around the anode of the tube is necessary to prevent unequal heating and for this purpose a new type of water jacket has been designed. This consists of an ordinary jacket with an inner flexible jacket to direct the water by the anode.

The tube is now being operated as plate modulated power amplifier on WGY where, due to the limitations of the circuit, the output is normally held at the comparatively low value of 50 kilowatts. Engineers are thus securing valuable operating data on the tube.

[The possibility of using 50 kw power was broached by WGY last Summer and the new tube opens the way on this.—Ed.]

SUPER STATION FOR MOTALA

Equipment for a super-broadcasting station at Motala, Sweden, has arrived. By the end of May it will be in operation.

Neutralizer Should Stop Signal in Test

Balancing Condenser in the New Universal Controls Self-Oscillation When Properly Set

Of the many ways suggested for controlling volume and regeneration in receivers, one which has met with a great deal of favor among set builders, is exemplified in the Universal four-tube receiver. The variable feature in question is condenser C4 which is connected between the antenna binding post and the plate of the first tube. When the capacity of this condenser is too large the signal stops entirely. The radio frequency energy from the antenna passes through the condenser and the primary coil L3 and a negligible amount passes through the antenna coil L1. This, of itself, would not completely stop signals since the detector tube picks up the energy and amplifies it by regeneration. What little energy goes into the first tube by way of L1 is amplified and this is sent through the condenser to the antenna and through coil L1. This is reamplified until the first tube oscillates. This stops the signal by choking the circuit.

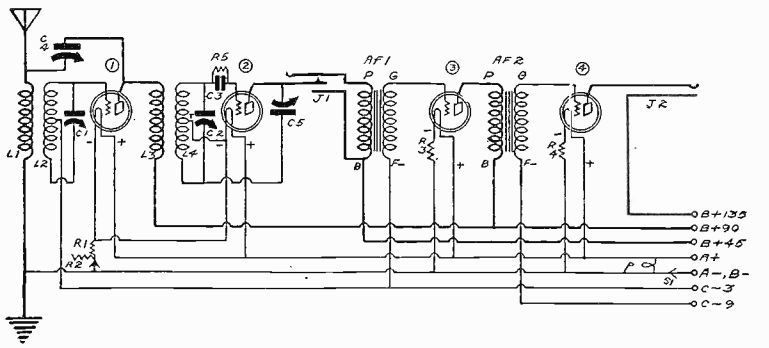


FIG. 1

The balancing of the new Universal is accomplished by C4, which must be at least 50 mmfd. The capacity should enable one to prevent reception, by using too much of it, then turning back for correct setting.

For certain combinations, the silence does not seem to be accompanied by oscillations. This apparently is due to a balancing effect between energy that passes through the condenser C4 to L3 directly from the antenna and that which arrives to L3 by way of L1 and the tube. When the current through C4 from the antenna and that from the tube are equal and opposite in phase, nothing passes through L3, and hence there is no signal. However, the volume can be controlled very simply and effectively by varying the capacity of C4.

The condenser should be of small capacity, not exceeding 50 micromicrofarads such as the General Radio type 368-B microdenser.

MAIL FROM FAR-OFF

One day's mail received by WGY contained letters from radio listeners in Tomsk, Siberia; Buenos Aires, Argentine; Akureyri, Iceland, and Fort Amador, Canal Zone. Each writer reported reception of WGY programs on the 32.77 meter wave of 2XAF, the developmental transmitter of the General Electric Company.

U.S. Opposes Meddling With Commercial Traffic

Formulates Proposals Asking World Radiotelegraph Convention to Avoid Code For Instructing Companies How to Run Their Business

Proposals formulated by the United States for the revision and modification of the International Radiotelegraph Convention and Regulations signed at London in 1912 are included in the agenda of the international convention to be held in Washington.

The American Government proposals suggest that the subjects of chief concern at the conference should be governmental protection of the public interest; secondly, they declare, there should be considered those questions which deal with economic and technical principles and methods of operation.

Under the first group are those subjects which concern sovereign governments as governments, and not as communication agencies, and which are therefore suitable for inclusion in a formal covenant between sovereign states.

Some of the Subjects

Such subjects deal with the Governments' concern for the protection of the public interest; for seeing that the public is accorded reasonable treatment; for preventing discrimination among users; secrecy of messages; avoidance of interference; the governments' obligation with respect to the safety of human life and to marine and aerial navigation; and related subjects. The provisions relating to these subjects are by their nature semi-permanent, modifications being necessary only to meet changes in government policy. They are subject to govermental or legislative enactment and must be such as to maintain the position of both the commercial and military interests of each country in its foreign relations.

The second class of subjects include those which deal with economic and technical principles and methods of operation, which are of concern to the managers of the service. They deal with such subjects as plant and traffic regulations; tariffs; operating procedure and routing; classes of traffic; technical application, etc.

Opposes Government Dictation

These are intimately associated with the development of the art and should be capable of being changed promptly in accordance with improved methods and economic conditions. They should be subject to decision by the active and responsible managers of the service and must be such as to maintain the rights of ownership and the benefits to be derived from the freedom of individual initiative

Attention is invited, in the proposals, to the fact that the United States has consistently found it necessary to abstain from adherence to the International Telegraph Convention because it is not disposed to impose the restrictions contained therein on its companies, nor to prescribe for its companies any detailed regulations not of direct concern to it as a sovereign government, particularly since no machinery exists to enable those companies to participate in the framing of such regulations, or to exercise their discretion as to whether they will adhere thereto.

Individual Enterprise

The United States therefore proposes a convention and regulations embodying only subjects which are in its opinion matters of direct concern to sovereign governments as such, and therefore suitable for inclusion in a formal international agreement among sovereign states. All other matters pertaining to the conduct of international communications, of vital concern to managements of communication services, but not directly to sovereign governments as such, are, by the terms of the proposal, left entirely to agreement among the interested managements.

Thrill of Distance Commended to Board

Lessee of WBBM in Letter to Radio Commission States That There Still Are Many DX Fans, Who Should Not Be Forgotten in Adjusting Conditions

C. B. Smith, president of the Stewart-Warner Speedometer Corporation, which also manufactures radio receivers and is lessee of WBBM, Chicago, in a letter to the Radio Commission, suggesting remedies for broadcasting conditions, incidentally remarked that the craving for distance still exists. He wrote:

We must classify the listeners as follows:

"(a) Those who are interested in programs.

"(b) Those who are interested in distance.

"That there are more of the latter class than is suspected is evidenced by the recent silent night controversy in Chicago, where an attempt has been made to determine the wishes of the listeners. The results were overwhelmingly in favor of the retention of silent night and the broadcasting stations themselves have recognized that fact.

"In consequence it appears to me that the Federal Radio Commission should keep in mind this thrill of distance. The statement may be made that it is not always possible for listeners to get distance because of static or other atmospheric conditions. This may have some truth behind it, but the fact remains that nearly every night persons in all parts of the country, who do not live in sections where there are numerous broadcasting stations, are able to bring in distant stations. In fact why would it not be a good plan for the members of the commission themselves to visit various parts of the country, including both the urban and suburban areas, and get some first hand information on reception?"

Stations Link 200 Cities for Yale Dinner

20,000,000, World Over, Expected to Hear Addresses by Taft and Others from Events in Scattered Locations

On Wednesday William Howard Taft, Chief Justice of the United States Supreme Court, will address the alumni of Yale University at the first Yale "Round-the-World Dinner." The dinner will be held simultaneously in nearly 200 cities in America and foreign countries and joined by a radio hook-up composed of eighteen stations. Chief Justice Taft will speak at the dinner in Washington, D. C.

Paris, London, Honolulu and Tokio are among the designated places of meeting for the "Round-the-World Dinner." In all, more than 30,000 Yale alumni have been invited, and the estimated audience for the broadcasting program is expected to reach 20,000,000.

7,000 at N. Y. Event

The largest number of alumni assembled at one place during the dinner will be at New York, where 7,000 are expected to attend. New Haven comes second with an attendance of 2,800.

Widespread interest in the $20,000,000 endowment campaign which will be begun on the day following the dinner is thought to be the cause of the "Round-the-World Dinner."

There will broadcast on the same program, but from other cities, speeches by Dr. James Rowland Angell, president of Yale University, and Dr. George E. Vincent, president of the Rockefeller Foundation, speaking from New York; Richard F. Grant, speaking from Cleveland; Harry B. Wallace, speaking from St. Louis, and Arthur Twining Hadley, ex-president of Yale University, speaking from Chicago. The Yale Glee Club will broadcast songs from New York.

List of Stations

The stations which will simultaneously broadcast the program are: WEAF, New York; WEEI, Boston; WCSH, Portland, Maine; WTAG, Worcester, Massachusetts; WJAR, Providence, R. I.; WTIC, Hartford, Conn.; WGY, Schenectady, N. Y.; WLIT, Philadelphia, Pa.; WRC, Washington, D. C.; WCAE, Pittsburgh, Pa.; WGR, Buffalo, N. Y.; WTAM, Cleveland, O.; WWJ, Detroit, Mich.; WSAI, Cincinnati, O.; WGN, Chicago, Ill.; WCCO, Minneapolis, Minn.; KSD, St. Louis, Mo.; WOC, Davenport Ia.

Foreign cities expect to pick up the programs on short waves of WGY's auxiliaries.

New Chain Planned to Compete with N. B. C.

A new chain of broadcasting stations extending through the East and mid-West will soon be inaugurated to compete with the National Broadcasting Company, according to Heber McDonald, representative of the A. H. Grebe Company, whose station WAHG, at Richmond Hill, N. Y., will be the Eastern end of the new chain. He declared that WHO, owned and operated by the Bankers Life Company at Des Moines, Iowa, would be the Western terminal.

"All the transmitters will be at least 5,000-watt equipments," declared Mr. McDonald. "I cannot announce at this time what other stations will be wired into the chain."

Stations Face Grouping As National or Local

Sixty-Four Channels and High Power For Leading Broadcasters, Twenty-Five Waves and 500 Watts For Rest, As in Council Plan, Pleases Board

MEANS SOME STATIONS MUST QUIT

Hearings Held by Commission Evoke Suggestions Like Those Adopted by Fourth Conference

By Thomas Stevenson

Washington.

One thing stood out above everything else during the hearings of the Federal Radio Commission on solutions of the broadcasting problem. It was the similarity of the testimony to that presented at the Fourth National Radio Conference held in Washington by Secretary Hoover in November, 1925.

Practically every witness before the hearings of the Commission presented views like those expressed when the industry was on a self-regulatory footing. The same faces were present, the same voices were heard, the same statements were uttered.

It recalls the recommendations of the Fourth National Radio Conference, which were unanimously adopted. It almost definitely points to the course which will be followed by the Commission in eliminating broadcasting interference. Incidentally, three of the Radio Commissioners were present at the Fourth National Radio Conference and voiced their approval of its recommendations.

Radio Leaders Present

The Fourth National Radio Conference urged limitation of stations; it recommended that broadcasting be confined to the band in use at present; it declared that any limitation of power would hamper full development of radio; it approved a 10-kilocycle separation between wavelengths or channels.

Some two hundred persons were crowded into the room in which the hearings were held. Among those present were Representative Wallace White, one of the authors of the radio law; Dr. J. H. Dellinger, chief of the Radio Laboratory of the Bureau of Standards; Chief Radio Supervisor W. D. Terrell; former Senator Lenroot of Wisconsin; C. Francis Jenkins, inventor; Senator "Jim" Watson, of Indiana; Acting Secretary of Commerce Stephen Davis and Paul Clapp, former assistant to Secretary Hoover.

During the hearings the Commissioners did not interrogate the witnesses. They paid close attention to the remarks of all.

Vice Chairman Eugene O. Sykes started the ball rolling. Without the customary rap of the gavel, Judge Sykes rose to his feet. There was an immediate hush in the room. In a quiet business-like voice, Judge Sykes explained the purpose of the hearings.

Reason for Hearings

"We called these hearings," said he, "in order that you men who have studied these problems may give us your views and ideas. We want them in order that we may profit from them in the performance of our duty."

Judge Sykes outlined the agenda of the hearings. First would be taken up the question of enlarging the broadcasting band, he said. "We want to know how many channels we will have with which to work first of all," said he.

Commissioner Henry A. Bellows presided during consideration of enlargement of the broadcasting band.

Frank Scott, formerly Representative from Michigan, and chairman of the House Merchant Marine and Fisheries Committee, which considered the White radio bill, was then introduced in the role of legal representative for the Radio Manufacturers Association and the National Association of Broadcasters. Mr. Scott acted as master of ceremonies in introducing speakers from those two organizations.

Opposes Band Change

Jack Binns, treasurer of the Hazeltine Corporation, pointed out that manufacturers and engineers thought it would be against the public interest to increase the broadcasting band. "To increase the band," he declared, "would be to cut down the efficiency of most receivers and at the same time increase their cost by at least 50 per cent." He asserted that most sets now in use could not be adjusted to take in new channels.

R. H. Langley, of the Crosley Radio Company, of Cincinnati, said if the band were widened it should be downward. "If we go up 50 meters," said he, "we gain only 5 channels. If we go down 50 meters we gain 50 channels." He said no listener, however, goes over the entire dial listening to all programs. "There are sufficient channels at present to satisfy listeners," he declared. "Listeners can already get enough stations to satisfy them."

He said that dealers who are stocked with receivers at present would not be able to move them if the band were enlarged because such action would tend to make present equipment obsolete.

Cost Would Increase

F. A. Kolster, of the Federal-Brandes Company, said that service to the public would not be materially increased by widening the broadcasting band. He declared the increased cost of receivers to the public would more than overbalance whatever advantages might be obtained. He thought engineers could design an instrument which would take in the additional channels, but at a much higher cost.

Dr. Alfred N. Goldsmith, of the National Broadcasting Association, declared his company would not object to the widening of the broadcasting band when it is proved that the additional frequencies will perform satisfactorily for broadcasting and at the same time will not seriously interfere with existing services. He recommended a flexible attitude on the part of the Commission.

K. B. Warner, secretary of the American Radio Relay League, declared that there are already adequate channels for broadcasting. He said the amateurs would be very reluctant to give up the band between 150 and 200 meters.

"The important thing," said he, "is to take care of broadcasting— not the broadcasters—and there are already sufficient channels for that purpose."

Taking up the discussion of power limitation, Commissioner O. H. Caldwell, of New York, pointed out that there are 733 American stations and 83 Canadians which must be taken care of. He said that if all stations were operated at very low power, it would be no problem at all to take care of them, because a number of stations could operate on the same wavelength without interfering with each other.

Almost all of the engineers present agreed that a certain amount of power is necessary to render reliable, satisfactory service for any considerable area. Alfred N. Goldsmith, chief engineer of the Radio Corporation, declared that the service range of a 500-watt station is around 10 miles and the service area of a 50,000-watt station is only about 100 miles.

"The history of radio is one of improved service," he declared. "The Commission should not take the 'radio golfers' into consideration in regulating broadcasting. I refer to the fellows who try to see how many miles they can get without caring how well the program comes in."

Classification of Stations

"It is necessary to have high power in order to override static and man-made interference if a dependable service is to be delivered day and night, Winter and Summer."

Presenting the views of the National Broadcasting Company, which he also represents, Dr. Goldsmith said:

"In the classification of stations for the purpose of power, it does not seem advisable to put limitations on the power of the station which aspires to give a wide and general service. The larger the audience, the greater the facility and ability of such stations to secure and furnish acceptable programs. It is therefore reasonable to conclude that, in classifying stations for power, definite limitations on those stations giving neighborhood service may well be made, while authorizing the use of power without specific limit by those stations desiring to furnish the largest possible audience with the best available programs of widest possible appeal.

"The Commission will perhaps find, when it comes to classify the stations for the purpose of assigning permissible power, that the two ends of the classification will cause it little difficulty; and it may therefore be disposed, when making its classification, to limit the power of the neighborhood station at one end and to impose no limitation on the large service-area station at the other end. The difficulty will be to draw the dividing line where these types of stations tend to merge. In our opinion, this division can be made on the basis of service to be rendered, judged in some measure at least by that which has been rendered in the past."

This is practically the same data as presented in the Council Plan, which pleased the Board.

A scheme of eliminating the interference caused by the second harmonic of a station was presented by Radio Supervisor E. A. Beane, of Chicago. Instead of assigning frequencies to stations in even tens, such as 610, 620, and 630, with a ten kilocycles separation between each, Beane suggested that they be assigned on fives, such as 615, 625 and 635.

He pointed out that the second harmonic of a station operating on 610 kilocycles would be on 1,220 kilocycles, where another station would be operating, thereby causing interference. If, however, the station operated on 615, the second harmonic would occur on 1,230 kilocycles, which would be at least 5 kilocycles from the nearest station, assuming stations were operating on 1,225 and 1,235 kilocycles.

Big Chain Broadcast Calls in 400 Engineers

Even Lesser Events Call for Much Planning and Rehearsing—Average N. B. C. Feature Requires Administration by Thirty Persons

By J. T. W. Martin

When a new program feature appears on the air, if it is well presented, there is nothing to indicate the preliminary work which has been necessary to prepare it for broadcasting. Still, no broadcast feature is a Topsy. None of them "just growed." Back of every one is a record of careful planning and development which, in the case of the average feature presented by the National Broadcasting Company, involves at least 30 people.

This figure, which includes members of six departments, varies within rather wide limits. Some features will require the services of only 20 persons, while others will involve several hundred. President Coolidge's address last Washington's Birthday, which was distributed for broadcasting from a nationwide special chain of 42 stations, required the services of 400 engineers alone, without considering the personnel of other departments which handled details of the arrangements.

Program features originating with the National Broadcasting Company fall into two main classifications—"sponsored" features put on the air under the auspices of commercial concerns for the purpose of building institutional goodwill, and "sustaining" features, including broadcasts by the various National Broadcasting Company "stock" companies, educational and religious periods and musical programs of all kinds from hotels, night clubs and prominent motion picture theatres.

Much Work in Planning

The life of a sponsored feature really begins, so far as the whole personnel of WEAF and WJZ are concerned, when a contract has been made between the company's commercial department and a commercial concern for the use of time on the air. Immediately the machinery of the program department of the station involved starts to function.

The contract itself may specify what entertainers are to broadcast during the time allotted to the new feature, and in this case the work of the program department is lessened. Usually, however, the commercial department, the new client, the station manager and the program department will combine to decide upon the artists, leaving the working out of the details to the program department.

The period of planning may involve almost any amount of work. The elusive idea must be pursued and captured and a definite scheme of entertainment mapped out. In some cases, three or four complete plans are made. Conferences are held among the program department, the commercial department and the sponsor and the type of entertainment is decided upon.

The time at which the feature will appear on the air must also be decided, a process which involves many considerations. The station management must balance its entire program for the evening and make sure that every feature attains as much prominence as possible. In other words, a whole evening's program should be varied if it is to be effective. Two periods of the same sort of entertainment should not follow each other or both of them will lose in effectiveness because of the fact.

When a plan has been approved work is begun on detailed programs. Artists are engaged, a process which may require auditions attended by representatives of the various departments and by the sponsor. A continuity is prepared for the opening program and an announcer is chosen for the feature. The artists are given the detailed program in order that they may start rehearsing. In short, a sample program is prepared for presentation.

Strive for Good-Will

In preparing the continuity, care is taken that the program shall merely create goodwill rather than describe the sponsor's products. The spoken portion of any sponsored feature should relate to the musical selections, if the entire program is to accomplish its object.

The detailed program is submitted to the department of musical and literary research in order that all copyrights on the various selections may be investigated. In some cases numbers are changed to comply with copyright restrictions.

When the sample program has been prepared it is assembled as a unit for rehearsal at the studio. This rehearsal is attended by a commercial department representative, a member of the program department and the sponsor. In instances which involve unusual pick-up problems a member of the operations and engineering department is also present to work out proper microphone placement and insure the best possible pick-up.

In the meantime three other activities have been begun, looking forward to the time when the feature will first be heard on the air. The traffic department has communicated with the various stations through which the sponsor desires his program to be heard and has arranged for telephone facilities to carry the program to these stations.

The clerical force of the program department has prepared program material on the feature and forwarded it to the publicity department, so that proper announcement of the coming feature may be made.

The rehearsal at the studio is criticized by those who attend it and any desired changes are made in the program. Other rehearsals will take place before the initial broadcast of the series goes on the air and rough spots in the presentation will be smoothed off.

Three Weeks' Notice

Shortly after the first rehearsal, however, the various departments which have helped to get the first program ready start to work on the second and third appearances of the feature. Detailed programs are made up and given to the artists three weeks in advance so that every detail of each presentation may be carefully worked out.

The final step in the presentation of the first program takes place when it goes on the air. The broadcast is listened to by the station manager or his representatives, for he is really the stage manager of the station.

In every case where contact occurs between various departments, printed forms are used to make sure that information is transmitted accurately. No details are left to memory or to oral agreement.

Once the first program has been broadcast a regular rehearsal schedule is maintained for further features in the series. Every broadcast must be rehearsed in the studio twice before it goes on the air, necessitating an elaborate schedule.

The general plan which is followed in the handling of sustaining features which originate in WEAF or WJZ's studio is much the same as the one outlined for the handling of sponsored features, with the exception of the parts played by the commercial department and by the sponsor.

There is also less detailed functioning of the machinery in most cases, since the National Grand Opera Company, the National Light Opera Company, the National Players and the other "stock" organizations which are heard from stations of the Red and Blue Networks are integral parts of the National Broadcasting Company itself.

Other sustaining features include those from remote points—banquets, music by hotel orchestras, political, social and sporting events of national importance. In putting these features on the air National Broadcasting Company engineers are concerned with the pick-up and as a rule the program department's part in the plans consists only in making sure that program material is forwarded to the publicity department.

One other main difference must be noted in the handling of sustaining features from the method used in putting sponsored features on the air. In the case of sponsored programs the sponsor decided what stations of the Red or Blue Networks he wishes to use, while sustaining programs are offered to all of the Network stations, and each decides for itself what features to broadcast.

Carnegie Institution Course Opens June 27

A course in radio communication is featured in the plans for the Summer session this year at the Carnegie Institute of Technology in Pittsburgh. The College of Industries will give a six weeks' course in radio communication from June 27 to August 5 under the direction of the Department of Electric Equipment and Construction.

Although the course is offered primarily for the benefit of teachers of industrial education, anyone is eligible to take the work. No special restrictions have been placed on a prospective student's educational training in order to enroll.

Included in the work of the course will be the study of elementary electricity covering magnetism, resistance, inductance, and capacity; methods of transmitting energy; properties of wave motion; theory of production and reception of electromagnetic waves; antennas, wavelength and measurements; transmission and reception of damped and undamped waves; vacuum tubes, operating characteristics, used as detectors, amplifiers, and oscillators; radio telephony, method of transmission and reception; practice in continental Morse code.

In addition to the radio course, the College of Industries will also feature courses in elementary electric wiring, advanced electric wiring, elementary principles of electricity and advanced electricity.

WGN Will Detail Chicago Ball Games

Baseball enthusiasts will be glad to hear that play-by-play descriptions of all the home games of the Chicago Cubs and the Chicago White Sox will be broadcast by WGN, direct from the Wrigley and Comiskey Parks.

This is the first year that any team in the American League has permitted the broadcasting of all its games. It also marks the first year that any radio station has offered such listeners daily broadcasts of the big league contests.

Quin Ryan, the premier announcer of this station, who was selected by Judge Landis as one of the official announcers for the 1925 World Series, and who also described the baseball games broadcast by WGN last year, will again be at the microphone.

"Graveyard" Channel Proposed for Unruly

All Stations That Contribute to Chaos Should Be Consigned to Wave Around 200 Meters, Furness Suggests

Washington.

Creation of a "graveyard" channel around 200 meters which would be dedicated to "chaos" and in which would be placed all broadcasting stations that would be otherwise eliminated was proposed to the Federal Radio Commission by G. C. Furness, of the National Carbon Company, makers of Eveready radio and flashlight batteries. Mr. Furness is the special announcer on Eveready programs over the WEAF chain.

After a discussion of the report of the Broadcasting Committee of the American Engineering Council, which proposed that 64 channels be assigned to super-power stations and 25 channels to low power local stations, the commission took up the question of station limitation. The subject was introduced by Commissioner Caldwell, who said that the testimony offered showed no solution of the broadcasting problem other than station limitation.

Summary by Caldwell

"For three days," said he, "the members of the Radio Commission have listened to your counsel with a great deal of interest and a great deal of appreciation. You have discussed these technical subjects from a great many angles. But you seem to lead to one conclusion—at least if we are to accept the ideas of you men who sit here in this room—and that conclusion is that the number of broadcasting stations has got to be cut down.

"For you have advised against widening the broadcast band so as to add any more channels, and you have expressed your advice on that subject absolutely and unanimously.

"You have advised very wide frequency separation between all stations that are near each other geographically, especially in cities.

"You have pointed out the importance of power in securing good service for the listener, and, of course, high power on any wave brings with it the tying up of a tremendous area of that wave, an area that is thousands of times the extent of the service area.

"And then you have in general advised against much dividing of time.

Only One Avenue Left

"You have thus defined the problem from all sides, from the listeners' standpoint in the requirement of good radio service.

"But if your advice is to be taken by the Commission on all these various points, you will see that you have cut down all avenues of escape for the solution of the present problem of 733 stations—except a reduction in the number of stations that may broadcast.

"Therefore, gentlemen, if your advice is to be followed on all the preceding points, what have you now to say to this question of cutting down the number of stations? Now how would you advise the commission to start going about doing it?"

L. W. Benedict, of Louisville, Ky., attacked stations which do not devote their entire time on Sunday to religious programs. C. E. Mason, of Philadelphia, charged that chain broadcasting is leading to a monopoly and that it cuts down the choice of listeners in selecting programs.

Furness said that if the plan of the American Engineering Council were adopted it would present a problem if any great number of super-power stations attempted to hook up for chain programs.

A good deal of laughter and joking characterized the discussion of station limitation One broadcaster brought forth a round of applause by informing the Commission that it was asking the broadcasters to offer suggestions as to how they might be loaded into a "hearse for a ride to the graveyard."

Frank W. Elliott, of WOC, Davenport, suggested that the stations be compelled to get together and work out the problem themselves. He suggested that a certain number of wavelengths be assigned to certain given areas and that the stations operating in that region at present be required to get together and decide how they are to be used.

Felix Offers Plan

A substitute plan for that offered by the American Engineering Council was presented by E. H. Felix, of "Radio Broadcast." Felix recommended that 11 channels be assigned for that number of super-power stations; 27 channels for 36 stations of 5,000 watts each; 19 channels for 60 stations of 500 watts each and 30 channels for 330 stations of 50 watts each.

The substitute proposal stirred up quite a lot of comment on what constitutes the real service area of broadcasting stations. Dr. J. H. Dellinger, of the Radio Laboratory of the Bureau of Standards, said the real service area of a station is that region which it can serve, night and day, Winter and Summer, regardless of static or other kinds of interference.

Commissioners Incline To the Council's Plan

Washington.

Members of the Commission expressed the opinion that a remedy for interference offered by the Committee on Radio Broadcasting of the American Engineering Council is the best yet proposed. The plan was incorporated in a report to the Commission and is the finding of a committee of some of the most prominent radio engineers of the country who made a special study of the broadcasting problem.

Under the plan presented wavelengths would be divided into two classifications—national and local. Sixty-four channels would be assigned to national stations and twenty-five to local. National stations would be permitted to operate with unlimited power; local stations would be limited to 500 watts power.

Such a scheme would enable the Commission to license 64 super-power stations and 300 local stations for simultaneous operation in the entire broadcasting band. Division of time or limitation of the power of local stations below 500 watts would permit the Commission to license additional stations. But the Engineering Council did not recommend such a course.

Commissioners Caldwell, Bellows, Dillon and Sykes say the plan is practical and would undoubtedly result in a high order of service. Their only objection to it was that it would not permit all existing stations to be licensed.

The report was prepared by the following engineers: Calvert Townley, of the Westinghouse Electric and Manufacturing Co.; Dr. Dellinger; Dr. Goldsmith; Prof. C. Moreau Jansky, Jr., of the University of Minnesota; R. S. McBride, consulting engineer; David Sarnoff, vice-president of the Radio Corp. of America; A. Atwater Kent, of the Atwater Kent Radio Mfg. Co.; Melville Eastham, of the General Radio Company, and Ray Manson, of the Stromberg-Carlson Radio Co.

Comment among broadcasters who have examined the plan indicates that they would not object to its adoption. A warning was sounded by the Commission that if anybody did not approve of the plan, he had better make known his objections or take the consequences.

FAVORS STATION CUT

(Underwood & Underwood)

DR. ALFRED N. GOLDSMITH, chief broadcast engineer of the Radio Corporation of America, and member of the radio committee of the American Engineering Council, who signed the report submitted to the Federal Radio Commission requesting that the present 733 broadcasting stations be reduced to 364. Under this plan there would be 64 national local stations and 300 locals.

Mrs. Coolidge Wants Better DX Conditions

Washington.

Mrs. Calvin Coolidge hopes the Radio Commissioners soon will be able to straighten out the broadcasting tangle. The wife of the President is a distance fan and she has been having trouble getting out-of-town stations because of interference.

When the Commissioners called on the president, Mr. Coolidge told them that Mrs. Coolidge would follow their activities with great interest. It is said that Mrs. Coolidge has no advance views as to the solution of the problem.

Coating on Studio Walls Improves Tone Quality

Ceilings Are Treated Also With Absorptive Surfacing, to Get Rid of the Echo Effect Without Making the Place Stuffy

To the average radio fan, sitting in his cozy home "listening-in," the programs that are projected through the ether and into his receiving set are just take-it-for-granted entertainment. Seldom does he consider that these same programs to which he may listen indifferently or with genuine pleasure—according to his individual taste—have utilized the scientific skill of engineers and other radio experts who are steadily experimenting to perfect the art of broadcasting.

One of the phases of broadcasting that is little appreciated by the listener-in is the acoustical arrangement of the studios. In radio construction it is always necessary to have the surfaces of the room highly absorptive to sound so as to eliminate to a great extent echo or reverberation, as it is technically called. If this were not done the music would have a "tin-panny" effect that is noticeable when broadcasting from large empty auditoriums and one note would be sustained so long by the various echoes that it would over-ride several succeeding notes and the music would run together.

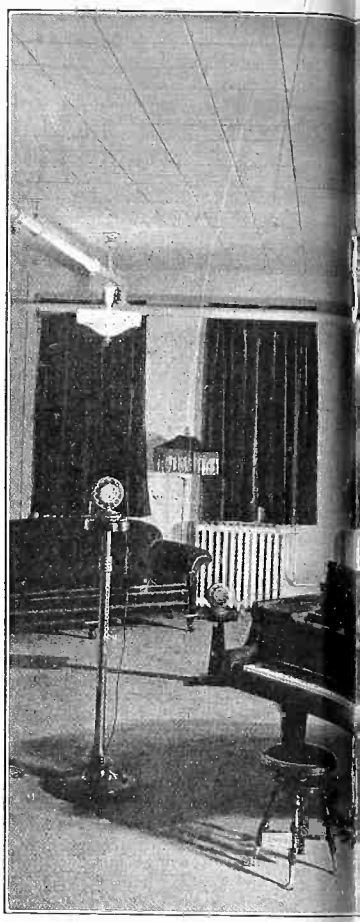
When broadcasting was in its infancy studios were designed to have as much sound absorption as it was possible to obtain. To do this it was necessary to employ heavy velvet draperies hung completely over the walls and ceiling. This method had two great drawbacks. First, the absorption of sound was so great that all the music reproduced sounded dead and lifeless, lacking that richness and resonance that we so much desire. Secondly, the studio was to close and oppressive that the artists could not do their best.

The broadcasting stations of today are getting away from this unfortunate condition. They are using draperies much more sparingly, while some of the newer stations have eliminated them entirely for acoustical correction. WBAL, Baltimore's super-power station, uses wall surfacing material of the proper sound absorptive value, obtaining just the proper balance to give pleasing resonance of tone with the entire elimination of draperies.

The material used on the walls of the studios at WBAL has an absorption value of about 30 per cent and is arranged in pleasing panel form, while that on the ceilings averages about 55 per cent, the higher absorption being obtained by the many fine perforations in this material. These surfaces, together with the thick, soft carpet on the floor, give the proper balance to bring out the full resonance and life of an orchestra and at the same time to tone down somewhat the brilliant staccato notes of a piano so that the sound will not seem to be coming from an empty barrel.

Careful consideration was also given by the engineers of this station to the selection of a material that would have equal sound absorption at all voice frequencies. Some materials used have a property of absorbing a greater percentage of high frequencies than low frequencies, so that in the reproduction by the microphone the original tone blending is lost.

The problem of accurate acoustical reproduction is very intricate and interesting. Much progress is being made through experimental work being done continually by broadcasting stations to improve their transmission.



THE STUDIO of WBAL. Note the t draperies are entirely eliminated. Reverb

Tenor Canary In Trim, Sings After Accident

Pete Van Curler, of WGY, Recovers from Attack By Cat and Performs Shrilly Before Microphone With Orchestra

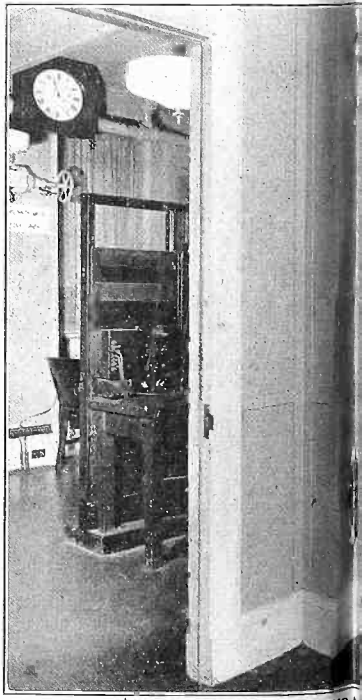
Pete VanCurler, feathered soloist of WGY, is back on the air.

The temperamental tenor canary, persuaded by the call of Spring, has broken months of silence and last week sang a trilling obligato to the jazz offerings of the Hotel VanCurler orchestra.

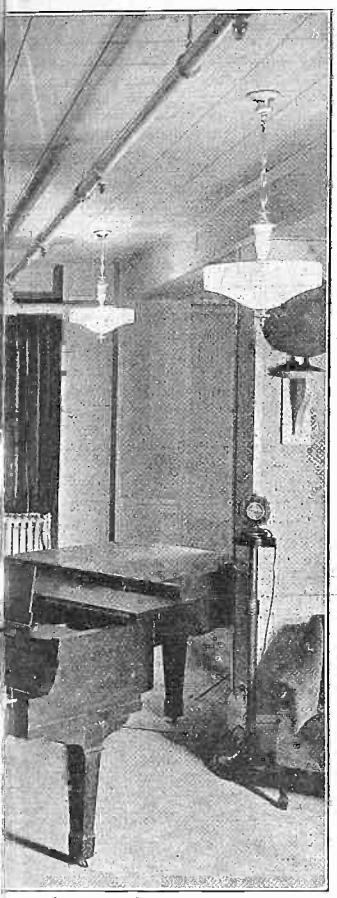
Peter was formerly one of the most popular afternoon entertainers of the Schenectady station. Then one evening a tramp cat made a murderous attack on Pete, tumbled the cage from its pedestal, and before anyone could interfere had cuffed Pete with a clawed paw.

For several days the canary was close to passing out but gradually he regained interest in food, but was silent, morose and highly nervous. Everyone about the hotel tried to encourage him to sing but he only blinked his remaining eye, shrugged his feathers and gave an occasional "peep peep."

A second canary, christened Paddy, was given cage room in the solarium and filled the place with melody. Pete began at once to perk up and in a few days was outsinging Paddy. The next problem was to get Pete to sing before an open microphone, and that was another story. For several weeks L. J. Barnes, WGY's dance announcer, has been trying to get Pete to sing while the orchestra was on the air. Both cages were brought close to the microphone, but only Paddy would sing. Last week Mr. Barnes put Paddys cage in the rear of the room. Apparently this arrangement suited Pete, for he began to sing with the first announcement and was peeping saucily at the sign-of.



THE ANNOUNCER'S BOOTH at WBA treated with ab



ent of the ceiling. Wall and ceiling
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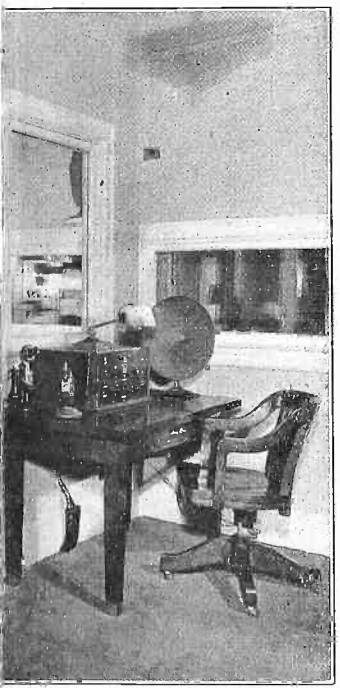


here the walls and ceiling are specially
ive surfacing.

Jazz Defeat Is Complete; Better Music Demanded

One Poll Shows Only 5 Per Cent. Want "Blues" Type and Other Tallies Confirm Fact Radio Elevated Public Taste

By Maxwell Alper

Jazz music, so far as the American radio audience is concerned, is a poor second indeed. At one time completely overwhelmed by the wailings and ululations of "blues" songs, the listeners now show a marked preference for a higher class of music.

Frank A. Arnold, a director of the National Broadcasting Company, said that a comparison of questionnaires sent out three years ago with some sent out recently prove that opera and other classical compositions have ascended to the heights of public acclaim. Mr. Arnold said that 75 per cent. of those who answered the questionnaire three years ago voted for jazz, while only 5 per cent. expressed a desire for it in answers to recent questionnaires.

"Independent of all things that appeal to the masses, we have the reaction of the individual," declared Mr. Arnold. "Truth is being spread. No program is accepted unless it educates, elevates, stimulates, or, taken all in all, is worth while."

Confirmed by Crosley

Powel Crosley, Jr., has also found that the radio public likes classical music. Responses to five Sunday afternoon chain concerts, in which only classical music was rendered, and which concerts Mr. Crosley had sponsored, proved that to him. As a result he will continue to broadcast such programs, featuring mostly the Crosley Moscow Art Orchestra.

This change on the part of American music tastes has been gradual. The turn was called several months ago. The complete change is obvious now.

Love for music, or a certain type of music, is inherent in the person. He may educate his taste in music, thus getting pleasure from only the finer things in it, but it is a far cry from jazz to classical compositions, and the jump in three years denotes a higher education in music has been achieved. A point worth mentioning is that similarity helped defeat jazz.

Radio played the major part in the development of the musical ear of the American people. Orchestras, the kind that can play and bring out all the beauty in a classical composition, cost a great deal of money. The men that compose them are fine musicians and demand large remuneration. And as it takes time to perfect the organization of a large orchestra, the expense of assembling them and of rehearsing them reaches great heights.

Need Endowments

To such an extent do these expenses go, that it has been found, with one or two exceptions, that to manage such an orchestra profitably is almost impossible. In almost all cases such orchestras are kept alive by wealthy persons interested in giving to the public the beauty that music holds for them. But the number of willing millionaires is limited, and hence there have not been nearly enough of philharmonic orchestras to make the rounds of the country. It was radio that made the nation-wide "tour" possible. A single appearance of a philharmonic orchestra is now eagerly awaited by the multitudes of radio listeners, and to the radio, no doubt, must be ascribed the sudden popularity of classical music.

The typical American's favorite musical composer, after Beethoven, the hundredth anniversary of whose death was recently celebrated, is Richard Wagner, and after Wagner, Johann Sebastian Bach. As for the Italian opera composers whose names were once conjured with—Rossini, Mascagni, Leoncavello, and Puccini—these are shown by American taste to be already demoted. On the other hand, Grieg, Liszt, Dvorak, and Mac Dowell, who help out in movie accompaniments, are on the margin.

Percentage of Preference

A ballot on the ten musical composers whose works would comprise an ideal five-foot shelf of the world's greatest music was completed recently by the Columbia Phonograph Company. Living composers were excluded from the ballot.

A list of composers was sent to leaders in the fields of music, art, civics, religion, and finance, and through newspaper publication, and by canvass of the ballot, thousands of votes from the general public were received. One of the results shown is that occupation has a decided influence upon musical taste. The votes of men and women were first counted according to their occupational fields. Marked variations in musical preferences were found.

The total vote of favorites of persons of all fields, and giving the percentage voting for each composer, is as follows: First ten: Beethoven, 100; Wagner, 90; Bach, 87; Mozart, 82; Brahms, 78; Schubert, 76; Chopin, 75; Tchaikowsky, 62; Handel, 56; Schumann, 42. Second ten: Mendelssohn, 47; Haydn, 38; Liszt, 32; Verdi, 27; Debussy, 26; Grieg, 26; Palestrin, 22; Franck, 20; Dvorak, 18; Mac Dowell, 16. The last dozen almost all names of which once were believed to be popular favorites are: Puccini, 15; Strauss, 12; Saint-Saens, 9; Weber, 7; Rimsky-Korsakoff, 7; Gluck, 4; Moussorgsky, 4; Massenet, 3; Rossini, 2; Berlioz, 2; Mascagni, 1; and Leoncavello, 1.

Public at Large is Tolerant

Among the first ten, Wagner received a 100% vote from all except educators and the general public. Bach was refused 100% by artists and educators. Only one group, the religious leaders, voted 100% to Handel, whose lowest, 25%, was given by the civic class. Chopin was the subject of the greatest contention, religious readers and financiers favoring him unanimously, musicians and artists, however, according him votes of respectively 46% and 57%.

Dry Charger Developed; Uses Patented Metal

Kuprox, Marketed by Kodel, Eliminates Electrolytes and Bulbs For Rectification—Bright Future Pictured

Cincinnati.

A single, reddish, unassuming disc of metal, smaller than a half-dollar, developed by a group of Cincinnati scientists, known as "Kuprox," is designed to replace the electrolytic, bulb and vibrating types of battery chargers. The electrolytic jar containing acid or other liquid, and the familiar glass rectifying tube, are replaced by a piece of solid, bright, durable metal.

Kuprox, as made up for such use, occupies a space less than that of a half-dollar, doing what the electrolytic, vibrating or bulb-type changers and eliminators did.

Much Secrecy Maintained

The scientist who discovered the underlying principles of Kuprox metal did so while doing intensive research work upon the atomic structure of certain elements, with a view of eventually releasing the enormous store of energy contained within the atoms of all matter. Dealing with particles which occupy less space than the head of an ordinary pin, this scientist discovered means of rearranging the atomic structure of a given metal, so as to give it entirely new properties among which is that of permitting an electric current to pass in only one direction.

A few small discs of such metal were presented to Clarence E. Ogden, president of the Kodel Radio Corporation, who obtained for this company the exclusive patent rights as applied to battery charging and radio use.

One of the main office suites of the Kodel factory was converted into a special laboratory and immense furnaces and necessary laboratory equipment were installed—as were private detectives from a nationally known detective agency, detailed to admit only the inventor and his assistants, and in addition, Prof. S. J. M. Allen, Ph.D., of the College of Engineering, University of Cincinnati, who was called upon to supervise the final details.

Kuprox Explained

Mr. Ogden said that Kuprox, during the next decade, would revolutionize certain electrical theories, which up until now were accepted as positive. Ogden said:

"Using temperatures far beyond those at which all known metals vaporize and become as steam, and condensing these particles suddenly within an intense magnetic field, workers in the Kodel laboratories have been able to reconstruct the atomic structure of the vaporized metal so that its atoms instead of being massed heterogeneously are arranged systematically, giving the metal entirely different characteristics than it possessed before, among which is the characteristic of permitting electric current to pass in but one direction.

"All matter is made up of minute particles, called atoms, which in turn consist of still further minute units, termed electrons and protons, the electrons being negatively charged particles of electricity and the protons the corresponding positively charged units. The laws of electrical conductance have been reduced to mathematical exactness and it has been proven beyond question that the transmission of electric current through a solid is accomplished by the migration of electrons among the atoms composing such material.

"The relative conductance of different materials depends solely upon the arrangement of the atomic structure. Metals such as copper, iron, etc., which conduct fairly well, have their atoms arranged so as to permit the free transfer of electrons from atom to atom, whereas in those materials called non-conductors, such as hard rubber, etc., this transfer of electrons cannot take place freely.

"The dream of scientists for ages has been to discover means whereby not only could they rearrange the atomic structure of a given material, thereby changing its entire physical qualities, but to separate the atoms, thereby releasing the enormous store of energy contained therein.

"It is but another step from the comparatively small battery charging and eliminator rectifiers now ready for the market to larger Kuprox units that will replace entire electrical sub-stations, permit the operation of interurban cars directly from high-tension alternating current lines, reduce the cost of electric current and power by eliminating practically all transmission losses, etc. Intensive research along these lines is being conducted day and night by the corps of Kodel engineers and scientists, and announcement of the first importance will be forthcoming at a very early date.

Work Among the Atoms

"While the atomic structure of almost any metal can be rearranged by the Kodel process so as to give it unilateral conductivity, copper has been selected for Kuprox rectifiers because of its extremely low resistance and its high heat dissipating qualities. To facilitate assembly and provide the greatest heat dissipating area, copper discs approximately 1½ inches square are first stamped from the pure metal, these being subjected to the special Kodel process, after which they are assembled in units.

"These units offer an extremely low resistance to an electric current in one direction, but present an almost perfect barrier to current flowing the opposite way. When connected in an alternating current circuit they maintain a given polarity at their outermost terminal, thereby delivering a pure direct current from an alternating supply. By using various numbers of units in series, in parallel, or both, almost any conceivable voltage or current can be obtained making Kuprox units ideal for every engineering service.

"Unlike other forms of rectifiers dependent for their action upon mechanical, chemical or ionic action, Kuprox units do not deteriorate with use, and therefore, last indefinitely. Consisting of heavy metal discs solidly bolted together, they contain nothing that will break, get out of order or fall apart and provide a construction almost as substantial as a solid piece of metal itself."

FOREST TALK APRIL 22

College Point, Tex.

Special talks on observance of American Forest Week will be broadcast by WTAW, the Agricultural and Mechanical College of Texas station, during the week of April 22. Many prominent authorities on forestry topics will be present.

Polyglot Mail Puts Board in Quandary

Washington.

Listeners are asked by the Radio Commission to go a little easy in their letters for the time being, at least. The Commission wants to hear from anybody on the broadcasting situation, but it cannot act as an information bureau.

Since the talk of Vice-Chairman Sykes over the radio the Commission has been swamped with mail. The bulk of the letters is complaints about particular stations.

A number of listeners have asked the Commission to help them identify distant stations which were picked up.

A few listeners are complaining to the Commission because stations do not announce their calls often enough.

Some listeners complain because stations are not quick enough in verifying reception.

One listener sent in ten cents for a verification stamp of a far-Western station.

Some of the mail gives evidence that stations are asking their listeners to write to the Commission indorsing them.

Many letters, however, discuss the broadcasting situation and give the views of their authors as to the proper solution. According to Commissioner Dillon, the letters indicate that the public has given a lot of thought to the matter.

Sam Pickard, secretary of the Commission, says that if the mail continues to increase a large force of clerks will be necessary to open it.

On the other hand, the Commission wants to receive the views of listeners concerning a method of reducing interference.

Listeners' Musical Tastes Put to a Test

Chicago.

As an invisible jury, listenrs of WBBM had an opportunity to test their musical taste.

The station broadcast the voice recital of advanced students of the Bush conservatory of music. The recital was presented to select a singer to appear with the Bush conservatory symphony orchestra, which will be directed in concert by Richard Czerwonky on May 26. Judges of the contest gave their decisions before the microphone so that the radio audience might compare its judgment and preferences with those of professional musicians.

Each student artist presented either an aria from a grand opera or from an oratorio, or a song with orchestral accompaniment. Tests to select a pianist and violinist to appear with the symphony orchestra were held on April 7 and 8 but were not broadcast due to conflicts in the WBBM program.

The voice recital was put on the air by remote control direct from the Bush recital hall, where WBBM wires have been permanently installed.

N. B. C. West Chain Makes Fine Start

The opening program of the newly formed Pacific Coast Division of the National Broadcasting Company was broadcast from the Colonial Ballroom of the St. Francis Hotel, in San Francisco.

George F. McClelland, vice-president and general manager of the company, made elaborate plans to make this inaugural program the finest presentation ever broadcast to listeners-in on the Pacific Coast and throughout the Northwest. The stations in the chain are: KGO, Oakland; KPO, San Francisco; KFI, Los Angeles; KGW, Portland, Ore.; KOMO and KFOA, Seattle, Wash., and KHQ, Spokane, Wash.

New Rectifier Tube Depends on Rare Gases

Several Times as Large in Size as Familiar Type of Valves, It Passes 350 ma. at 200 v.—Will Be Used in New Receiver Model

A special rectifier tube, many times larger than any ordinarily used in radio, has been developed by the Freed-Eisemann Radio Corporation and is used in their new socket power set. President Joseph D. R. Freed said, in explaining the operation:

"The household current of 110 volts is taken from the light socket by simply plugging in and is sent through a transformer from which it goes to the device which steps it up to 157 volts. It must be remembered that the current on leaving this device is still alternating.

"The next operation is when the AC reaches the new tube. This tube is several times larger than any other in use and contains rare gases which play an all-important part. It has a current and voltage rating 350 milliamperes at 200 volts direct current output from the filter circuit. Its greatest allowable AC input voltage per anode is 350 volts.

Lasts About a Year

"Long life is one of the important characteristics of the tube. Intensive tests show that it will have a useful life of at least one year at the rate of not less than three hours use for every day in the year. Under ordinary conditions no receiving set is used every day and this means that the tube will have a life for in excess of 365 days.

"The house current enters the tube and emerges from it as direct current. This current we call rectified direct current, but it is not entirely pure. It contains ripples and these have to be eliminated before it becomes true direct current. This is done in the filter reached by the current as the next step. After filtration the current is straight DC and it then becomes the supply for the A, B and C requirements of the set. For the B and C requirements it is a high-voltage current of from 22 to 157 volts. For the A requirement it passes through a resistor which cuts down the voltage until it meets the filament need.

Through Four Operations

"In this way the ordinary household current passes through four operations before it takes the place of B and C batteries and through five changes before it is ready to substitute for the A battery. None of the devices is conspicuous in size and all operate automatically. To the casual observer there is no change in the design of the set except the large tube.

"There are no other changes in the tubes used in the electrical sets. They use the regular standard 301-A or 201-A type and power tubes. It is important to note that contrary to previous attempts at electrification no dry-cell tubes are used in any part of our electrical set."

The receiver is proving very popular.

Sets Put in Taxicabs Help to Boom Business

Users of Vehicles in New Zealand Respond Enthusiastically to Enterprise of the Operator—How Aerial Problem Was Solved

New Zealand is the scene of a serious undertaking to equip every taxicab in the country with a radio receiving outfit. The details of the venture are related in a letter from The National Electrical and Engineering Co., Ltd., of Wellington, to Fada Radio, of New York City.

The Blue Cab Co. started in business in Wellington. The National Electrical and Engineering Co. fitted the fleet of taxicabs of this concern with equipment using a "three-tube set mounted on a bracket at the back of the driver's seat." A cone speaker was mounted on the top of the receiver.

These were the first cabs in New Zealand to be so fitted and it is reported that "this stunt has put the taxicab company on the map properly and has gained for them a tremendous amount of business." A great deal of publicity was the result of the installations.

How Aerial Was Mounted

D. G. Wyles, manager of the installing company, reported that "we have used for an aerial a zinc sheet mounted on insulators following the practice adopted by the Daimler company in their cabs in London. We have since found that a half dozen lengths of ordinary flexible wire wound round the inside of the cab are quite satisfactory, providing the roof of the cab is not metal."

So successful was the original undertaking that business was sought in four of the larger cities of New Zealand, where local broadcasting conditions warranted making installations in taxicabs.

Some Technical Troubles

This matter also opened up a general discussion of installation of radios in motor boats and automobiles. Inquiry has been made on the question of elimination of noises from the electrical system of the car while it is running.

The explanation is made that no difficulty is encountered from magneto noises as a small choke pulls these out but where a Delco system is in operation the engineers have been unable satisfactorily to overcome noises unless a separate A battery is used. It also entails making a ground connection to the chassis of the car, whereas by using the car battery for the filament no separate connection is necessary for the ground terminal of the receiver. This latter system provided better reception.

Announcers Fined For Any Long Pauses

Cincinnati.

When the poet said "they also serve who only stand and wait" he wasn't thinking about announcers who let thirty seconds or more pass between numbers. That subject was handled by the poet who said "O Death, where is thy sting?"

At WLW, the longest normal pause between the conclusion of a number and the beginning of an announcement is three seconds. Sometimes a group of circumstances extends the silent period of five seconds, but that is the absolute deadline.

Remote control broadcasts naturally are exceptions. When a number is being broadcast from a distant place conditions enter into the situation that can't be handled by the studio director.

But when the microphone in the Crosley stations studio is silent between numbers Fred Smith, director of the studio, looks angry.

Although WLW always has observed the highest degree of watchfulness to prevent pauses exceeding three seconds, Smith has gone even farther. He has installed a box, bearing the slogan. "Money Talks if the Mike Doesn't". Into this box the guilty announcer must drop one dollar every time the pause between numbers exceeds five seconds. This wasn't an arbitrary measure. The announcers themselves thought it was a good idea.

"Program Weekly" Gernsback's Latest

A new magazine, called "Radio Program Weekly," the purpose of which is to effect a closer connection between broadcast stations and the listening public, has made its attractive appearance on the newsstands. Hugo Gernsback is the editor.

The magazine, a non-technical radio publication, will concern itself only with broadcast activities, programs, intimate gossip about artists and radio fiction and will circulate only in the New York metropolitan district.

It is felt that this new weekly will satisfy the demand of radio listeners for a complete program service.

"Radio Program Weekly" is sponsored by the Experimenter Publishing Company, Inc., 230 Fifth Avenue, New York City, publishers of "Radio News," "Science and Invention," "Radio Listeners' Guide," "Amazing Stories," "Spare-time Money Making" and "Radio Internacional."

Station Is Erected To Fill Dead Spot

Montreal.

To fill up a dead spot in the vicinity of Quebec City the Radio Department of the Canadian National Railways recently opened up a powerful broadcasting station, CNRQ, Quebec. The station operates on a wavelength of 340.7 meters. This is the eleventh of the chain of stations to be organized by the Canadian National Railways, from one end of the Dominion to the other.

In all broadcasts the station will be connected either by telegraph or telephone wire to the studios of CNRM at Montreal and CNRO at Ottawa. On some occasions CNRT, at Toronto, will be hooked in. In this way it is hoped that all the dead spots that exist within the vicinity of these stations will be killed.

Reports are coming in from all parts of the Dominion, complimenting the engineers of CNRQ on the excellent quality and great volume of the station. The dead spots are also being covered.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address Radio University, RADIO WORLD, 145 West 45th ST., New York City.

When writing for information give your Radio University subscription number

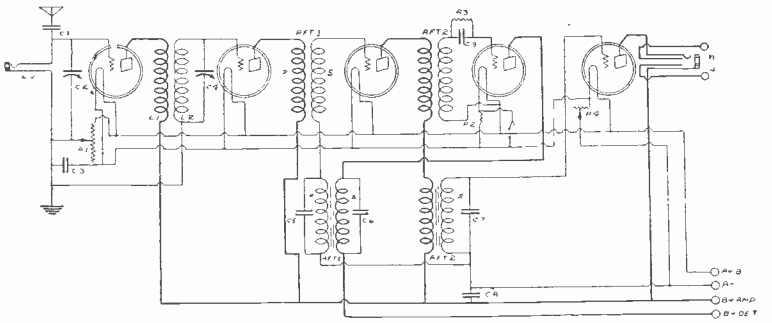


FIG. 528

The circuit diagram of the five-tube receiver requested by Frank Montana.

I HAVE a seven by twenty-four inch cabinet, two three-to-one ratio audio frequency transformers, two .0005 mfd. variable condensers, two untuned radio-frequency transformers (marked 200 to 600 meters), a six-ohm rheostat, a 400-ohm potentiometer, a single and a double circuit jack and five X type sockets. I would like to have the circuit diagram of a five-tube receiver using these parts, with provision for a loop.

(2) Please state how many turns are to be wound to make the coils, for use with the .0005 mfd. variable condensers.

(3) The constants of any other necessary parts would also be appreciated. Please give any other general information.

(4) Could you show how this receiver would appear in the cabinet, with all the parts mounted?—Frank Montana, Los Angeles, Cal.

(1) The circuit diagram of a receiver using these parts is shown in Fig. 528. You will note that is a reflex, the third radio frequency stage being the reflexed one. The untuned radio frequency transformers are used in this stage as well as the detector stage. One audio frequency transformer is used in the reflexing stage, while the other is used as a straight stage of audio frequency amplification.

(2) Only one coil is to be wound. This is L1L2. L1 is the primary and consists of ten turns. L2 is the secondary, which consists of forty-five turns. Both these windings are placed on a tubing three inches in diameter, utilizing No. 24 double cotton covered wire. A space of one-quarter inch should be allowed between these two windings. The beginning and the end of the windings should be marked with pieces of paper for simplifying the wiring.

(3) C2 and C4 are the .0005 mfd. variable condensers, C2 being shunted across the loop and C4 across the secondary of the tuned radio frequency transformer. C1 is a .00025 mfd. fixed condenser. C3 is a .0005 mfd. fixed condenser. C5, C6 and C7 are .0005 mfd. fixed condensers also. The six-ohm rheostat is used to control the filaments of all the tubes. So that you may use a 12 type tube as detector a ¼ ampere ballast resistor is inserted in series with the filament, but may be short-circuited out for the higher filament voltage tubes. Across this ballast a filament switch is inserted. The grid leak has a resistance of two megohms, while the grid condenser has a capacity of .00025 mfd. LJ is the loop jack. The double circuit jack is used in the last audio output. Across the inner terminals of this jack binding posts are connected. These posts are permanently connected to the speaker. The jack is used for the insertion of the phones to tune in. As soon as the station has been tuned in with the phones the plug can be pulled out and the speaker is automatically connected to the output. The antenna and ground, as shown, are not permanently connected to the set. They may be used to strengthen the signals. For best results, when using the antenna and ground, another coil is, of course, necessary. This coil should have a primary winding of ten turns and a secondary winding of forty-five turns, both wound on three-inch diameter tubing using No. 24 double cotton covered wire. The primary should be inserted in series with the antenna, while the secondary should be shunted across the variable condenser. A double circuit jack may be used here to enable you to switch from the antenna to the loop. The beginning of the primary winding should then be brought to the antenna post. The end should be brought to the ground. The beginning of the secondary winding should be brought to the third terminal from the top of the jack. The other inner terminal of the jack is brought to the end of the winding. The bottom terminal of the jack is brought to the rotary plate post of the variable condenser. The top terminal of the jack is brought to the stationary plate post of the variable condenser. The antenna series condenser may be dispensed with when installing the antenna and ground in this manner. The condenser across the A minus and the B plus detector has a capacity of 1 mfd.

(4) Fig. 529 illustrates how the completed receiver should appear when inserted in a cabinet. The jacks (not the output jack), phone posts and battery posts are all inserted in the rear of the cabinet. The two large dials control the variable condensers. Next to the left hand dial is the filament rheostat. The potentiometer follows. In the right hand corner the phone jack is inserted. In the left hand corner the filament switch in the detector filament circuit is placed. The —01A tubes should be used throughout the receiver for best results. The detector plate voltage is forty-five. The amplifier voltage is ninety.

* * *

I HAVE a three-tube receiver, using a three circuit tuner in the regenerative detector circuit and two stages of transformer coupled audio frequency amplification. The primary of the coil is wound on a three inch diameter tubing using No. 22 double cotton covered wire. It consists of fifteen turns. The secondary is wound on the same tubing with the same wire and consists of forty-five turns. No space exists between the two windings. The tickler is wound on a one and three-quarter inch diameter tubing, using No. 26 single silk covered wire. It consists of thirty-five turns. A .0005 mfd. variable condenser is shunted across the secondary winding. The —01A tubes are used in the detector and audio stages. Three to one ratio transformers are used in the audio circuit. The filament of the detector tube is controlled by a twenty-ohm rheostat. The filaments of each audio tube is controlled by a 1A Amperite. The plate of the detector tube is supplied with forty-five volts, while the plate of the first audio tube is supplied with ninety. The plate of the last tube is supplied with one hundred and thirty-five volts. A four and one-half volt C battery is used in the first audio grid circuit. In the second grid circuit a nine volt C battery is employed. The antenna used on this set is one hundred feet long and is of the single wire type with the lead-in coming in from one end of the wire. Now, the results with this set are excellent when receiving stations above 355 meters. Below there I find it very difficult to control the oscillatory action of the detector tube. What could be done to remedy this? I have tried inserting fixed condensers in series with the antenna, reducing the number of turns on the tickler to thirty, reversing the tickler leads, reducing the plate voltage on the detector tubes, but to no avail. —Lester Mazzers, Baton Rouge, La.

Reduce the number of turns on the primary to eight. Place the primary winding at least one-quarter inch from the secondary. If this does not help push it one-half inch away.

* * *

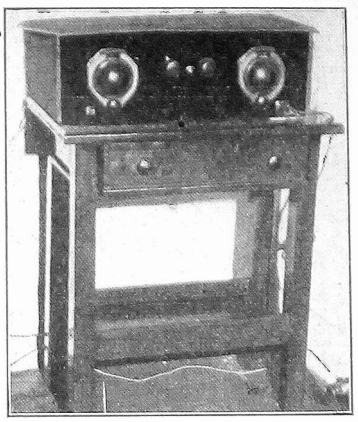


FIG. 529

How the completed five-tube reflex appears in its cabinet.

I WISH to build the five-tube Diamond of the Air, using —99 type tubes in all but the last stage, where I intend using a 120 tube. Please tell me what type Amperites should be employed.

(2) Also state the B voltage to be used on the detector, RF, first and second audio and last audio.

(3) I have a loop which is two feet square, is wound with fourteen turns of No. 18 bell wire, each winding being spaced one-quarter inch. Could this be used on this set?

(4) I was thinking of installing another double circuit jack at the detector circuit output, so that it will be possible to listen in on the phones or plug in on the phonograph with a pickup, without taking either plug out. Is this O K.?—Harry Morris, Long Island City, N. Y.

(1) Use No. 4V-199 Amperites for the filaments of the RF, detector first and second audio tubes. Use a No. 120 Amperite for the filament of the last tube.

(2) Use 45 volts for the detector plate. Use 90 volts for the RF, first and second audio. The plate of the last tube receives 135 volts. Use a four and one-half volt C battery on the grids of the first two audio tubes and a twenty-two and one-half volt C battery on the grid of the last tube. (3) Yes. (4) Yes.

* * *

PLEASE TELL me where the following Cuban stations are located, who they

(*Concluded on page 26*)

Do you want to have manufacturers of radio parts and sets, as well as mail order houses, send you newsy announcements of their latest offerings? If you want a steady stream of such radio literature arriving at your home, fill out and mail the coupon below.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufactures, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature

Name .....

Address ....

City or town ....

State .....

A. R. Sadler, Box 115, Point Loma, Calif.
S. D. MacOwen, 3310 Bowen, Memphis, Tenn.
Lucien A. Deroum, 14 Galivan St., Waterbury, Conn.
B. W. Johnson, 223 Soulard St., St. Louis, Mo.
H. D. Westbrooks, 611 Chamberlain St., Knoxville, Tenn.
H. J. Turicchi, 112 East 116th St., New York City, N. Y.
William W. Skaggs, 2420 Fulton St., Berkeley, Calif.
John Young, Little Current, Ontario, Canada.
Arthur H. Martins, 79 Holland St., Fall River, Mass.
Harold Braus, 475 Fairview Ave., Brooklyn, N. Y.
George S. Mott, 924 East 26th St., Paterson, N. J.
Elbert Kees, 2822 Overlook Drive, Huntington, W. Va.
C. A. Corbina, 362 Winson St., Marion, Ohio.
Kenneth C. Eaton, 401 Spokane Ave., Seattle, Wash.
Theodore Huntley, 309 McNeal St., Melville, N. J.
V. P. Smith, 612 East King St., Lancaster, Pa.
Cornelius V. Banta, 4517 37th St., S. W., Seattle, Wash.
J. P. Morgan, 2621 Center Ave., Pittsburgh, Pa.
J. Stalder, P. O. Box, 274, West Hoboken, N. J.
Gus A. Blodau, Fifth Ave., N., and Monroe, Nashville, Tenn.
Ralph Quarles, 138 West 53rd St., New York City, N. Y.
Louis Willard, R4, Box 344, Pine Bluff, Ark.
R. M. Hall, 1213 South Alice St., Sioux City, Ia.
W. O. Leiby, Box 884, Arcade Station, Los Angeles, Calif
M. Ross, 1974 Grand Ave., New York City, N. Y.
R. F. McKenna, 913½ Water St., South Brownsville, Pa.
E. L. Watkins, 109 Weyman Ave., New Rochelle, N. Y.
Nelson F. Colvin, 2018 Greenup St., Covington, N. Y.
A. R. Hopper, P. O. Box 1227, Jonesboro, Ark
Harry Ocko, 1598 Sterling Place, Brooklyn, N. Y.
M Therald Capron, South Main, Hemlock N. Y.
H. D. Dorsett, Box 52, California, Ky.
Deacon's Sales Service, 32 Lake St., Nutley, N. Y.
O. Blitz, 5615 Genoa St., Oakland, Calif.
B. Stahl, 104 West 61st St., New York City, N. Y.
Edward C. Fry, Uncas, Okla.
Reinhart Kleinke, 1207 Kint Ave., Sheboygan, Wis.
Leonard Johnson, 1726 6th Ave., N., Great Falls, Mont.
A. A. Doughty, 818 Ocean Parkway, Brooklyn, N. Y.
Henry C. Gancel, 640 Riverside Drive, New York City, N. Y.
A. J. Bohlett, 1515 Baymiller St., Cincinnati, O.
A. M. Kelly, 301 East 43d St., Kansas City, Mo.
E. A. Bell, 3208 1st St., Des Moines, Ia.
J. S. M. Neves, Box 49, R. F. D., Route 1, Hemet, Calif.
H. H. Zertien, 125 Rasseter St., Dorchester, Mass.
Malcolm T. Jacobson, Communication Section, Chanute Field, Rantoul, Ill.
I. A. Kellum, South Sioux City, Neb.
Prad R. Hitney, 586 West 178th St., New York City, N. Y.
C. L. Mincheu, 409 South 5th St., McGehee, Ark.
E. L. Watkins, 109 Weyman, New Rochelle, N. Y.
John G. Frank, P. O. Box 276, Hudson, Mass.

NEW CORPORATIONS

Humphrey Battery and Radio Service, New York City, N. Y., $5,000; A. V. Hamburger, E. J. and G. Humphrey. (Attorney S. S. Hamburger, 1440 Broadway, New York City, N. Y.)

Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD: 1926:

Sept. 4—The Four Rectifier Types, by K. B. Humphrey. A Simple Battery Charger, by J. E. Anderson.

Sept. 11—The Beacon (3-tubes), by James H. Carroll. The 1927 Model Victoreen, by Herman Bernard.

Sept. 18—The 1927 Victoreen, by Arthur H. Lynch. Eliminater in a Cash Box, by Paul R. Fernald.

Sept. 25—The Lynch Lamp Socket Amplifier, by Arthur H. Lynch. Wiring up the Victoreen, by Herman Bernard.

Oct. 2—The Victoreen (Continued), by Herman Bernard. New Equamatic System, by Capt. P. V. O'Rourke.

Oct. 9—A Practical "A" Eliminator, by Arthur H. Lynch. Building the Equamatic, by Capt. P. V. O'Rourke.

Oct. 16—The Bernard, by Herman Bernard. How to Box an "A" Supply, by Herbert E. Hayden.

Oct. 23—The 5-tube P. C. Samson, by Capt. P. V. O'Rourke. Getting DX on the Bernard, by Lewis Winner.

Oct. 30—The Singletrol Receiver, by Herbert E. Hayden. How to Get Rid of Squeals, by Herman Bernard.

Nov. 6—Reduction of Interference, by A. N. Goldsmith. Variations of Impedances, by J. E. Anderson.

Nov. 13—The 4-tube Hi-Power Set, by Herbert E. Hayden. A Study of Eliminators, by Herman Bernard.

Nov. 20—Vital Pointers About Tubes, by Capt. P. V. O'Rourke. The 4-tube Diamond of the air, by Herman Bernard.

Nov. 27—The Antennaless Receiver, by Dr. Louis B. Blan (Part 1). Short Waves Yield Secrets, by M. L. Prescott.

Dec. 4—The Regenerative 5-Tube Set, by Capt. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack. The Antennaless Receiver, by Dr. Louis B. Blan (Part 2). Winner's DC Eliminator, by Lewis Winner.

Dec. 11—The Universal Victoreen, by Ralph G. Hurd. Some Common Fallacies, by J. E. Anderson.

Dec. 18—Selectivity on One Tube, by Edgar Speare. Eliminating Interference, by J. E. Anderson. The Victoreen Universal, by Ralph G. Hurd (Concluding Part).

Dec. 25—A New Coupling Device, by J. E. Anderson. Functions of Eliminators, by Herman Bernard.

Jan. 1, 1927—The 2 Tube DeLuxe Receiver, by Arthur H. Lynch. The Twin-Choke Amplifier, by Kenneth Harkness.

Jan. 8—Tuning Out Powerful Locals, by J. E. Anderson. A Choice Superheterodyne, by Brunsten Brunn. The 2-Tube De-Lux Receiver, by Arthur H. Lynch (Part 2).

Jan. 15—The DeLuxe Receiver, by Arthur H. Lynch (Part 3). The Simple Meter Test Circuit by Herbert E. Hayden. The Superheterodyne Modulator Analysed, by J. E. Anderson.

Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight Into Resistors, by J. E. Anderson. A Circuit for Great Power, by Sidney Stack.

Jan. 29—The Harkness KH-27 Receiver (Part 1), by Kenneth Harkness. Use of Biasing Resistors, by J. E. Anderson.

Feb. 5—5-Tube, 1 Dial Set, by Capt. P. V. O'Rourke. The Harkness KH-27 (Part 2), by Kenneth Harkness. What Produces Tone Quality, by J. E. Anderson.

Feb. 12—Phone Talk Put On Speaker, by Herbert E. Hayden. All Batteries Eliminated, by Herman Bernard. The Harkness KH-27 Receiver, by Kenneth Harkness (Part 3) conclusion.

Feb. 19—The 6-Tube Victoreen, by Herman Bernard, (Part 1.) The Big Six Receiver, by Wentworth Wood. "B" Eliminator Problem, by Wm. P. Lear. The Phasatrol Circuit, by Capt. P. V. O'Rourke. The 6-Tube Victoreen, by Herman Bernard (Part 2) conclusion.

Feb. 26—The 5-tube Diamond in a Phonograph, by Hood Astrikian. How To Read Curves, by John F. Rider. Proper Tubes for 5-Valve Receiver, by J. E. Anderson.

Mar. 5—Introduction of 4-tube Universal, by Herman Bernard. Discussion on DX, by Capt. P. V. O'Rourke. Sensible Volume Control, by Chas. Gribben.

Mar. 12—Ten Tell-Tale Points, by J. E. Anderson. How To Figure Resistors, by Frank Logan. The 4-tube Universal, by Herman Bernard, (Part 1.)

Mar. 19—Psycho-Analyzing Circuits, by Thomas L. McKay. The Universal, by Herman Bernard (Part 2). How to Use a Wave Trap, by James H. Carroll.

Mar. 26—The Universal, by Herman Bernard, (Part 3). Flow of Current in a Vacuum Tube, by Radcliffe Parker. Broadcasting Hypnotism.

April 2—Facts Every Experimenter Should Know, by J. E. Anderson. A Ship Model Speaker, by Herbert E. Hayden. The 3-tube Compact, by Jasper Henry. The Nine-in-Line Receiver, by Lewis Rand (Part 1.)

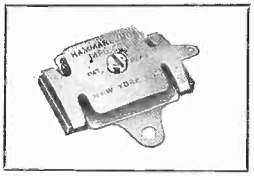
April 9—A 5-tube Shielded Set, by Herbert E. Hayden. The Power Compact, by Lewis Winner. The Nine-in-Line Receiver, by Lewis Rand, (Part 2.)

Any copy, 15c. Any 7 copies, $1.00. All these 32 copies for $4.00, or start subscription with any issue. RADIO WORLD, 145 West 45th Street, New York City.

THE RADIO TRADE

New Hammarlund Midget Condenser

A small variable condenser having an exceptionally wide capacity range, designed for use as a neutralizing condenser in sets using the bridge method of balancing tube capacities, has been placed on the market by Hammarlund. The wide capacity range makes it equally valuable as a compensator for the units of a gang tuning condenser. Arranged for attaching directly to the binding posts of the sockets or the condensers, it simplifies wiring and connections. For convenience in connection, the entire top plate and its soldering lug may be removed and reversed. The small size permits its use in sets where space is limited.



The condenser is ruggedly built, having a bakelite base mount, mica dialectric and a heavy phosphor bronze spring plate. Very gradual and even changes in capacity are obtained by movement of the center screw. The maximum capacity is 50 mmfd; minimum capacity, 2 mmfd.

Brach Totem Pole

The ugly wires and tall poles which constitute the installation of the antenna on a roof can be dispensed with, according to the L. S. Brach Mfg. Co., of Newark, N. J., who have just placed the Brach Totem Pole Antenna on the market. It resembles a small flag pole, with wire wound around it. Specifically it consists of a balanced wound coil tapped in the center wound around a pole. Four bolts and three guy wires are all that are necessary for the complete installation. The illustration attests to the pole's simplicity as well as its handsomeness. It may be mounted to a slanting or flat roof or to the window sill in a similar position to that of a flag pole. The antenna is non-directional and adds selectivity to a set.

Crosley Announces Socket Power Sets

Direct light socket operation with no batteries, A, B, or C, has been developed by The Crosley Radio Corporation in two new models which are now in the hands of its dealers.

These models, known as the AC-7 and

WATCH EXPIRATION OF YOUR SUBSCRIPTION!

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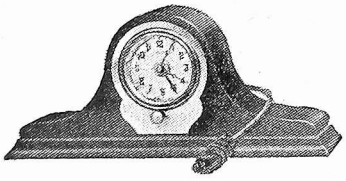
RADIO WORLD, 145 West 45th St., New York City. (Phones: Bryant 0558-0559.)

AC-7C, operate in conjunction with the Crosley Power Supply Unit, a device which converts ordinary 60-cycle house line alternating current into direct current for radio operation.

The AC-7 is a table model and the AC-7C is a console model of the same set, with built-in Musicone.

New Radio Timer Controls Set Operation



One of the newest and most helpful necessities ever offered to the radio fan is the Radio Timer, just being placed on the market by the Timing Appliances Corporation, 26 Court Street, Brooklyn, N. Y. This wonderful appliance is in the form of a clock, durably and handsomely made which is simply and quickly attached and which is electrically operated from the storage battery without much drain thereon. It performs seeming miracles, for instance, starting the radio set at a specified hour or minute desired; stopping the set at any wanted time; starting, stopping and restarting the set when and just as desired. Last but not least, it automatically shuts off the set if left on through the operator's error. Really a clock with a brain. The clock part of the apparatus is a fine timekeeper that will last a lifetime. It is of beautiful design that will ornament any set, being built in a special marine finish. It can be attached in a moment. It is sold on a money-back guarantee at a very reasonable price for an apparatus of this kind. The manufacturer's checking slip and guarantee is enclosed in every box together with full and complete directions. Information and literature may be had upon application to the address above.—J. H. C.

Efficient Shields for Any Circuit

Every up-to-date fan has turned to shielding as a panacea for modern radio ailments. So surprising are the results attained by proper shielding that they are almost unbelievable until one has tried it and convinced one's self. In order to make it easy for those who are unable to obtain the proper size cans or shields for their particular circuit, and to reduce the element of expense, the American Radio Hardware Company, 135 Grand Street, New York City, has brought out a beautifully made aluminum shield in a handy size. These shields can be used in any combination, providing a wide range of sizes and can be used in any set from a Victoreen down to a one tuber. Under laboratory test they produced results equal to the most elaborate system of shielding at many times the price. The shields are marketed in boxes, making a set of two at a price that is within the reach of every fan, enabling the use of as many sets as are needed for the complete shielding of a multi-tube set at a very low cost. The manufacturer is desirous of getting in touch with good jobbers and dealers all over the country who wish to handle a new and fast selling item. Full information will be furnished upon application to the above concern. —J. H. C.

Can I Be of Assistance to You in Great Britain?

An Englishman now in New York, and of excellent standing in his home country, is about to return to England for a temporary visit on an important radio matter. If you are seeking high-class radio connections in Great Britain address Box G, care Radio World.

AT YOUR SERVICE

[This department is conducted by Robert L. Eichberg, director of the extension division of the Federated Radio Trade School, 4464 Cass Avenue, Detroit, Mich.]

Fusing the A Battery

The latest specifications call for the installation of fuses in the A battery circuit, yet only about one out of a hundred installations has this feature.

The fuses should be located as close as possible to the A battery terminals, so that the current will have to flow through them, whether the battery is on charge or operating the set. It is possible to mount these fuses directly on the battery and this is advisable. The fuses should be not greater than 10 ampere capacity, and either automobile or electric-light type of mountings and fuses may be used.

If you have a storage battery which is encased in a wooden box it will probably be easier to procure and install the electric-light type of fuse base and fuse, as these can be purchased in local stores. The base is made of porcelain and resembles an ordinary electric-light socket. In fact, an electric-light socket may be used. The fuse is mounted in a plug which screws into a socket arrangement. These fuses may be had in any different range; but the ones you will use should be 10 ampere capacity.

The porcelain socket may be fastened to the wooden case with ordinary wood screws, as there are holes provided in it for this purpose. Be very, very careful, however, that the screws are not long enough to go completely through the wood, for if they do they will damage the rubber sells of the storage battery.

One terminal of each socket is connected directly to one terminal of the battery and the other, either to the set or the charger or charging switch, as the case may be. Two such fuses are used on each battery and connections are made as heretofore outlined, so that if either of the battery leads should be short-circuited, there will be no danger of the wires heating up.

In the case of batteries which use a rubber box it perhaps would be better to use the automobile type fuse, which is a small glass cartridge containing the fuse wire. The metal cable on one end of this cartridge may be soldered directly to the battery terminal. The other end may be soldered directly to the lead as described in the installation of the other type of fuse.

QUESTIONS AND ANSWERS

I HAVE a six-tube receiver and find the tuning very critical. When I tune in each station it whistles. The stations below WGBS (316 meters) are very hard to tune in. I have to tune finer for those above 316 meters. Would I get better results by using separate rheostats to control the radio and detector tubes? All tubes are controlled by one two-ohm rheostat. I have a 15-ohm and a 25-ohm rheostat. Could I use these to control the radio and detector tube, and could I use a 112 Amperite to control the two audio tubes? If I put 135 volts on the last tube instead of 90, as I have now, would I get better results? I am using all UX201A tubes.

When I have my filament rheostat turned down below half, I get fading, and when I turn it down, the fading increases on all stations.

ROY R. ENGELHARDT.

You may use your 15-ohm rheostat to control the detector tube and the 25-ohm rheostat on the radio frequency. A 112 Amperite will handle the two audio stages well. The reason signals get fainter when you turn your rheostat more than one-half way down is that then you are burning your tubes at considerably less than the rated filament voltage. You are not getting five volts on the filaments. You will not need 135 volts on the plate of the last tube with a 201A in that socket. Ninety volts will do. The rheostat arrangement should help your whistle problem.

* * *

IF YOU had a 100-foot aerial between insulators and you took off your leadin wire in the center, would that cut your aerial wave length 50% and then would you have for a complete aerial 50 feet plus your leadin wire? In other words, does it make any difference where you take off your leadin wire?

EDWARD VOIGHT.

It certainly makes a difference from where on the antenna the leadin wire is taken. The effect of taking it off the center would be about as you describe. The thing to do is to take the leadin from the end of the antenna which points towards the direction from which best reception is desired, or if the aerial is not strictly horizontal, from the higher end.

Getting Best Results From Home Made Coils

(*Concluded from page 6*)

secondary winding, that is, whether this is wound for a .0005 or a .0005 mfd. condenser. A good rule from this point of view is to make the number of primary turns from one-fifth to one-quarter of the number on the secondary. The size of L1 also depends on the type of tube to which it is connected. A tube like the CX299 requires more turns than a tube like the CX301-A, because the 299 has a larger plate impedance. If the impedances were to be matched the primary connected to the smaller tube should have about 50% more turns than the primary connected to the larger tube. However, it is not practical to match the impedances, so that the turns have to be fixed by other considerations.

The type of circuit also enters into the choice of the number of turns in the primary. If there are more than two tubes in the radio frequency amplifier and if there is no provision made for neutralization, the turns are limited by the tendency to oscillate. It is necessary to use fewer turns than desirable to prevent self-oscillation. Using a small number of turns increases the selectivity of the set and at the same time it decreases the undesired regeneration, but these advantages are gained only at a sacrifice of sensitivity or volume, especially on the higher waves. If the circuit is properly neutralized to nullify the regenerative tendency, the full number of turns as required for maximum amplification may be used. The advantages gained are stability and even amplification over the entire tuning range, but some selectivity is sacrificed.

Consideration of Stability

The primary should be placed at the filament end of the secondary, either on the same form or on a smaller diameter inside the secondary. The direction of the winding of the two coils should be the same, and when they are so wound the plate terminal of L1 and the grid terminal of L2 should be farthest apart. This would place the B plus terminal of L1 and the filament terminal of L2 adjoining. This scheme of connection should be followed out in nearly all cases. It is well to separate the two winding by a small space and to bunch the primary turns.

The tickler L3, as was stated above, should be wound with rather fine wire. The number of turns to be used is not critical but it should be ample to enable oscillation at all settings of the tuning condenser. With a good tube and normal plate voltage about 35 turns on a two-inch form should be enough. It makes little difference whether the tickler is placed near the grid end or filament end of the secondary. A little more stability may be expected if the tickler is at the filament end.

When the tickler coil is stationary and the regeneration is controlled by a variable condenser (e. g., C2 in Fig. 4), the tickler coil should be placed at the filament end of the secondary. The number of turns this tickle should have depends on the size of the variable condenser C2. If this condenser is a .00025 mfd. the tickler may have about 40 turns of fine wire. If the condenser is smaller a somewhat larger number of turns should be used.

The connection of the tickler as in Fig. 2 is customary, but this method of control is subject to hand capacity unless the tuning coil and the variable condenser C2 are well shielded from the hand or completely insulated dials are used—those with no metal at front. An alternative connection is shown in Fig. 2. This is not subject to hand capacity effects provided that the rotor plates are connected to the filament. The condenser C3 should be used as a short-circuit preventive and its value may be .001 mfd. or greater.

A Neutralization Method

One of the best methods of neutralization is shown in Fig. 4. The coil Ln has the same characteristics as the primary L1, that is, it should have the same inductance, it should be wound with the same size of wire and it should be placed in a similar position. It should be connected to the grid of the first tube through the neutralizing condenser Cn as is indicated in the drawing.

Agency Broadcasts

The S. M. Masse Company broadcast each week. Short talks of five to ten minutes on business conditions, market trends and a brief review of the week are given.

The company, advertising and merchandising specialists, are broadcasting over WTAM on Monday evenings. While these talks are on business conditions and market trends yet they are general enough to interest nearly all adults. Listeners in can get in a few minutes a comprehensive view of all that is interesting in the business field.

RADIO UNIVERSITY

(*Concluded from page* 20)

are owned by, wavelength they operate on and power used—2FP, 2OK, 6JB and 8BY.—Wrigley Paskall, Atlanta, Ga.

2FP is located in Havana, operates on 355 meters and uses approximately 400 watts, ownership unknown. 2OK is also located in Havana, is owned by the Creditory Construcciones Company, operates on 360 meters and uses 100 watts. 6JB is located in Central Tuincu, is owned by Frank H. Jones, operates on 275 meters and uses 100 watts. Mr. Jones owns another station in Tuincu, with call letters 6KW. This one uses 4000 watts. 8BY is located in Santiago, is owned by Alberto Ravalo, operates on 250 meters and uses 100 watts.

* * *

IN THE Nov. 6 issue of RADIO WORLD, on the University pages, there appeared a circuit diagram of a six-tube receiver, which used double impedance coupled audio frequency amplification. I would like to substitute this audio amplifier, with a three-stage resistance coupled amplifier. Two B plus voltages are used. Also automatic filament controls are used. Is this O. K?

(2) What changes will be necessary?—Gregory George, Niagara Falls, N. Y.

(1) This amplifier can be added. (2) Some changes will have to be made though. A separate rheostat should be connected in the detector filament circuit. This should be of the twenty ohm type. The B voltage for the two radio tubes should be made independent to that of the B voltage for the audio amplifiers.

* * *

I HAVE had good success with the new Universal (March 12, 19 and 26 issues) but sometimes feel I have not succeeded in completely balancing or neutralizing the RF stage. I wound my own coils.—Joseph Fort, Nome, Alaska.

Try using a smaller negative grid bias than 3 on the RF tube. Leave the first AF bias at 3 volts negative. If the balancing condenser (50 mmfd.) does not absolutely stop self-oscillation add a few more turns to the primary L3 of the interstage coupler.

* * *

MY BROTHER recently gave me a five-tube receiver containing a stage of turned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification. I live quite close to a powerful broadcasting station and find I cannot tune this station out. When a more powerful local comes on, they drown this other local out, but you can still hear them in the background, which makes it very annoying. Could I kill this station by building a wavetrap? (2)—Where would it be inserted?—Louis Kennedy, San Francisco, Calif.

Procure a three-inch diameter tubing, and some No. 22 double cotton covered wire. Wind fifty turns of this wire on this tubing. Shunt a .0005 mfd. variable condenser across the beginning and the end of this winding. That is, the stationary plate post is connected to the beginning of the winding and to the antenna direct, while the end of the winding is connected to the rotary plate post and is brought to the antenna post of the set. This is the simplest and most effective arrangement.

* * *

IN THE Feb. 26 issue on page 11, there appeared a circuit diagram of a three-tube receiver which I would very much like to build. (1)—I have a two and three-quarter inch diameter basket weave coil consisting of a fifteen turn primary and a fifty turn secondary wound with No. 24 double cotton covered wire. Could this be used? (2)—What capacity variable condenser should be shunted across it? (3)—Could a three to one ratio audio frequency transformer be used in the first stage and a two to one ratio transformer in the second stage? (4)—I would like to use a power tube in the last stage. Will this necessitate the use of a separate ballast resistor for the filament of each tube, or could a ¼-ampere ballast resistor be used to control the filament of both tubes? (5)—Is the detector grid return circuit hooked up for the —00A type tube?—Dave Kuthers, N. Y. City, N. Y.

(1)—Yes. (2)—This should be of the .0005 mfd. type. (3)—Yes. These can be used. Suggest you place the two to one AFT first, and the three to one second. (4)—You can use the ¼-ampere ballast. (5)—No. It is hooked up for the —01A type. Use a negative return for the —00A tube.

* * *

I HAVE two condensers, each of the triple gang type, consisting of three .0005 mfd. condensers, mounted on one shaft. I would like to construct an eight-tube receiver using five stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer audio frequency amplification. Is such a set practical for the layman?—Harry Norten, Logansport, Ind.

No. You will have to shield each stage, as well as neutralize them. It will also be very difficult to neutralize the stages.

* * *

REGARDING THE six-tube receiver shown diagrammatically on page 10 of the March 12 issue of RADIO WORLD. (1)—Could a three stage resistance coupled amplifier be added? (2)—Could I add regeneration to the detector for more sensitivity? (3)—Could I place a double circuit jack at the detector output. (4)—How? (5)—Could I use basketweave wound coils with .00035 mfd. variable condensers? (6)—Is C5 a .00025 mfd. grid condenser and R7 a 2 megohm grid leak?—Warren Uhalt, Plattsburgh, N. Y.

(1)—Yes. (2)—No, since the tuning will become very difficult. (3)—Yes. (4)—The top spring is brought to the P post of the detector socket. The second spring from the top is brought to the P post of the transformer. The third spring from the top is brought to the B post on the first audio transformer. The bottom spring is brought to the B plus detector post. Be sure you do not reverse these connections. (5)—Yes. (6)—Yes.

The Melo-Heald Set A Fine DX Receiver

(*Concluded from page 7*)

efficiency, but rather a gain. This is true because modulation where high amplitudes are involved does not follow the same law as detection of very weak amplitudes.

The intermediate frequency amplifier is the body of the Super-Heterodyne. It is that part of the circuit which makes this type of receiver superior to others with respect to selectivity and sensitivity. It amplifies selectivity without the need of a multitude of tuning controls. Super-Heterodynes often stand or fall on the performance of this part of the circuit. If the selectivity is not great enough one of the main advantages of the system is lost. If the selectivity is too great side bands are lost and quality suffers. If the intermediate amplifier self-oscilliates during reception, all is lost. If the amplification is not high the receiver fails of its mains purpose. Hence we must have moderate selectivity, high amplification and freedom from self-oscillation.

Coil Placement

Amplification is obtained by employing many stages of intermediates, with transformers matched to the tubes with which they are used. Over-selectivity is avoided by tuning none of the windings and using rather fine wire. Adequate selectivity is obtained by taking advantage of the fact that all the secondaries form tuned circuits in conjunction with the capacity of the windings and the capacity of the tubes. The only requirements for good selectivity are that all the transformers be exactly the same, that they be placed similarly, and that they work between similar tubes. These conditions are readily met in manufacturing.

Self-oscillation can easily be controlled by several methods. In the first place the transformers should be properly placed with respect to one another. It is well to follow the manufacturer's recommendations. Then the plate voltage should not be too high. This the builder has completely within his control. With these disposed of there remain the additional methods of grid bias and filament voltage control. This grid bias is controlled by means of a 400-ohm potentiometer connected across the filament battery, to the sliding arm of which all the grid returns of the intermediate tubes are connected. The voltage may thus be varied between minus and plus 5 volts. The filament voltage is controlled by a two-ohm master rheostat connected in the negative leg of the filament battery.

[*Part II, the conclusion, next week.*]

LIST OF PARTS

One No. 160 oscillating Melocoupler.
One No. 120 mixing Melocoupler.
Six No. 135 long wave Melocouplers
Three Meloformers
Eleven Na-ald push type sockets.
Two Electrad .00025 mfd. fixed condensers.
One Electrad .006 mfd. fixed condenser.
Two Electrad 1 mfd. bypass condensers.
One Lynch metallized 4 meg. grid leak.
One Lynch metallized 3 meg. grid leak.
Two Lynch No. 2 Equalizors.
Eight Eby binding posts.
One Carter 400-ohm potentiometer.
One Carter Loop battery switch.
One Yaxley 2-ohm rheostat.
One Yaxley 6-ohm fixed-variable resistance.
One Yaxley No. 660 cable connector.
Two Yaxley pup jacks.
Two Hammarlund .0005 mfd. midline variable condensers.
One Hammarlund .000032 mfd. midget condenser.
One Jewell 0-100 No. 135 milliammeter.
One Jewell No. 135 B double scale voltmeter.
One Frost 200,000-ohm No. 892 variable resistance.
One 7 x 28-inch drilled and engraved panel.
One 10 x 27-inch baseboard.
Three Formica terminal strips.
Two National Velvet Vernier dials.
Bus bar.
One package of Kester resin-core solder.
Soldering lugs.

BUILD the new Universal, described in the March 12, 19 and 26 issues. Send 45c. for these copies or $1 extra for blueprint, or $1.30 for all four. RADIO WORLD, 145 W. 45th St., N. Y. C.

Dellinger Finds Sphere Of Beam Work Limited

Sharp Definition, As From Searchlight, Deemed Improbable—Radio Transmission of Power Held Impractical, But Not Distant Object Control

By Dr. J. H. Dellinger

Chief, Radio Laboratory, Bureau of Standards

The conspicuous success of broadcasting frequently gives rise to speculation as to the possibilities in other applications of radio. The waves from a radio station have a natural tendency to spread out in all directions. Broadcasting, as we have it today, is the culmination of development of the non-directional property of ordinary radio waves.

From the early days of radio it has been a goal of scientific imagination and effort to concentrate a beam of radio waves in one direction like a searchlight. The possibilities of individual communication and of navigational aids and control, if such a thing could be done, are fairly obvious.

We are so accustomed to think anything possible with radio that we dislike any thought of limitations. Many efforts have been made to produce radio beams, and a number of very interesting things are done with such directive properties as radio waves do have.

Sharp Definition Difficult

The directing of radio waves in a very sharply defined beam, like light from a searchlight, is a consummation not likely to be achieved. Nevertheless the approximations that have been and are being made are of very great value. About ten years ago Marconi demonstrated that by the use of a parabolic reflecting arrangement radio waves could be practically directed in a desired direction. With such an arrangement the intensity of the waves along the desired directions was several times that at angles greater than 30 degrees from that direction. With waves of the order of 3 to 10 meters in length a reflecting arrangement of practical size can readily be constructed and the waves can be transmitted distances of several thousand miles.

From this beginning, reflecting arrangements of improved types have been developed by American and other experimenters, giving the evolution of the so-called beam system. The beam system has been adapted for practical use, particularly by Great Britain. Beam stations are carrying regular radio traffic between England and Canada, and other beam stations are being erected for communication with other parts of the British Empire.

Antennas as Reflectors

In these stations wavelengths up to as great as 100 meters are used and the reflecting devices are very large, straight rows of antennas. Instead of relying upon a parabolic arrangement or reflectors the currents in the various wires of the straight row have their phases so adjusted as to reinforce radiation in a particular desired direction and diminish it in other directions.

Certain things have been discovered in the realm of high frequencies or short waves in the last year or two which give renewed interest to the possibility of using beam methods for communication between one point and another. Very short waves exhibit the phenomenon of skip-distance, that is, beyond a short distance around the transmitting station there may be a zone of several hundred miles where the signal cannot be received and beyond this there will be another zone of a certain width where the signals come in very well.

If now it were possible to confine such waves sharply along a given line from the transmitting station, the area where they could be received would be limited in two different directions and thus the signals from the transmiting station would be receivable at just one limited area on the earth's surface.

"Spotting" the Delivery

By suitable control of the wavelengths and times of transmission this system would permit the putting of a message down at any desired spot on the earth. The trouble is that beams cannot be sent out anywhere nearly sharply enough to accomplish this. The dream of radio as a means of individual and secret communication between persons at two desired places on the earth thus fades away.

It is in the realm of navigational aids that directional radio has attained greatest success. The directional finder is a device

now well known to mariners. In its simplest form it is merely a coil of wire which indicates the direction from which a radio wave is coming merely by turning the coil and listening to the variation of the intensity of the received signal.

This simple device has many uses. By virtue of its complete lack of response to waves coming from a direction at right angles to the plane of the coil, it can be used to eliminate interference from any particular station. As an aid to ocean navigation it is particularly valuable under conditions of fog. Before the advent of the direction finder, sound signals were the only recourse of the mariner in fog. The distance at which sound signals can be heard is so small that radio is the only actual assistance in fog when great distances are involved. Consequently the radio direction finder is a necessary supplement to the sound and light signals provided in lighthouse service, and lighthouses are being increasingly equipped with radio transmitting systems.

Marine Use In Lead

In the rapidly developing realm of air navigation, the direction finder has not been found so practical as in marine use. Fortunately there is another way of utilizing directional radio which bids fair to solve the problem of air navigation in fog. This method takes advantage of the directive properties of a coil antenna. Two coil antennas are used, erected at right angles to each other. Each of these sends out radio waves largely directed in the line along which the antenna points. An airplane flying along a line equidistant from these two lines receives signals of equal intensity from each. When off to the right or the left of this line, it receives one signal more intense than the other.

A number of ingenious methods have been worked out to take advantage of this variation to indicate to an aviator when he is on the course and when he is off. This system is now being developed on the basis of installation of regular radio beacon service on the civil airways of the United States. The importance of this application of directional radio transmission may be seen from the fact that there are 8,234 miles of airways regularly carrying the mail, express, etc., in the United States at the present time.

Remote Control

I have been asked whether the development of directional radio is bringing nearer the possibility of wireless power transmission. There is a vast popular misconception of this subject. It is not the part of a scientist to pronounce anything impossible, but the idea of transmission of substantial amounts of power to considerable distances by radio is ridiculous. It would be possible to build a radio station to transmit enough power to heat a house several miles away, but it would be the most inefficient thing in the world, and not even the wealth of Henry Ford would suffice to pay for the enormous transmitting station that would be required.

Another application of radio, the remote control of distant objects, machinery, ships, etc., on the other hand, will be somewhat facilitated through the use of directive radio transmission.

10-Kilowatt Tube Gets an Obituary

A new 10 KW tube having blown out after 4,148 hours of service, WOC sent out the following "obituary":

It is with the deepest regret that we must chronicle the passing of a worthy public servant, none other than Mr. Ten Kilowatt Amplifier Tube, who was until last week a very active and integral part of the broadcasting business at WOC, Davenport.

He was blown and raised in some Western Electric hothouse during 1924 and first went into the active business of broadcasting along with some score of other tubey gentlemen (now long since deceased) about Xmas Day, 1924, and continued in his capacity as Amplifier at WOC until just last week, never failing even for one day to be on his job. And his labors totaled 4,148 hours. His end was sudden; while preparing himself for a long stretch of duty he emitted a peculiar gurgle, and when his overseer went to help him it was found that he had succumbed.

A successor was immediately appointed and installed, but the latter proved to be just as weak and frail as the respected deceased had been hale and hearty after such a long, strenuous life. For the successor had only just had his water jacket buttoned around him when a stroke rang down the curtain on a short and very inactive life. However, still another successor was immediately initiated and he was greeted with a cooling shower of distilled water, and although under the terrific strain of having the yelpings of enthusiastic sopranos coursing through his veins, it is believed that he will go a long way to rivaling the record laid down by his illustrious predecessor. Now, seriously, can some other broadcaster hang up a better record on a 10 kw. amplifier tube than this one just removed from the WOC transmitter?

Radio Map Recorder Used by the Los Angeles

A weather map recorder will be used by the dirigible Los Angeles, so that maps sent out by the U. S. Weather Bureau may be recorded by a radio process when the dirigible is enroute. It takes twenty-five minutes to record a map by this process, invented by C. Francis Jenkins. The recorder weighs less than 100 pounds and is one yard square.

The higher frequencies, 4,000 to 10,000 kilocycles, are more suited for weather map reception, due to the lesser amounts of static and atmospheric disturbances encountered. As every such disturbance is recorded along with the desired signal, it was advisable to avoid as much as of it as possible.

A trailing wire antenna will be used to pick up the signals. After being amplified, they are applied to the recorder.

COMPLETE LIST OF BROADCASTING STATIONS appeared in RADIO WORLD dated April 2. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

Another Canadian Station Alters Wave

Montreal.

Because of the interference caused by broadcasting stations in the United States moving off the allotted wavelengths and using those granted for the exclusive use of the Dominion, another Canadian radio station has been compelled to effect a change and transmit programs in another channel in an effort to avoid such interference.

Hitherto CNRW, the Canadian National Railways Winnipeg station, has transmitted on 284.4 metres, but this has been changed to 405.2 meters. Experimental broadcasts were transmitted from CNRW on a length of 440 metres, but 405.2 has been adopted, for the present, at least, and pending the hoped-for readjustment of broadcasting channels as they affect international radio.

Previous interference had caused a temporary change between Toronto and Ottawa stations.

Hopkins Wins Out; Gets Cone Patent

Marcus C. Hopkins was recently granted a design patent for his specially ornamental oval speaker, after much litigation. The first time the speaker was presented to the patent examiner the application was rejected on the grounds that the device did not represent an invention, but merely entailed the placing of a cone unit in a base, substantially the same as used in other speakers.

However, this decision was reversed, the examiners-in-chief holding that the built-up speaker in no way resembled any types patented before.

The speaker is oval in shape, the unit being a part of the complete speaker. The oval panel provides a border effect.

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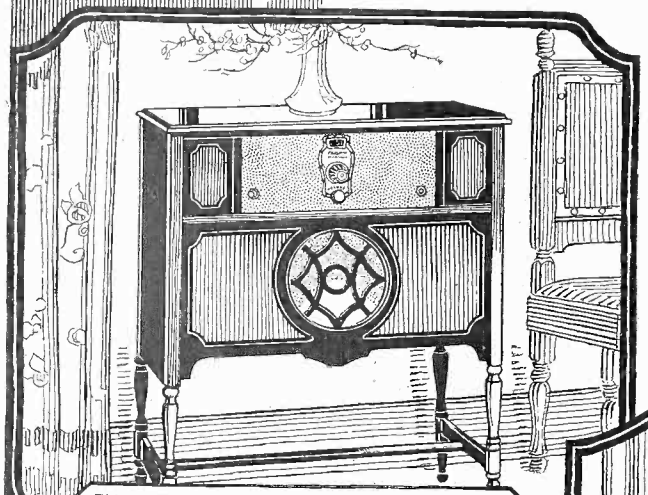
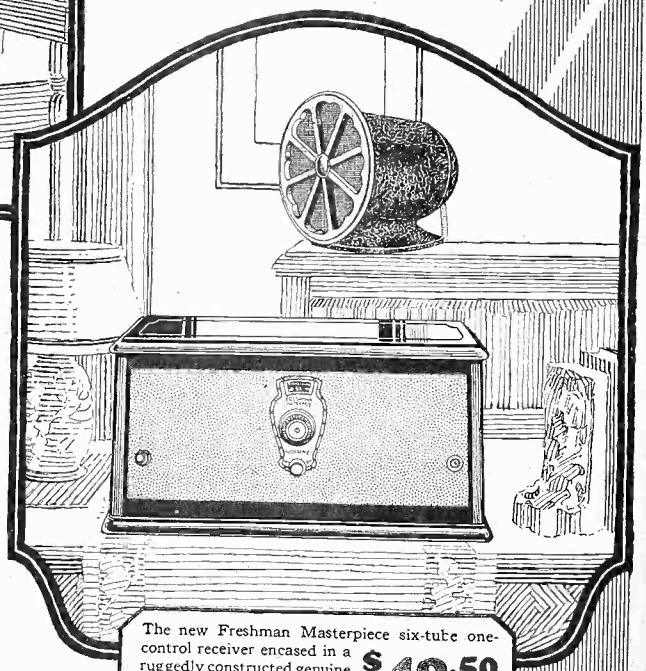
Ever increasing manufacturing facilities, made possible by the great public demand for the Freshman Masterpiece, enables us to produce these Quality Radios at very moderate cost.



This sturdy console is panelled entirely of genuine mahogany. Contains built-in cone speaker and spacious compartments for all accessories. Model 7-F-3. **$79.50**



The new Freshman Masterpiece six-tube one-control receiver encased in a ruggedly constructed genuine mahogany cabinet. Model 7-F-2 **$49.50**

Freshman Master Speaker, as illustrated, ten dollars

A new radio that "gets" everything

SIX TUBES — ONE CONTROL

Merely turn the dial from point to point and station after station comes in separately, clearly and distinctly. The one dial is the only tuning device on this new Freshman radio. Its amazing power assures reception from great distances with "hair-line" selectivity and fine tone quality.

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