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RADIO WORLD

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America's First and Only National Radio Weekly

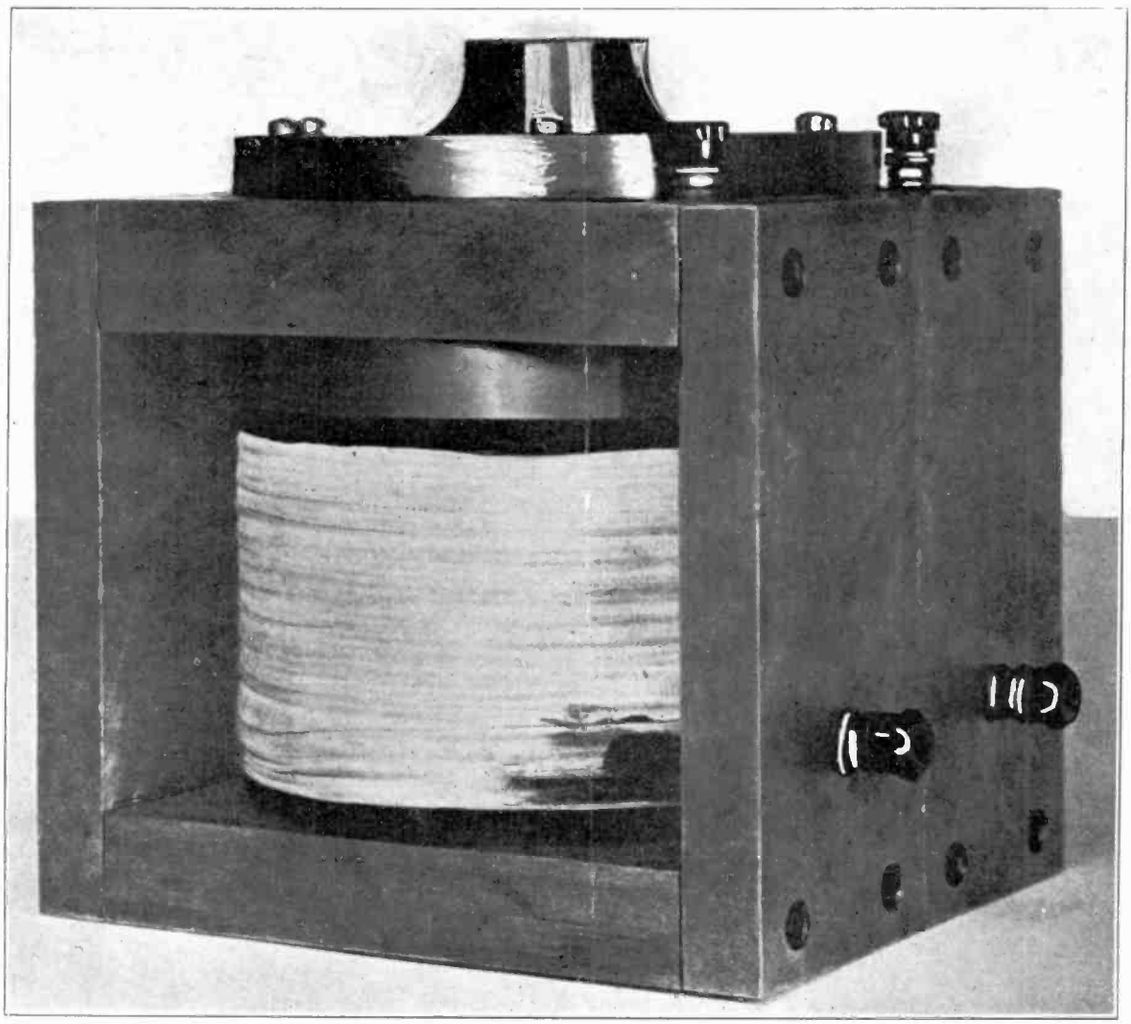
How To Conceal Speaker in Console

A 3-Tube Reflex

Resistance Coupling Used in the Output

A New Broadcast Method

SPEAKER CARRIES 3/4 OF A MILE



(Wide World)

CLOSE-UP of the coil and unit system of the "Exponential Horn," the new speaker that can be heard distinctly for three-quarters of a mile. **See page 13.**

SIXTH YEAR

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RADIO WORLD

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A CONSOLE CONE With the Speaker Out of Sight

By Thorvald Larsen

Photographs by Herbert E. Hayden

MANY persons would like to have a cone type of speaker because of its total fidelity, but object to the usual open air construction. They want it concealed in a console. A cone diaphragm and a unit may be used for the purpose.

A close-up view of such a unit as it is mounted behind the cone is shown in Fig. 1. It is secured to a specially cut rugged insulating plate by means of the two main assembly screws of the units and a third screw and a metal bridge across the bend of the U-shaped magnet. Spacers are placed between the unit and the plate to allow ample room between the armature and the tip of the cone without making the coupling rod longer than is absolutely necessary. Three binding posts are also attached to the insulating plate. Two of these are for the speaker terminals and the third is for a ground connection, the framework of the speaker being grounded.

Close Fit

The method of mounting the unit and the binding posts on the insulating strips can also be seen from Figs. 2 and 3.

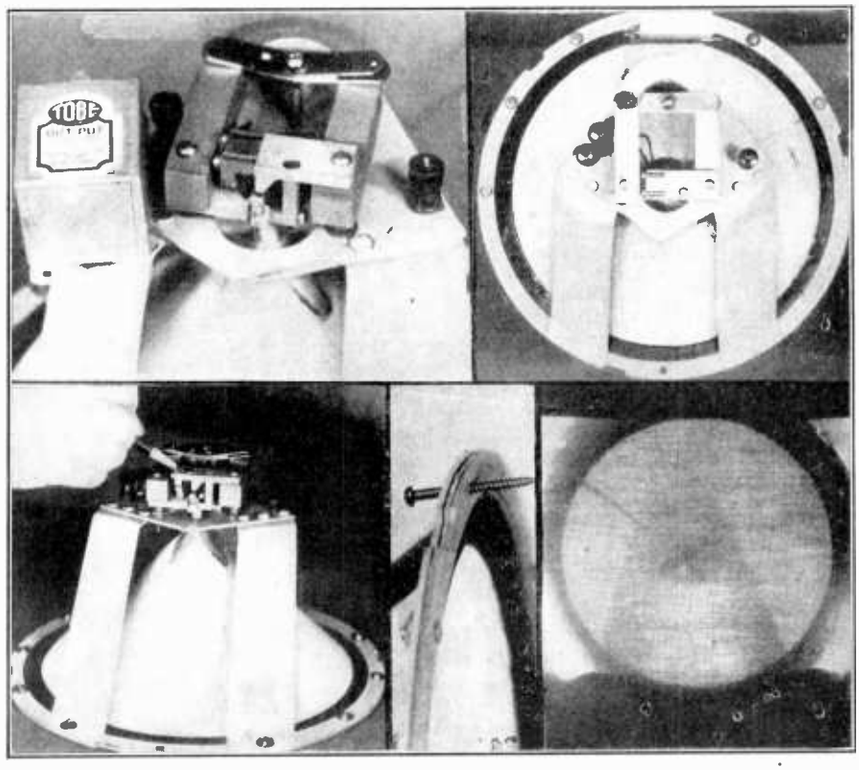
The model used for the photographs was the R. C. A. 100 speaker, without shell. One of the things which contribute greatly to the efficiency of this unit is rigid assembly. Note the close fit of all the parts attached to the magnet and the many screws whereby these parts are cross-locked. There are two identical soft iron pole pieces and two identical auxiliary brass pieces accurately machined to fit snugly together. These four pieces are so securely locked together that the assembly is nearly as rigid as a solid piece of metal. The armature, the two spools and the armature spring are locked into this rigid assembly.

The insulating plate holding the driving unit is securely fastened to three brass spacers by means of machine screws. These spacers are of approximately the same length as the height of the cone and serve as its support. How these are made and secured is clearly shown in Figs. 2 and 3.

Data on the Cone

The cone proper is made of a fine grade of parchment paper. Its angle is considerably smaller than that of the ordinary cone, and is about 130 degrees. Thus the cone serves both as a horn and a diaphragm, or vibrator. This method of construction throws the greater part of the energy forward where it is wanted and very little backwards, where it would merely give rise to echo effects and distortion of the wave.

The periphery of the base of the parchment cone is attached to a ring of suede or chamois skin, and this in turn is clamped between two wooden rings. The soft skin serves to dampen the vibrations and make the cone free edged in effect without any actual free edges to cause rattling. The skin ring is shown in black in Figs. 2, 3 and 4, and is known technically as the baffle. An additional buffer ring of some soft material can be placed between the two wooden rings. This will help to hold the skin ring securely between the rim of the speaker. The rings are held together firmly by machine screws and nuts placed about thirty degrees apart. Three of these screws are also used for holding the three brass spacers with the driving unit to the wooden rings.



VIEWS SHOWING SPEAKER INSTALLATION

Fig. 1 (top left)—Close-up view of the driving unit and filter condenser of the console cone speaker.

Fig. 2 (top right)—Looking squarely at the apex of the cone speaker, with the driving unit in the foreground, binding posts, mounting plate, brass spacers, chamois skin ring and wooden mounting rings plainly shown.

Fig. 3 (lower left)—Side view of the cone speaker, which clearly illustrates the method of construction.

Fig. 4 (lower center)—Close-up view of the wooden rings and suggested method of mounting the speaker on the front panel of the console or cabinet.

Fig. 5 (lower right)—View of the completed speaker installed in a console. A diaphanous silk curtain in front of speaker effectively conceals it from view without interfering with the sound. When all the light comes from the front not even the outlines of the speaker can be seen.

Output Device

If the speaker is to be mounted in a console or cabinet a large hole into which the cone will fit should be drilled in the front panel of the console, if no opening is already provided. The cone can be inserted into the console, with the apex in, and the wooden rings screws to the front panel. For this purpose holes already in the rings can be used. Wood screws should be used. Fig. 4 shows how this part of the work can be done.

If it is desired completely to conceal the speaker in the cabinet this can be done by placing a silk curtain in front of it, using a color scheme which harmonizes with the rest of the furniture. Many consoles have this feature provided. Fig. 5 shows how this can be done, although this figure does not show how the speaker will look when completed. In this photograph the lighting has been reversed.

THE BIAS RESISTOR Often Reduces Amplification

By J. E. Anderson

Consulting Engineer

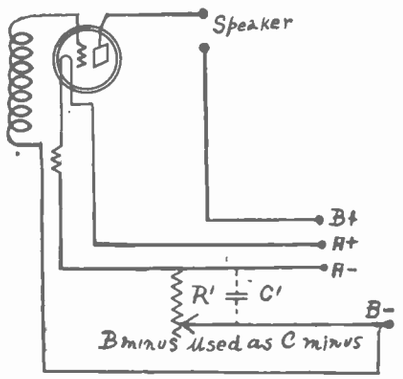
IT is common practice in B battery eliminator design to provide for grid bias on all the tubes by suitably tapping the output potentiometer or fixed resistors for the filament or plate return. A certain portion of the resistance is put in the grid circuits so that the voltage drop due to the sum of all the plate currents in the receiver can be utilized as grid bias. The resistance is adjusted to the tube which requires the highest negative bias and then the other tubes are taken care of by connecting their grid returns to points intermediate between the most negative point on the resistance and the filament cap. Sometimes a condenser is connected across the major portion of the common resistance and sometimes a condenser is connected across each portion into which the resistance is divided.

Now, that is a very convenient way of getting a grid bias without the use of batteries. But this apparent simplification of the circuit really makes its operation characteristics very much more complex than they were before. The amplification is greatly affected. Let us note what the effect is in a few typical cases.

Resistance In Two Circuits

If a —71 tube is used with 180 volts on the plate the required grid bias is 40.5 volts. The plate current under these conditions is 20 milliamperes. What resistance is required to cause a drop of 40.5 volts with 20 milliamperes? By Ohm's law we get 40.5 divided by .02 amperes, or 2,025 ohms. This is the required resistance for getting the proper grid bias on the power tube when only the plate current from that tube flows through the bias resistance.

This resistance is both in the plate and the grid circuits of the tube and consequently the AC voltage drop in it is added to the input voltage to the tube. But these two voltages are in opposite phase, so that the larger the current in the plate of the tube the less is the effective input voltage to the tube. Hence the grid bias resisance reduces the amplification. In a typical case the reduction in amplification was nearly 40% when the resistance was 2,025 ohms. That is the case of a —71 type tube with a load resistance of 12,000 ohms.



INSTEAD of B minus being directly connected to A minus a resistor intercepts these two points. Where a common A supply is used, all the plate current must flow through this resistor, R1. The resultant voltage drop leaves B minus negative in respect to A minus to the extent of that voltage. This bias is used for the last audio tube only. C1 is a by-pass condenser.

When there are more than one tube on the grid bias resistance, that is, when the plate currents of more than one tube flow through it, the value of the resistance required is different. Suppose that the set contains an RF stage with 5 ma plate current, a detector with 1 ma, two resistance coupled tubes with .5 ma each and a power tube drawing 20 ma. The total plate current is then 27 ma, all of which must flow through the grid bias.

Lesser Resistance Now

The value of this resistance must now be 1,500 ohms to give the correct grid bias for the last tube. But this requirement changes whenever any change is introduced in the plate voltage on any tube and in the filament current in any tube. Therefore when this system of obtaining grid bias is used it is important to keep all the conditions constant in the set.

If only the last tube gets its bias from the resistance the change in the amplification will not be of great effect. It is still a decrease, although three more audio frequency plate currents flow through it, because the plate current in the last tube is much greater than the algebraic sum of the plate current of the three others. But if the two resistance coupled tubes also get their bias from the resistance, by tapping it suitably, the amplification may be decreased or increased by the resistance. The plate current in any one tube decreases the amplification in that tube but increases the amplification in alternate tubes. The complete mathematical analysis of the case is very complex and just what the total effect on the amplification will be can not be determined without going through with the complete analysis. That it may be considerable, however, is evident from the fact that in some cases the common grid resistance will cause oscillations in the circuit and in other cases it will decrease the amplification appreciably.

Serves as Stabilizer

From this it is obvious that the common grid resistance if made variable can be used as a stabilizer and as an oscillation control. One adjustment can be found at which the low frequency oscillation can be stopped. This, however, does not mean that the circuit will be well behaved at higher frequencies. But a condenser across the resistance will effectively nullify its effect at high frequencies provided the condenser is large enough. The common grid resistance is never an aid to quality, and for that reason its value is doubtful, even if it simplifies the wiring.

Filtering the plate current supply contributes little improvement in quality when there is a common resistance in the grid circuits. The trouble is just about as serious even if the plates are fed with storage B batteries. Of course when there is a large common impedance in the plate circuits an additional difficulty is introduced. But common impedance is negligible when storage B batteries are used.

Needs Large Condenser

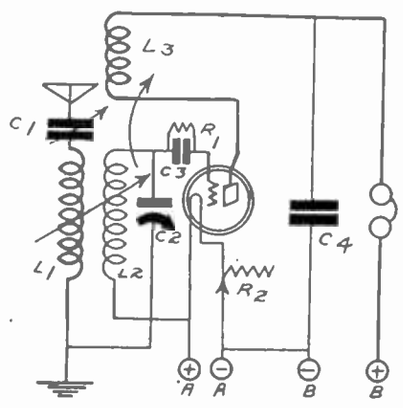
Very large condensers placed across the common grid resistance are advantageous, but they must be so large that the voltage drop in them is negligibly small in comparison with the voltage input to the tubes. This must be true for even the lowest frequencies which the circuit can amplify. Not only must a large condenser be connected across the entire grid bias resistance but one must also be connected from the tap to the filament, provided the grid bias for the voltage amplifier tubes is obtained by tapping the main grid bias resistance. As a matter of fact it is more important to by-pass that portion of the grid bias resistance which is common to all the grid circuits than to by-pass the main portion. No condenser of practical size will have any appreciable effect in by-passing the low frequencies ordinarily classed as motorboating.

DX Easy on Single Tube

You can build a one-tube set that will bring in distance regularly by following the diagram herewith. A 7x12-inch panel affords plenty of room. C1, .0005 mfd. is placed at left on the panel, C2, same capacity, at right, and the coil in the center. At lower center is the 20-ohm rheostat, R2. The coil is a three-circuit tuner. The by-pass condenser C4 is .001 mfd. The grid condenser is .00025 mfd. and the grid leak is 2 meg., if fixed, or preferably a Bretwood De Luxe Model variable grid leak, mounted on the baseboard, for which a pedestal is provided on each leak.

Once the setting is found that affords maximum volume on weak, far-distant signals, it is left that way.

If on C1 tuning is somewhat restricted on the lower wavelengths, connect a 10-turn coil in series with the aerial, anywhere inside the house, not necessarily near the set.



FINE DX from this set.

A 3-TUBE REFLEX Using Anderson's Low-Pass Filter

By Edgar B. Francis

THE three-tube reflex, with up-to-date embellishments, makes a very good receiver, one that is economical in cost of construction and operation and renders highly satisfactory service. Properly built of good parts, it functions without suffering any of the ills previously ascribable to reflexes, particularly distortion and the infamous audio howl.

Distortion was prevalent in reflexes of a few years ago for the combined reasons that audio transformers were poorly accommodated to reflex work, indeed weren't much to brag about for any use, and provision often was made for varying the filament temperature of the reflexed tube. That temperature should remain constant, because any tube used for audio amplification should have steady emission, steady bias and steady input impedance, except only so far as frequency itself affects the impedance. Too low a filament temperature or emission will produce an audio howl, or, if there is a tendency to howl, it will be greatly accentuated. The fact that the reflexed tube is of course also a radio amplifier led frequently to the inclusion of a rheostat as a volume control in this tube circuit, with the vice of altered emission heaped almost wilfully upon the audio circuit. Hence, doing away with that clears the way for easiest success with the reflex, which may be freely admitted to have been a troublesome circuit in the past.

The Low-Pass Filter

It is advisable to resort to the best device for keeping stray radio frequency currents out of the audio circuit. Common practice was to put a fixed condenser across the secondary of the first audio transformer. The connection would be from G to F on AF1 in Fig. 1. But that method, besides not by-passing a very high percentage of the RF, when such values as .0005 or .001 mfd. are used, alters the tonal characteristics. Especially where .002 mfd. is used for this purpose, as was a favorite practice, are some of the higher audio frequencies by-passed, resulting in a cloying sweetness of the voice, most unnatural, and certainly frequency distortion, since a gruff masculine voice is made to sound somewhat effeminate, and music is robbed of its crispness.

The stray RF currents are kept out of the audio circuit in Fig. 1 by utilizing the low-pass filter as designed by J. E. Anderson for use in resistance coupled audio (issue of May 21), but applicable to a reflex, also, as shown here for the first time. The low-pass filter consists of a radio frequency choke coil (L6) and two .0005 mfd. fixed condensers (C4 and C5). The choke coil is in series with the grid return lead, while the condensers are in series with the coil but in parallel with each other. Notice that the condensers by-pass also the A, B and C batteries, an incidental point.

The circuit is easy to build, one of the most important considerations being the placement of parts. Once that is solved there is no trouble. The first coil, L1L2, should be placed at left rear of the 7x20-inch baseboard, while the other coil, L3L4L5, is mounted at right of the front panel, because it has a variable primary A small knob is attached to the shaft of this coil.

Panel Arrangement

On the left-hand side of the front panel is placed the tiny variable condenser C7, in a position corresponding with that occupied by the shaft of the variable coil. Both shafts should have the same sort of knobs, for instance, rheostat knobs, for appearance sake. The two tuning condensers and dials are placed in between these. At lower center of the front panel you may place an A battery switch, either in the positive or in the negative leg. This switch is not shown in Fig. 1.

One socket is placed just back of the center of the front panel, or if not central in respect to the panel itself, at least in respect to the two tuning condensers, which are panel-mounted. This is tube No. 1. Behind it is placed the second audio transformer, with primary toward the front panel. The third tube, No. 3, is placed behind the second audio transformer, near the back end of the baseboard, while the other socket (No. 2), is mounted on the baseboard on the same line, but at right rear. The first AF transformer is to the left of tube 2. The low-pass filter is placed with choke coil about 2 inches away from the end of the secondary L2, and at right angles. It is a good plan to mount the coil L1L2 horizontally, that is, with windings running from front to rear of the baseboard, if one imagines he were winding the coil. The other coil is necessarily mounted in a perpendicular fashion, although it might have a slight tilt to it, as would be the case where the Aero coil is used.

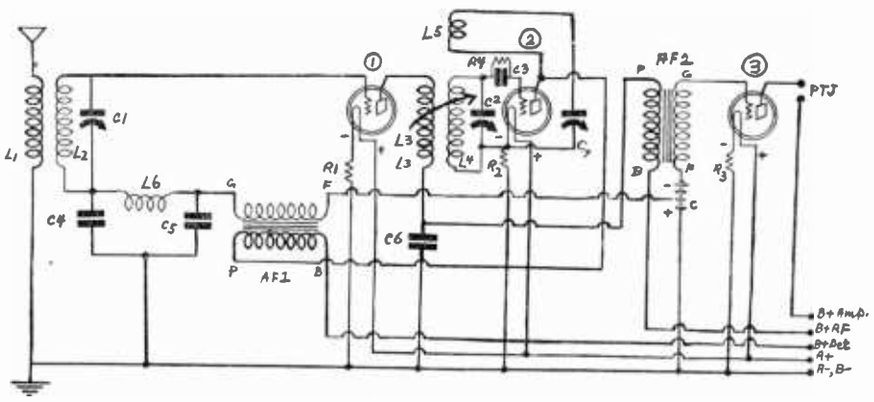


FIG 1

The three-tube reflex, using a low-pass filter to keep the radio frequency out of the audio channel, and designed so that all filament temperature is kept constant, a point of particular value in a reflexed stage, since underheating the filament of this tube gives rise to an audio howl. The receiver is extremely sensitive and selective. Volume control is obtained by means of the variable primary L3, while highest sensitivity is achieved by correct setting of the regeneration condenser C7 for respective frequencies. L3 also affects sensitivity.

LIST OF PARTS

L1L2—One Aero coil No. WT-40.
L3L4L5—One Aero coil, No. OS-55 (known as oscillator).
C1—One .00037 mfd. Karas Orthometric condenser.
C2—One .0005 mfd. Karas Orthometric condenser.
C3—One .00025 mfd. Electrad fixed mica condenser, with clips.
C4, C5—Two .0005 mfd. Electrad fixed mica condensers.
C6—One 1 mfd. Electrad by-pass condenser.
C7—One General Radio Micro-condenser, type 368 (12 mfd.).
L6—One radio frequency choke coil.
AF1—One General Radio audio transformer, type 285-D.
AF2—One General Radio audio transformer, type 285-L.
PTJ—Yaxley pup jacks.
R1, R2—Two type 4 Lynch equalizors (for type A tubes).
R3—One type 2 Lynch equalizor (for 112 tube).
R4—One Lynch metallized 5 meg. grid leak.
One Carter A battery switch.
Three General Radio sockets, type 349.
One 7x21-inch front panel.
One 8x20-inch wooden baseboard.
Two Karas Micrometric dials.
Two Eureka dial pointers.

ACCESSORIES

One — 01A tube, for reflexed stage (No. 1).
One—00A tube, for detector (No. 2).
One 112 tube for final audio (No. 3).
One 9-volt C battery, for 135 volts on speaker; same battery tapped at 3 volts for grid return of reflexed stage.
One 7x21x9-inch cabinet.
Three 45-volt B batteries (45 volts for detector, 90 for reflexed stage and 135 for speaker).
Aerial and ground wire, lightning arrestor, ground clamp, lead-in wire.

Circuit Analysis

It will be noted that the circuit consists of a stage of tuned radio frequency amplification, a regenerative detector, a first audio stage, using the radio tube also for this audio, and a second and final audio stage. The regeneration is obtained by means of a tiny variable condenser in series with the plate coil L5. The connection of L5 to filament minus of the detector tube is shown, since it is assumed that a special detector, e.g., UX200A or CX300A, will be used. Otherwise make the grid return of the detector tube to positive A, instead of to filament minus, and likewise connect the rotor of C7 to the same point as the low potential end of L4 is connected to, for facilitating regeneration.

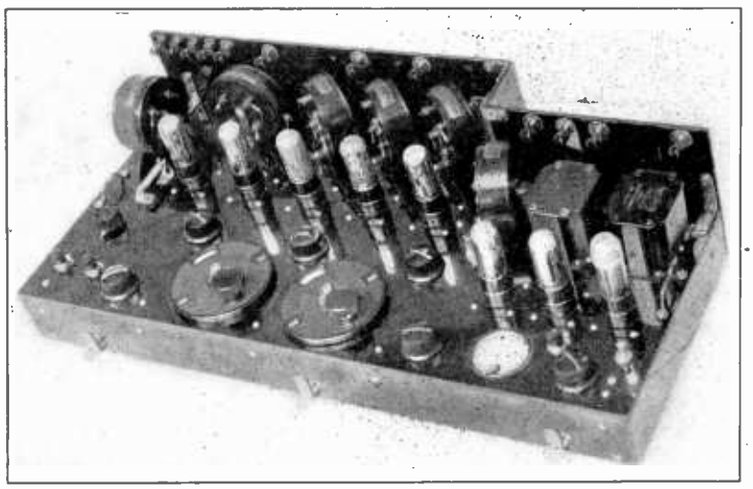
As for the tuning coils and condensers, L1L2 is a radio frequency transformer, an Aero coil No. WT-40 having been used in the laboratory model. This was tuned

(*Concluded on page 20*)

THE VICTOREEN As a De Luxe Portable Receiver

By Capt. Peter V. O'Rourke

Contributing Editor



IF an outside aerial is desired as an optional feature, the antenna coupler should be placed at extreme left.

The first article on the Victoreen Portable was published last week, issue of May 21.

THE loop is provided with a strong brass pivot at its lower end, and this pivot fits into a turned shoulder. A specially constructed brass mounting into which the pivot fits is mounted on the baseboard at the extreme left end of the set, in which the loop can turn freely. The pivot is long enough so that there is no wabbling of the loop as it is turned.

The loop is so constructed that the central upright member can be removed and the loop folded up to fit into the case. The mounting and folding operations can be performed without the aid of any tools.

While the circuit is designed for 135 volts on both the audio tubes it may be that the volume will be too great for good quality if this voltage is used for both tubes. In that case the plate return lead of the first audio tube can be switched over to the 90 volt point on the battery. This change should be accompanied by a corresponding change in the grid bias on the first audio tube. The set is so designed that these changes can be effected conveniently by simply moving the leads.

The Antenna Coupler

In case it is desired to use an open circuit antenna in place of the loop, an antenna coupler may be provided at the extreme left end of the set. This coil looks just like the intermediate transformers and the oscillator coil. To change the circuit from loop operation to antenna a small switch is used.

There are some noteworthy features in this receiver which are not found in ordinary sets. Looking closely at the bottom of the lid in the photograph on the front page of the May 21 issue one will observe a coffin-like box with four hinges and four locks. This box is used for stowing the tubes away while in transit. It contains the cotton batting in which the tubes were originally wrapped up and packed separately.

Between the front edge of the subpanel and the wall of the case is a long narrow compartment extending the length of the case and 1½ inch wide. This compartment contains a variety of tools that are useful in operating the set. There are a camel's hair brush for dusting the set, and a rubber tube for blowing dust out of inaccessible corners; also screwdrivers, pliers, wire cutters, spare wire, screws and nuts.

Free of Secondary Interference

The case containing the set is of wooden construction covered with black leather. The size is 9 x 17 x 26 inches. The complete weight of the set ready for use or travel is 61 pounds.

The receiver is remarkably free from that class of interference which has been called secondary cross talk, that is, squealing caused by beating of two intermediate frequencies of nearly the same frequency. When tested there was only one point at which this was noticed at all, but each of the two interfering stations could be tuned in without any squealing at one point. Hence the interference did not prevent reception on any station. That test was in New York City. In some other place, where stations of different frequency predominate, this type of interference would naturally have been noticed at some other point on the dials, if at all.

The comparative freedom from this type of interference is due to the choice of intermediate frequency and to the selectivity at broadcast frequencies in the loop circuit. With a fixed intermediate frequency nothing can be done to ameliorate the interference except making the circuit selective in the radio frequency level. The regenerative loop does that and it is sufficiently effective for nearly all cases of interference.

[Trouble-shooting Next week]

LIST OF PARTS

C1, C2—Two .0005 mfd. Precise condensers.
C3—One No. 368-A General Radio microdenser.
C4, C6—Two .00025 mfd. Sangamo moulded mica condensers.
C5—One .01 mfd. Sangamo moulded mica condenser.
R1, R2, R4—Three 30-ohm Carter rheostats.
R3—One 20-ohm Carter rheostat.
R5—One 10-ohm Carter rheostat.
R6—One 400-ohm Carter potentiometer.
R7, R8—Two 2-megohm Durham metalized resistors.
R9—One 500,000-ohm Carter potentiometer.
AF1, AF2—Two Amertran De Luxe audio transformers, first and second stage.
S—One Yaxley filament switch.
One Victoreen oscillator coupler (150).
Four Victoreen intermediate frequency transformers (171).
Eight Benjamin UX sockets.
Two Marco vernier dials.
One Fiat folding loop with mid-tap M (wound for .0005 mfd.).
Nine binding posts.
One Formica panel and five Formica strips.

ACCESSORIES

One Crosley Musicone speaker.
Seven —99 tubes.
One —20 tube.
Three 45-volt small B batteries.
Six No. 6 dry cells.
One 22.5 volt grid battery with taps.
One suitcase.
A quantity of Formica cut to size.
Brass angles, screws, nuts, hooks and eyelets.

Changes in Personnel Announced by N. B. C.

Several new appointments and changes in titles in the National Broadcasting Company organization became effective recently.

H. W. Angus, formerly assistant vice-president and general manager, was appointed a vice-president of the National Broadcasting Company and assigned to the direction of programs and sales.

H. C. Smith was transferred from the commercial department and assigned to the office of G. F. McClelland, vice-president and general manager, with the title of assistant to the vice-president and general manager.

The operation and engineering department is hereafter to be referred to as the plant operation and engineering department and the publicity department becomes the press relations department.

Aerial Around the Hull Does Trick on Cruiser

Desiring to have a receiver aboard and yet no unsightly antenna wires, Captain F. G. Moe, skipper of the 38-foot cruiser, Momo, of New York, devised a method of concealing the antenna in the hull of the ship. A piece of No. 10 rubber-covered insulated wire is placed clear around the boat. The wire is so placed that both ends are brought to a plug. Should the ship swing into another direction while a station is being received, a simple switch of plugs will bring it back again.

SINGS REQUESTS ONLY

In his regular programs at KFI, Los Angeles, Paul Roberts, tenor, sings no songs of his own choosing, for the requests from the public form a list much longer than he could possibly sing in the one hour allotted to him each Friday night.

AN OUTPUT Resistance that Couples to Cone

By James H. Carroll

Contributing Editor

WHEN using a power tube such as the -71 in the last stage it is customary to use an output filter consisting of a shunt choke coil and a series condenser. The plate voltage is supplied through the choke, which has a comparatively low DC resistance. The speaker is connected in series with the condenser between negative A and the plate. All the alternating current is supposed to go through the speaker and the condenser.

This combination often results in motorboating, particularly when there are three tubes on the common source of plate voltage.

Now, if all the plate alternating current flowed through the speaker and the condenser, none would flow through the choke coil and the plate battery or eliminator. Then the circuit could not oscillate at low frequencies because it contains in effect only two plate circuits on the common impedance of the plate voltage source.

But the choke coil is not a choke to the lowest frequencies and the condenser is not an admittance at these frequencies. Most of the alternating current flows through the choke at low frequencies and very little of it through the speaker.

How Oscillation Arises

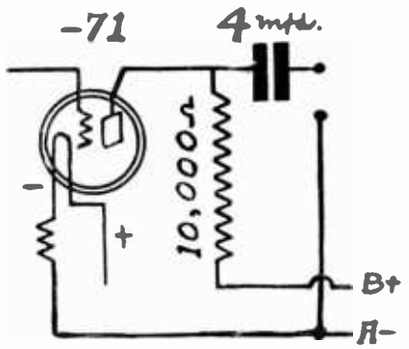
Hence on the low frequencies the circuit becomes odd, or one having three plate circuits on the common impedance. Low frequency oscillation is the result.

Suppose now that we replace the choke coil with a non-inductive resistance of 10,000 ohms, as described by Herman Bernard in the September 12, 1925, issue of RADIO WORLD. The impedance of this resistor remains the same for all the frequencies. However, even now more current will flow through the common impedance at low frequencies than at high audio frequencies because the series condenser offers a greater impedance at the lower frequencies. Also more current flows through the resistance at all high frequencies because there is no inductance to stop it.

But due to the high value of the resistance in comparison with the impedance of the speaker, the amount that flows through the resistance is not enough to cause oscillation. By the time the condenser in series with the speaker offers a very large impedance to force the current through the resistance the amplification of the circuit is too low to produce oscillation. Hence this ameliorates motorboating. It not only cuts motorboating in most cases but it has the tendency to even out the amplification all over the audible band. But some loss of output is unavoidable, since there must be some energy loss in the resistance.

Needs Low Mu Tube

The Bernard method of coupling the speaker can be used effectively only with but tubes of very low output impedance. The resistance used to couple the speaker must be large in comparison with the output resistance of the tube and at the same time large in comparison with the impedance of the speaker. If the plate resistance of the tube is large the coupling impedance must also be very large and the effective voltage on the tube will be too low. The impedance of the



RESISTANCE coupling, used in the output, where a low mu tube is employed, affords fine quality. The voltage drop in the resistor is high, hence only a B eliminator high-voltage supply is practical. in the resistor is high, hence only a B The resistor may be 5,000 to 10,000 ohms, and of the power type, e.g., El-Menco Hy-Watt.

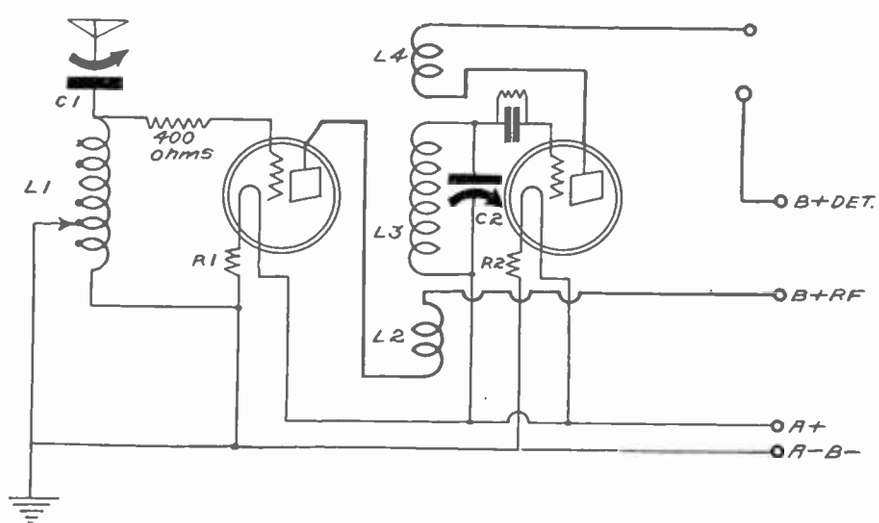
speaker will be small as compared with the plate resistance of the tube. Hence a low mu tube, like the -71, must be used. The larger the series condenser, the better is the transfer of energy from the tube to the speaker and the more uniform will be the output.

When this system is used it is of advantage to use the maximum voltage of the battery or eliminator, so that the effective voltage on the last tube is about the same as it would be if a choke coil were used. To establish a current of 20 milliamperes through the 10,000 ohm resistance the required source would have to be 380 volts. However, satisfactory operation can be obtained on a much less effective plate voltage provided that the grid bias on the tube as adjusted to fit.

The Time Interval

A peculiar effect is noted when the coupling resistance is used instead of a choke coil. After turning on the set there is an appreciable time interval, about two or three seconds, before the signal comes through. This is apparently due to the time it takes the condenser in series with the speaker to charge up to the plate voltage. The charging time is longer through the resistance than through the choke. This, however, does not interfere with the operation as soon as the condenser has been charged. The same time lag is noticed wherever there is a condenser of some magnitude that must be charged before normal operation can be attained. For example, if the stopping condensers in the resistance coupled stages are very large the time required for charging through the high resistances is of appreciable duration. The condensers must be charged to a voltage which is the sum of the plate and the grid voltages.

Adaptation for Antenna Variations Aids Receiver



Some provision for accommodating a receiver to various lengths and capacities of antenna circuit, a tap-switch being used. Also the antenna circuit is tuned by the .0005 mfd. variable condenser, C1. The coil L1 may consist of 40 turns of No. 22 double cotton covered wire on a three-inch diameter tubing, tapped at the 28th, 30th, 35th and 38th turns. R1 and R2 are Amperites suitable for the tubes used, which may be —01A or —99. The second coil is a three-circuit tuner. The tuning condenser C2 is .0005 mfd. The grid leak and condenser combination has the usual values. The 400-ohm resistance in the gird lead of the RF tube is a balancing agency. A filament switch should be inserted in series with plus A post.

TEST PARTS FIRST
Then Put Them in Set and Wire Up

By J. C. Bedloe

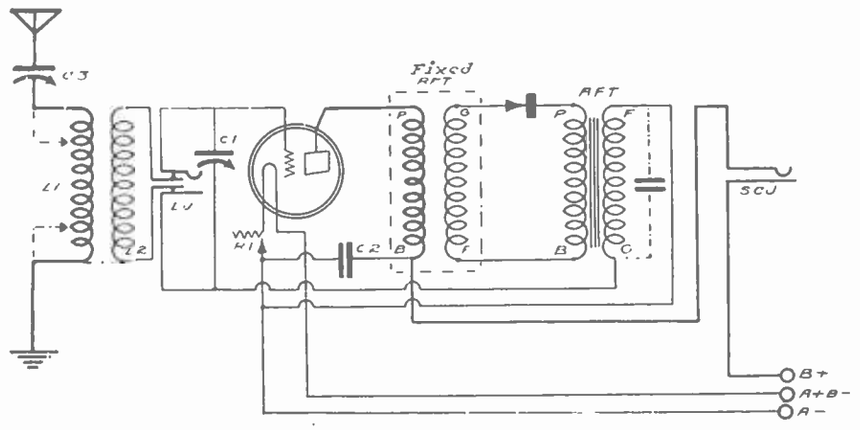


FIG. 1

A jack, used for changing over from antenna to loop, as in this diagram, is the cause of a great deal of trouble. The inner terminals sometimes do not make contact with the upper ones when the plug is taken out. An optical test would never show this. Use a phone unit and a battery for testing continuity of connection.

"TAKE your time" is a motto which should be kept in mind by every home constructor. Hurriedly put together coils, hastily followed diagrams, quickly wired sets, and the use of untested parts can never aid the successful completion of a receiver, no matter how much of an expert you may be.

Whether the parts to be used are manufactured or home-made, they should be tested for continuity of circuit. Manufacturers always strive to have each product electrically perfect, but accidents and errors will ocur. And no one can tell when they will happen.

It also makes matters easier if you put a tested part in a set rather than to put it in untested only to rip it out after you have spent much time wiring.

Good Test Set

A single dry cell and one phone will save you much trouble. Many fans think that they can guess what the trouble is by just looking at the parts. Jacks, switches, all types of variable instruments or apparatus where the connections actually can be seen are the sufferers of this means of testing. A screw being tightly bolted down over a piece of wire is no criterion of a perfect connection. The wire may be broken underneath the bolt and the cotton insulation is holding the wire down.

Therefore before beginning the construction of a set you should be absolutely sure that the apparatus to be used is electrically perfect.

If a certain article is specified by the designer and you have one similar, but not exactly the same, which you wish to use, don't go ahead and use it until you have received authoritative information as to its adaptability. A designer states a certain piece of apparatus should be used because it worked best in his model, and he knows that the best results can be obtained when using that piece of apparatus.

When laying out the parts be sure to follow all directions. If a statement such as "place the coils at right angles, 6 inches away," is made, don't place them in back of each other, 4 inches away. Don't try to make the external appearance what you think is more handsome, by placing the condensers or coils closer to each other.

Are You Able to Judge?

If you wish to put the set in a certain cabinet which will necessitate the use of different size panel than specified, be sure and find out if it is all right to go ahead, unless you are expert enough to rearrange efficiently.

The wiring is, of course, the next operation. Study the diagram carefully. After each lead has been connected up, check it up both against the diagram and the directions. A good scheme is to place a crayon mark on the diagram over every completed connection.

New Transmitting Plan at KDKA Is a Marvel

Pittsburgh.

A new system of modulation has been working very successfully at KDKA. It is called "frequency modulation," because instead of varying the amplitude of the signal component of the wave, this component is kept constant, while the transmitting frequency is varied, but not more than 500 to 800 cycles. The fact that the frequency variation can be kept to 500 cycles makes possible 500-cycle frequency separation of stations, in other words, .5 kc instead of the prevailing 10 kc, an improvement of 2,000 per cent.

Very sharp transmission tuning is necessary. The system enables use of high power, even as much as 50,000 watts, or a hundred times the power of average stations, without the high-power broadcaster blanketing stations in the vicinity or coming in all over the dials of receivers.

The Westinghouse Electric & Manufacturing Co., owner and operator of KDKA, quietly conducted the tests, and announced that the result was satisfactory.

May Help Clear Up Air

The new system of transmitting may prove helpful in solving the frequency problem for the Radio Commission. Under the present method of transmitting with varied amplitude of the signal component, the 10 kc separation is necessary, indeed in congested areas like New York and Chicago the Commission will require 50 kc separation, ultimately. Thus with 950 kilocycles separating the highest from the lowest broadcast frequency there are 95 channels, at 10 kc separation, but with frequency modulation the channels could be increased to 1,900. This would accommodate all-comers with full time on the air, and without interference.

Reports made to the Westinghouse Co. disclose that greater signal strength was noted at distant points, for instance New England and Michigan, when the frequency modulation method was compared with power modulation.

Inside the power room, also, the new method makes a difference, as most modulator tubes are dispensed with, so that twelve 10-kilowatt water-cooled tubes, costing $175 each, are saved. The heat dissipation in such tubes is enormous, rising to as much as 50 per cent., so that 60,000 watts of power are thus conserved, or can be used to increase the transmitted power.

Called Radical Departure

A statement issued by the company set forth:

"So radical is the departure from present methods of broadcasting that the engineers hesitate to forecast the great improvements in transmission that apparently will result from the general application of the system. It is important enough for the present that these new fields of radio endeavor have been opened wide for further development."

The engineers themselves define the system as "frequency modulation." They say that it is a revolutionary departure in nearly all respects from the present method of "power modulation."

It is explained that a ten-kilocycle separation between stations will be required with present-type radio receivers. The new system requires sharp tuning to eliminate interference by powerful stations operating on adjacent wave bands.

Conserves Power

"New developments in broadcast transmission are of such far-reaching effect that apparently closed fields of radio progress are now opening to future exploration, due to work at Pittsburgh by engineers of the Westinghouse company," according to the company.

"The system has unprecedented operating efficiency. It eliminates three-quarters of the transmitting tubes at KDKA, permits the broadcasting of a wave many times sharper than heretofore possible, and provides the range and quality of transmission with less than half the usually required power input. It is regarded as extremely important in offering a practical solution to many problems of transmission, including the possibility of great reduction in station interference. It opens up a new field in which engineers foresee an opportunity to overcome static and local interference."

A CONSOLE TYPE of Pickup and Heineman Motor

By Herbert E. Hayden

Photographs by the Author

A MODERN phonograph can be made at home at no great expense. The fan can make one on which he can play the best records with quality of reproduction comparable with the best radio reception. It it very simple.

The main ingredients are a box of suitable dimensions, a spring motor, a turntable and an electric pick-up. With this and his audio frequency amplifier and loud speaker he can make something equally delightful to eye and ear.

The photograph of a suitable spring motor especially made for phonograph purposes by Otto Heineman is shown in Fig. 1. This motor has a wind-up crank extending outward in the photo, a speed control lever seen at the left, and a main spindle for attachment to the turntable.

Interior of Housing

In Fig. 2 is shown the interior of the box housing the motor. This box may be purchased or it may be made without difficulty out of ply wood. The bottom has been removed to show the manner of mounting the spring motor.

The exterior view of the box is shown in Fig. 3. The speed control lever is seen at the left on top of the box, and the turntable spindle is seen in the center. On the side is seen the opening for the wind-up crank.

All the drilling required for the top of the box is facilitated by the use of a template which is shown in Fig. 4, and which is supplied with the motor. This plate is laid on the top and marks made with a pencil. The holes can then be drilled out with an auger and bit. An extension bit will be needed for the larger holes. Fig. 4 also shows the appearance of the box after the motor has been mounted.

When you are drilling the holes the wood may sometimes chip, leaving unsightly cracks. There will also be many cracks along the edges of the box and many nail holes. All imperfections in the finish need filling. This can best be done with the aid of plastic wood.

Dries and Becomes Wood

This new material can be moulded like putty but it has the property of turning into wood when it dries. When dry it can be sandpapered down to a smooth finish and it will take paint and varnish just like natural wood. In other words, after finishing it is impossible to detect where the imperfections had been. The job will look like a piece of artistic furniture as far as the finish goes. The method of applying the plastic wood is shown in Fig. 5.

After the box has been finished and the motor mounted the turntable can be put in place, as shown in Fig. 6. The turntable is furnished with the motor.

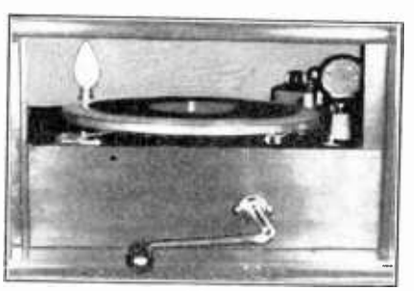
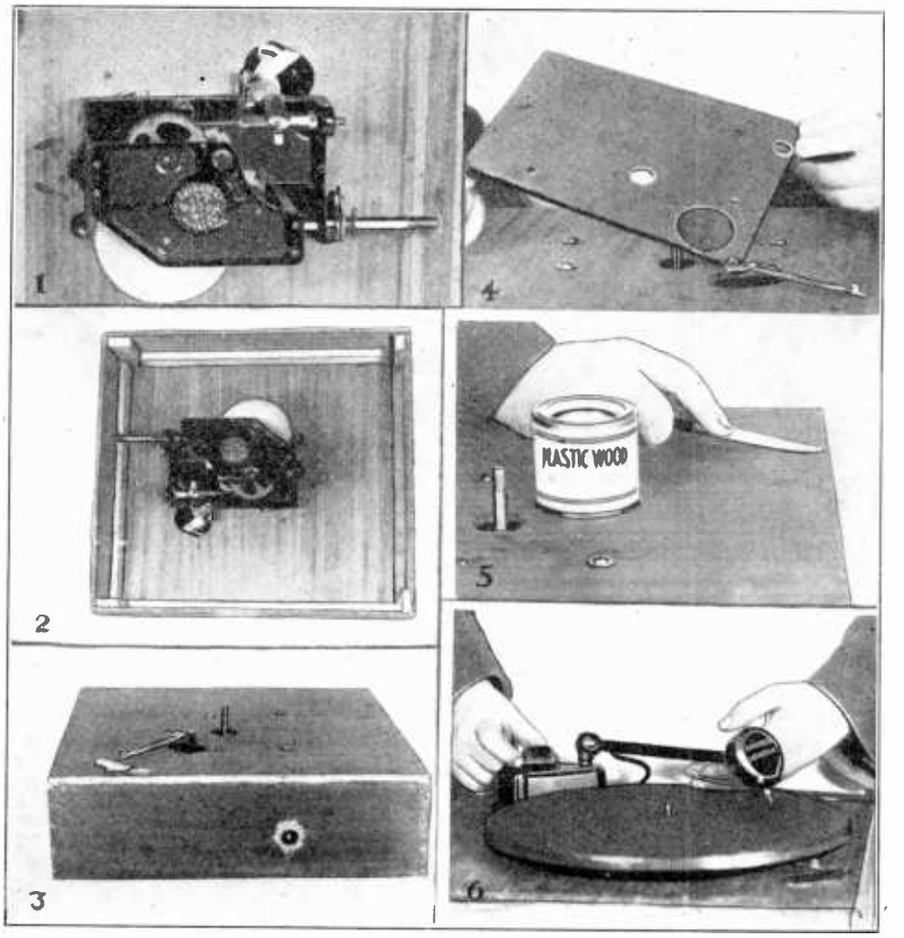


FIG. 7

The phonograph may be installed in a console as shown, with crank extending toward you. The tone arm is pushed back to make room for the electric pick-up at right.



THE PROGRESSIVE STAGES in the construction of a turntable pickup outfit, so that phonograph records can be played, using the pickup, and the rendition amplified by your audio channel and reproduced on your radio speaker.

The top of the box is large enough to hold an electric pick-up unit, the Crosley Merola, as shown in Fig. 6. The needle of the Merola is placed on the record on the turntable. As the record turns an electric voltage is generated in the unit. This voltage is put on the plate of the detector.

Plug in at Detector

There is a plug at the end of the cord leading from the Merola, and all that is necessary to impress the voltage on the plate is to put this plug in the socket from which the detector tube has been removed.

The volume is controlled by a modulator which is located in the base of the pick-up unit. The music inscribed on the record will then be reproduced on the loudspeaker of the set. The tone quality is dependent largely on the quality of the loudspeaker, on that of the amplifier and on the quality of the record itself.

Suspended Microphone Replaces Pedestal Type

The technical staff at KFI, Los Angeles, recently designed and installed in the studio a new microphone system which is said to have overcome many of the deficiencies and imperfections which were occasionally evident when the old system was employed. The old style pedestal microphone has been replaced by a system of microphones suspended from a rod from the ceiling. The rod is movable and extendable, and permits the instrument to be placed to any part of the studio. Two microphones are now employed and these may be turned in any direction, giving more perfect balance in all combinations of vocal or instrumental entertainment.

H. L. Blatterman, chief technician of KFI, states that while the system may not be the ultimate, it constitutes a great step toward better broadcasting.

Diver on Bed of Sea Broadcasts a Talk

HAMBURG.

Completely equipped with a receiving set and a microphone, Alnwil Harmstorf, a deep sea diver, spoke from the bottom of the sea to an aviator in flight. The scene of the test was the Island of Sylt. The diver's microphone was connected through a tube to the radio equipment aboard the steamer Kehrweider, which in turn radioed the messages to the 'plane. Several broadcasting stations picked up the signals and rebroadcast them. Reports from both the aviator and listeners-in indicated the tests were successful.

Why Adjustment of Nut Is Failure on Some Cones

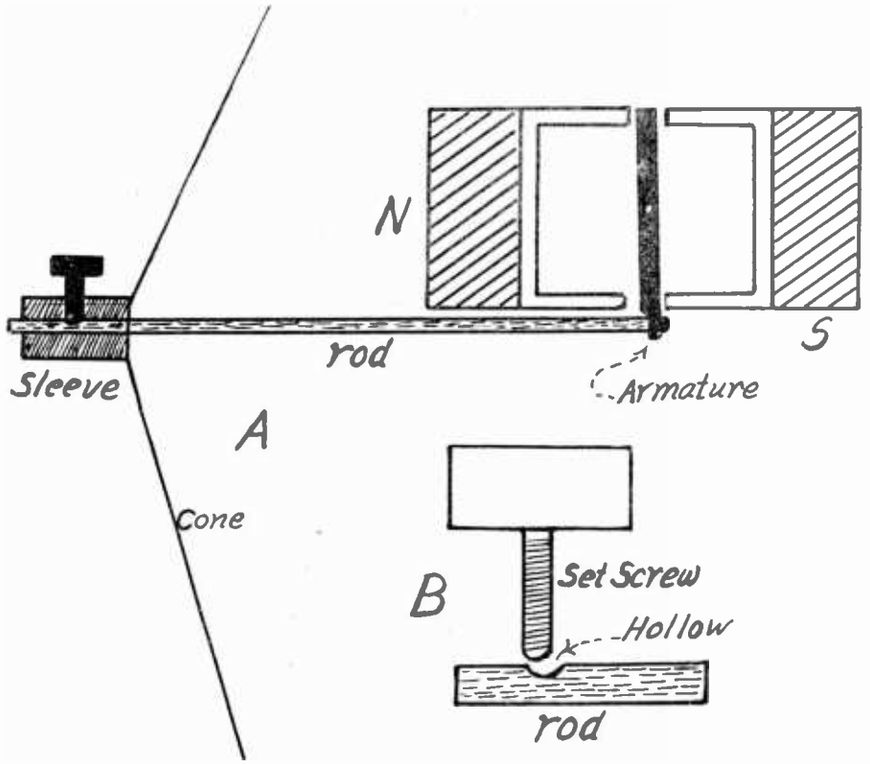


FIG. 1

The set-screw adjustment of a cone speaker at the tip of the cone is not always effective. A shows a schematic of a cone speaker with a balanced armature. The coupling rod is held fast by a set-screw in the sleeve at the tip of the cone. When the rod expands more than the cone, due to temperature changes, the armature is unbalanced, as shown in the drawing. This might cause the armature to strike against the pole pieces, N and S. To adjust, loosen screw and tighten again, but not too hard, or a hollow will be pressed in the rod, as shown at B. Next time an adjustment is made the screw will hit the edge of the hollow and when forced down will drive the rod forward and no adjustment is possible.

As is well known, the cone speaker changes size with temperature and humidity variations. This change upsets the balance of the driving unit and the result is often to cause the armature to strike the pole pieces on even the weakest signals.

To remedy this condition there is a small set-screw at the tip of the cone which holds the coupling rod. When the strain is great enough to upset the balance the adjustment can be restored by loosening the set-screw, letting the coupling rod move a bit relative to the sleeve, and then tightening the screw again.

While this adjustment is made the set should be turned off so that the coupling rod is still.

Effect of Overdoing It

What is not so well known is that this adjustment sometimes does no good. This is the case after a few readjustments of the speaker. The reason for the failure is simple. If the set-screw is tightened a little too hard the tip of it digs into the side of the coupling rod and makes a little hollow. Suppose that the speaker needs adjustment due to expansion or contraction of the cone and rod. The set-screw is released, the unit adjusts itself with respect to the sleeve at the tip of the cone, but this adjustment is small as compared with the radius of the set-screw. When the screw is again tightened the conical tip of the screw forces itself into the hollow and after the screw is down in place there has been no net change in the relative positions of coupling rod and cone.

Light Twist Is Enough

If the material of the set-screw is softer than that of the rod no hole will be dug into the rod. On tightening, the screw tip will only flatten out and no permanent harm will be done. But in any case it is well to deal gently with the set-screw and coupling rod. It is not necessary to use pliers to tighten the screw. A light twist with the fingers will be enough to hold the rod and cone firmly together.

CONSTANTS FOR RESISTIVE AF WITH HIGH MU

Since the amplification in resistance coupling is entirely due to the amplification constant of the tube itself, the advent of the UX240 or CX340 tube, of exceptionally high amplification factor, is of prime interest to advocates of this method. Furthermore, the correct application of the new tube is of equal importance, because the voltage amplification actually realized is based on the correct values of the associated components.

The new tube, properly applied, has an overall amplification about equal to that of transformer coupling with the 201A tube. In fact, using the new tube as the detector and also as the first stage, the power tube of the second stage will deliver a satisfactory volume. It appears that three stages of resistance coupling are no longer essential. Under the conditions of actual voltage amplification, the new tube will average between 15 and 20, or representing better than 50 per cent. utilization of the inherent amplification factor of 30.

Uses a .25 Meg. Coupling

Either the UX240 or the CX340 has the same filament characteristics as the standard 201A tube, namely, 5 volts and 25 amperes. The plate voltage, on the other hand, should be 135 to 180 volts, preferably the latter for best results. The plate resistance is stated as 150,000 ohms. The coupling condensers recommended range from .006 to .05 mfd., as there does not appear to be a noticeable gain in quality in going beyond .05, while possibilities of blocking and distortion rapidly increase. As for resistors, the values vary materially from those employed with former high-mu tubes. Thus the plate coupling resistor should be 250,000 ohms instead of the usual 100,000 ohms, while the grid leak should be 2 megohms. These values will apply only to those stages using the high-mu tube. Negative grid biasing by means of a C battery is strongly advocated for the best tonal quality with the new tube. At 180 volts on the plate, the tube should be biased with 3 volts, and at 135 volts it should be biased with 1.5 volts.

Constants Stated

For those seeking a simple, inexpensive yet remarkably good tone quality with ample volume, the following combination is suggested:

Use a UX240 or CX340 as the detector, with a .00025 mfd. grid condenser and a 2 megohm Durham metallized resistor as the grid leak. The detector output is turned over to a coupler comprising a 250,000-ohm plate coupling resistor and a 2 megohm grid leak, with a .01 coupling condenser. The first amplifier is a UX240 or CX340 tube. The output of this stage is delivered to a second coupler, consisting of a 250,000-ohm plate coupling resistor and a 100,000 grid leak, with a .01 mfd. condenser. The second tube should be a 171 type, if possible, although the 112 type may be employed with a 250,000-ohm grid leak. The detector should be operated on 90 volts, and the amplifier tubes on 135 or 180, with proper grid bias.

Draws Less Current

Remarkable volume, together with crystal-clear tone quality, will be obtained with this arrangement, particularly in combination with a good cone speaker. Marked B battery economy will be noted, for the new high-mu tube draws about a tenth the plate current required by the 201A type.

UNIVERSAL SUITS HIM TO A "T"

EDITOR RADIO WORLD:

I take this opportunity to express my appreciation of the wonderful hookup you gave me and others through the columns of RADIO WORLD, namely the Universal four-tube set, as designed and described by Herman Bernard. Los Angeles isn't the best place in the world for the DX hound, but my little set consistently brings in Denver, Salt Lake City, and Oakland, despite our warm weather. The set's tone, volume and selectivity are all that could be desired. I read RADIO WORLD regularly and will continue to do so, as it is about the best radio magazine I ever saw.

HOWARD T. WRIGHT,
148 So. Ave. 57,
Los Angeles, Cal..

Signal Corps Overjoyed By Short-Wave Success

The Signal Corps of the United States Army is actively pursuing development of high frequency radio for use on Army aircraft, because these sets have proven far superior to high power low frequency sets, the Department of War announced.

Reviewing the trend of its experimental work with high frequency radio development, the department explained that the Signal Corps first commenced use of this type of communication in 1917, mainly because it was desirous of overcoming interference from sets using the more common wavelengths and because it wanted sets which could radiate efficiently on small antennas. The use of a small antenna, the department states, is important for airplanes, as a long one interferes with the maneuvering of the plane.

High Frequency Effective

The full text of the department's statement follows:

"One of the most remarkable advances in radio development during the past two or three years has been the use of high frequency radio transmitters of small power for long distance communication. While some of the advantages of high frequencies had been known for a long time, the ability of high frequencies to be effective with a fair degree of reliability at great distances is a comparatively recent discovery.

"The Signal Corps started experimental work on radio sets, both telephone and telegraph, using high frequencies, late in the year 1917. Frequencies from 30,000 to 2,500 kilocycles (10 to 120 meters) were investigated in both transmitters and receivers.

Two Main Reasons

"This investigation was undertaken for two main reasons: First, to overcome interference from sets using the more common wavelengths at that time, which were in the band of frequencies now used for broadcasting; and second, to obtain sets which could radiate efficiently on small antennas, the use of a small antenna being important for airplanes, as a long antenna interfered with maneuvering the planes, and a small antenna was important for a small portable field set.

"This experimental work resulted in the completion, during 1918, of satisfactory radio telephone sets for airplanes operating on frequencies from 4,000 to 2,600 kilocycles and of a small portable field telegraph set working on about 4,160 kilocycles.

"The above sets were of a few watts output and were intended for short distance work only and they proved satisfactory for the work for which they were designed.

Twenty-five Sets Constructed

"Twenty-five models of the short wave airplane set were constructed. These sets gave satisfactory telephone communication between planes three miles apart, the maximum ranges obtained being about seven miles. The portable telegraph set with only minor modifications is one of the modern army sets for short range work of from 5 to 15 miles, and additional sets of this design are now being purchased from time to time.

"The ability of short waves to be effective at great distances was not discovered until several years after the above sets had been completed. In June, 1925, the Signal Corps placed an order with a commercial company for a high frequency set of 1 KW output, capable of working on any frequency from 15,000 to 3,750 kilocycles and to be crystal controlled.

Helped by Navy

"Early in 1926, the Signal Corps decided that the War Department Radio Net could handle official business with much less expense and provide quicker service if high frequency radio sets of low power were installed to supplement the low frequency sets of high power. The Navy had had considerable experience with high frequency transmitters and with crystal control for such transmitters.

"The engineers of the Signal Corps conferred with the Naval Research Laboratory and due to the co-operation obtained from this laboratory, the Signal Corps was able to construct in its own laboratory 10 high frequency crystal controlled transmitters of Navy design and to have them installed during the year 1926.

Ten More Being Made

"Ten more transmitters of similar type but of improved design are under construction and will be installed during the present year. These transmitters are of 500 watts, rated output, and their construction has been warranted as they are used for about 75 per cent. of the official messages of the War Department Radio Net at a great saving in power bills and maintenance. During the summer when static conditions are severe, these sets have proven far superior to high power low frequency sets.

"Further development of high frequency sets for aircraft is being actively pursued."

$250,000 Fund Sought For Socialist Station

Socialists are still engaged in trying to arrange for the erection of a station in honor of the memory of Eugene V. Debs. The call letters would be WDEB, and the location "somewhere in the East."

Norman Thomas is chairman of the committee which is seeking to raize $250,000 for the new station. Campaign headquarters is at 31 Union Square, New York City. A board of trustees, selected from every side of liberal, radical, and labor opinion, will guarantee a non-sectarian control of the station, Mr. Thomas said.

SCOPE OF TUBE STARTLED HIM, SAYS DEFOREST

When Dr. Lee DeForest first introduced the three-electrode vacuum tube, back in 1908, he did not know half of the things it would do, nor did he dream of the future that lay before it.

This he revealed to the American radio audience in a recent address over WLW, the Crosley station in Cincinnati.

"In 1908 I did not realize that this lamp, that I had named the audion, could be made to amplify high frequency and audio frequency electric currents to an unlimited extent," Dr. DeForest said. "And it was not until four years afterwards, in 1912, that I made the discovery that this same detector and amplifier valve could also be made to generate high frequency currents, and thus could be employed as a transmitter of radio, as well as in a receiving set."

A Scientific Revolution

This property of the three-electrode tube to oscillate has alone made possible radio broadcasting as it is known today.

"In 1915 this radio tube first made possible the transcontinental telephone service in America," Dr. DeForest continued, "just as last January it brought about the opening of commercial trans-Atlantic radio telephone service between London and America.

"The audion, in short, has completely revolutionized the entire art of electrical communication by wire and wireless, has created the new universal industry of radio broadcasting and is thereby working a change in our civilization, our methods of thought and our modes of life, as profound as that which was introduced six centuries ago by the art of printing."

Prophesies One Language

Dr. DeForest also recalled that when he was in Europe nineteen years ago introducing his audion, there were only 80 of the tubes in existence. Now about 80,000 are being manufactured daily.

Dr. DeForest, in closing his talk, predicted that the popularity of radio, which makes it possible for a voice in London to be heard in Madrid, Berlin, Vienna, Rome and other capitals at much greater distances, will ultimately bring about a common understanding and feeling of kinship among the peoples of the earth. This, he said, will eventually mean a universal language and universal speech.

The appearance at WLW took place while Dr. DeForest was a guest of Powel Crosley, Jr. Mr. Crosley recently became president of the DeForest Radio Company, which retains Dr. DeForest as vice-president and consulting engineer.

Zons Tube Operates Direct From DC Line

A tube which receives its plate and filament supply from the 110-volt DC line was recently demonstrated by Dr. Frederick W. Zons. The base of the tube is standard and therefore the tube can be placed in the present sockets. Two terminals embedded in a Bakelite base on top of the tube are connected to the line. These serve a pair of heating elements in no way connected to the rest of the circuit. These elements consist of small tungsten wire coils, wound over refractory tubes.

The heat given off by these heaters is produced for a small thimble of nickel coated with an oxide. The thimble takes the place of the filament. The thimble terminals are then connected to the regular F posts on the socket, the grid return connection being made in the standard fashion.

"When operated from lighting circuits supplying 110 volts direct current, both A and B batteries may be eliminated," said Dr. Zons. "The 110 volts are applied directly to the filament of the tube and the same voltage is utilized, through a simple filtering device, to supply the plate voltages required. The tube operates at maximum efficiency at approximately 90 volts plate potential. This makes it impossible to burn out the filament of the tube by short-circuiting the A and B circuits, as the two voltages are practically equal."

STAFF BEHIND STUDIO PLAYS DIFFICULT ROLE

By J. T. W. Martin

Unseen and unsung, the radio technicians who handle the input apparatus at WEAF and WJZ. follow a rigid, exacting routine. Their work is interesting because it is practically unknown. Like all behind-the-scenes workers, they are faced with the knowledge that the better they accomplish their tasks, the less limelight they will attract to their efforts.

These technical men are divided into two main watches, one watch being occupied with program features broadcast from 6:45 A. M. until noon, the other taking care of network events from 4:00 P. M. until midnight. Sub-division of the watches, however, provides that some men will be on duty during the middle of the day. Members of both tours of duty are shifted from week to week.

The crew which is to handle the details of a program arrives in every instance one hour before the feature is to begin, in order that every portion of the apparatus, from the microphones which are to be used down to the special circuits which are to carry the music and speech to the various network stations, may be thoroughly tested.

Microphones Tested

This work includes talk and music tests of the microphones in the studio or at outside points, checking the continuity of lines from the control board to the microphones and making sure that all special circuits are being provided with proper amplification at all frequencies. In addition, incoming and outgoing special circuits must be balanced so that the same degree of amplification prevails throughout the system. The smallest details of this testing and checking must be carried out with the greatest care, necessitating that the work progress slowly.

Men are assigned to handle the telegraph lines which are used for communication between the control rooms of WEAF and WJZ and the network stations. For convenience in handling messages, the various telegraph transmitters in this system are combined into six separate groups, each one providing connection with a particular group of stations.

Clocks Are Checked Up

The engineers assigned to the telegraph lines check their watches against those of the operators of the various network stations, making sure that all the timepieces in use are showing the absolutely correct time. This is necessary in order that every network station may be able to time its program in order to fit in features from WEAF or WJZ exactly when they start.

Communication is carried on between the network stations as the testing of circuits continues, and when a program is ready to be sent out, a system of cues is transmitted which enables the correct chain of stations to begin transmitting the network feature simultaneously.

Each separate network feature is "stage-managed" by a different announcer, through an intricate but positive system of control devised by O. B. Hanson, manager of operations and engineering of the National Broadcasting Company. The announcer presides over a control box in one of the studios, operating various buttons which automatically connect the proper special circuits with the microphones which are being used, and through a system of lights, an operator in the control room is enabled to keep an accurate check on the manner in which the announcer is handling the program.

By treating each separate network feature as a unit, it is possible to handle several different programs at the same time. On one recent occasion, five program features were being handled at once in the control room of WEAF when three separate network programs were being sent to various combinations of stations and tests were being made on two remote-control broadcasts preliminary to their transmission. This involved the services of five announcers and five operators.

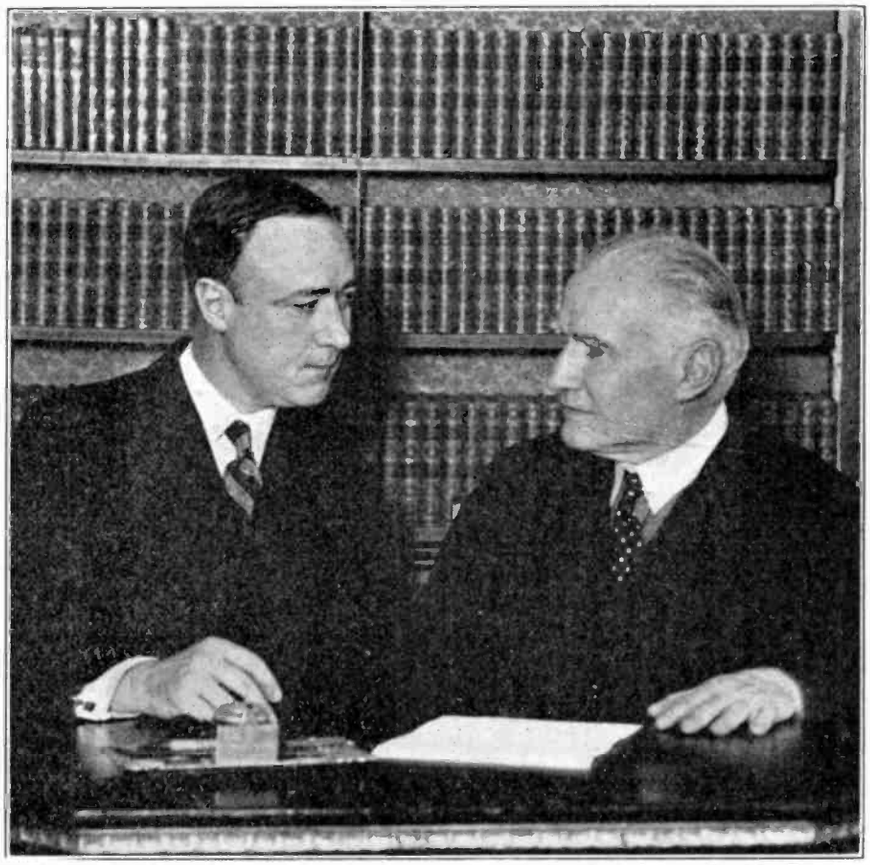
Regulated by Meter

When the testing has been completed, a few minutes before the next feature is due to be heard, the entire layout, including outgoing special circuits which will carry the program to the network stations and in the case of a remote-control broadcast the incoming special circuits as well, is turned over to the announcer. At this time, the operators must be sure that every portion of the apparatus and the circuits is electrically correct.

Throughout the program, the operator in charge of the transmission monitors the outgoing music and speech by means of a meter and regulates the volume. In addition, he listens to the feature on a loud speaker attached to a receiver which is picking up the program from WEAF or WJZ. In this manner, a double check is obtained throughout the course of every feature.

Telegraphic connection is maintained with the network stations while the feature is on the air, operators at the various stations communicating with those at WEAF and WJZ at regular intervals.

NOTED MUSICIAN SIGNS UP



WALTER DAMROSCH (right) signing up with Merlin H. Aylesworth. Mr. Damrosch will be musical counsel of the National Broadcasting Company.

Damrosch Is Music Coun

Walter Damrosch has accepted the post of musical counsel for the National Broadcasting Company. Merlin H. Aylesworth, president of the company which owns and operates WEAF and manages WJZ in New York and WRC in Washington, D. C., so announced.

Mr. Damrosch will officiate and advise in all matters relating to the higher musical activities and possibilities of the radio. He already has under way a gigantic plan for promoting fine music through the medium of broadcasting.

This plan provides for a series of concerts supplemented by talks, which will reach the majority of the 25,000,000 students in American schools and colleges.

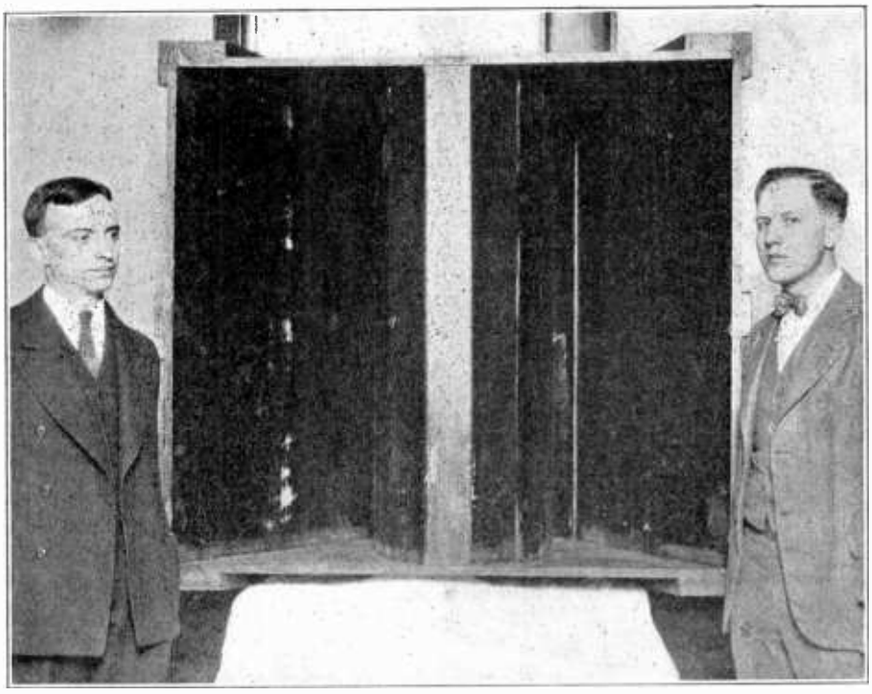
Big Possibilities

Interviewed about the plan at his home, Mr. Damrosch said:

"My experiences of the past Winter in broadcasting orchestral concerts with the New York Symphony Orchestra and in giving Wagner lecture recitals at the piano have so amply borne out my belief in the extraordinary possibilities of broadcasting that I have accepted with the greatest interest the position offered me as musical counsel of the National Broadcasting Company.

"The immediate impetus for this offer was a plan which I had outlined to Mr. Aylesworth, president of the company. This plan is the outcome of more than 25,000

NEW HORN HEARD 3-4 OF A MILE



(Wide World)

MATHEMATICAL ENLARGEMENT of the tone chamber, by using internal curves in the construction, helped toward making possible the demonstration of a remarkable new speaker. This device, known as "the exponential horn," is shown above, with the inventors, Dr. Joseph Slepian (left) and Clinton R. Hanna, of the Westinghouse Electric & Manufacturing Company. The power required to drive the new speaker is no greater than that needed for the speakers that are prevalent in homes. This is even less than the wattage needed to ligh a flashlight bulb. The horn, as shown above is 4 feet square, yet it has the same tonal characteristics as would be present in an ordinary horn 14 feet long. The "exponential horn" handles the audible range impartially.

Pittsburgh.

A remarkable speaker, known as "the exponential horn," which reproduced with clear volume for three-quarters of a mile, was demonstrated by the Westinghouse Electrical & Manufacturing Company.

The speaker was invented by Clinton R Hanna and Dr. Joseph Slepian, research engineers of the company.

One of the outstanding points regarding the new speaker is that it reproduces all the audio frequencies evenly, at full volume, hence without audible distortion, and with no greater driving power than is used for actuating the standard speaker in the home.

Reasons for Success

Proper coupling between the diaphragm and the driving pin and actuation of the atmosphere in an amplified way through the use of the special internal curves in the horn are given as the reasons for the remarkable performance.

The curves inside the horn are particularly important in keeping the amplification at a level during reproduction, so that even the low notes come through with full volume and faithful zooming, while the high audible frequencies are not atenuated.

Horn 48 Inches Square

The horn used in the demonstration was 48 inches square, yet it produced the same effect as would be expected from a horn 14 feet long.

An idea of the small wattage necessary for proper actuation of the horn is gleaned from the fact that it is less than the vattage required to light a flashlight bulb.

(Other Photograph on Front Cover)

BATTERY TIP

Always put distilled water in a storage battery before charging, not after.

Appointed sel of N. B. C.

letters that I received not only from the larger cities, but from country towns and Western farms and ranches. In many of these letters the wish is expressed that orchestral music by radio should be extended to our schools and colleges,—that my concerts and explanatory comments could thus supplement the work done by local teachers in the schools. This suggestion appealed to me greatly. The possibility of playing and talking to an audience of 25,000,000 young people, fascinates me to such an extent that I shall gladly carry out the plan if it proves acceptable to the school authorities.

Twenty-Four Concerts

"I propose to give twenty-four orchestral concerts with explanatory comments on the works presented and on the instruments of a symphonic orchestra. These concerts shall be broadcast to every school and college in the country that chooses to accept them. There will be three series of eight concerts each, with carefully graded programs, one for the elementary schools, another for the high schools, and the third for colleges.

"Previous to each concert I would send to every school that desires it a questionnaire on the music to be performed and on my explanatory comments, together with the proper answers. These answers would, of course, be intended only for the eyes of the music teachers."

AUTOMATIC SET SAFETY FACTOR FOR BELLANCA

Spurred on by the lesson taught by Nungesser, who discarded radio equipment and was lost with his navigator in the Paris-to-New York flight, those in charge of the Bellanca 'plane Columbia have equipped it with a 250-mile range transmitter. An electric generator, driven by wind pressure, supplies the power for the set.

B. E. Smith, one of the executives of the Allen D. Cardwell Co., of Brooklyn, N. Y., the firm that built the transmitter and receiver said:

"The new transmitter will have a reliable transmitting radius of 250 to 500 miles under favorable conditions. This will be utilized to send dashes continually while the plane is in flight so that ship and shore stations, and all radio compass or direction finding stations, can easily determine the exact course taken by the aviators.

"Long dashes will be automatically transmitted at intervals of about one minute on the 800-meter wave. This scheme will have the advantage of conveying to all listening stations, the fact that everything is all right with the plane as long as the signals are heard. If the signals stop coming in, however, ships in the vicinity which have been listening to the signals and making compass readings on them can proceed with all speed to the point indicated by the last bearings taken. It will not be necessary for the aviators to touch the transmitting key. A control switch is used to change the transmitter over from the position of automatic transmission of dashes, so that it may be utilized to transmit code messages by means of a special flameproof and waterproof sending key."

The weight of the transmitter, including tubes, is ten pounds. The installation is said to be the most complete ever made on any 'plane.

The installation was made for protection of Clarence Chamberlin and Lloyd Bertaud on the New York-to-Paris hop.

Coolidge Speech to Go Over Chain on May 30

The Red and Blue Networks of the National Broadcasting Company will link together the greater part of the nation for the annual Memorial Day tribute to the heroes of the Civil and Spanish-American Wars to take place in Washington, D. C. The proceedings of the services, to be held in the Amphitheatre at Arlington, Va., will be broadcast on the afternoon of Memorial Day through associated stations of these networks, beginning at 2:30 o'clock, Eastern Daylight Saving Time (1:30 o'clock, Central Daylight Saving Time).

The exercises will be featured by an address by President Coolidge. The President will be introduced by Major General John L. Clem, Commander of the Department of the Potomac, Grand Army of the Republic. Dr. H. A. Johnson, Assistant Adjutant-General, will read General Logan's order establishing Memorial Day.

A musical program will also be heard by the radio audience, participated in by the United States Marine Band, the Imperial Male Quartet, Ruby Smith Stahl and Gertrude Lyons, vocal soloists.

Big Shakeup of Waves; Few Stations Unchanged

Washington.

Broadcasting stations are now operating on what are termed "temporary permits," but within a few days 60-day licenses will be granted, accompanied by a big shakeup in wavelengths, division of time and power. Henry A. Bellows, Radio Commissioner, said that virtually all of the 681 broadcasting stations now on the air will be affected by the plan worked out by the commission.

Commissioner Bellows said the plan involved the most equitable and effective employment of the 89 available wavelengths that the commission has been able to fix upon. It contemplates no elimination of the number of stations, he said, but will result in drastic power reductions, changes in wavelength assignments among a large share of the broadcasters and the division of broadcast hours, the latter particularly in the congested areas.

Plan to Minimize Interference

The commission formulated its plan of distributing powers and waves on a geographical basis, and fit the respective stations into its "pattern" so as to cause the least possible amount of interference, according to Mr. Bellows. Wide distance and frequency separations will be maintained under the plan so that heterodyning will be reduced to an absolute minimum, he said.

Since the pattern is rigid, Commissioner Bellows estimated that more than 600 of the present stations may have to shift their frequencies to varying degrees when they are fitted in; both the large and small broadcasters will be affected, he said. The assignments of powers, frequencies and broadcast hours will be made on the basis of public service, mechanical efficiency and record in the past, he added.

Exceptions to the commission's license orders will be heard at public hearings to be held before the full commission, sitting in Washington, Mr. Bellows stated. Divisions of broadcast hours may not be required among some of the established stations whose records have shown consistent good service, but they may have to shift their wavelengths.

Mr. Bellows said there is an erroneous impression among broadcasters that the wave band between 240 and 300 meters is bad. It is mechanically as easy to get good results on a 250 meter wave as on 475 meters, he said. Most old radio sets operate well 130 meters on either side of 360, or from 230 to 490 meters, according to Mr. Bellows. Without interference by other stations, any of these waves is good, so that the commission expects little complaint from broadcasting stations required to use them as long as they are cleared.

The commissioner again called attention to the fact that the commission intends to adhere absolutely to the tentative agreement allocating six wavelengths exclusively to Canada and sharing 12 others with Canadian stations. Local low power stations largely will be placed on the shared waves, being situated at points where they will not interfere with the Canadian station using the same wave and where the Canadian station will not interfere with them.

Problem in N. Y. and Chicago

Mr. Bellows said the biggest problem faced by the commission in regard to the division of broadcast hours is in the centers where large numbers of broadcasting stations are clustered. He said an absolute separation of 50 kilocycles between stations will be maintained in the New York and Chicago areas, or within a radius of 50 miles of these cities, which have the largest number of stations anywhere in the country.

Outside the 50-mile circle, however, the separation cannot be as great but the kilocycle separation will be the maximum. Mr. Bellows called attention to the fact that within 100 miles of these and other large centers there were many stations which must necessarily divide broadcast hours and limit power output, since the number of waves available for assignment to them are limited.

He cited the following totals of stations within 100 miles of these cities: New York, 80; Chicago, 68; Boston, 32; Baltimore, 30; Cleveland, 27; Los Angeles, 26; Detroit, 23; Pittsburgh, 21; Cincinnati, 21; Omaha, 21; Davenport, 19; Seattle, 18; San Francisco, 18; Rochester, 16; Minneapolis, 15; Portland, Ore., 13; Denver, 11; St. Louis, 10, and Kansas City, 10.

NOYES DOES CONTINUITY

R. Dana Noyes has joined the staff of WJZ and has taken over the duties of writing continuity for certain broadcast features. He is also engaged in conceiving new ideas for broadcast features.

SIX STATIONS "NATIONAL" IN BOARD'S PLAN

By Thomas Stevenson

Washington.

Six national and about 530 local stations!

That is the new plan of the Federal Radio Commission for relieving broadcasting congestion. The plan practically has been adopted. A few finishing touches will be applied and it then will be held up for public scrutiny.

According to Commissioner Henry A. Bellows, the spokesman for the Commission, there is to be an entirely new allocation of wavelengths to all stations. Few stations will keep the wavelengths they have. The change will be made effective June 1.

Commissioner Bellows expresses fond hopes for the new plan. Without definitely saying so, he indicates that he believes it is the best that can be done under the present law.

The Federal Radio Commission has come to the conclusion that it would be unconstitutional to deprive any broadcasting station of its license. Leaning heavily on the views of Commissioner Eugene O. Sykes, who recently was a Justice of the Supreme Court of Mississippi, the other members of the Commission have decided that the Broadcasting Committee of the American Bar Association knew what it was talking about when it said that stations cannot be deprived of a license without compensation or due process of law.

Least of all does the Commission want the Radio Law of 1927 pronounced unconstitutional by the courts. Such a decision might result in another stampede similar to that when the courts took the reins of leadership out of the hands of Herbert Hoover last July.

Approval is Required For Transfer of License

Washington.

The Radio Commission issued an order that no broadcasting license can be transferred without its approval. The text follows:

"Section 12 of the Federal Radio act provides that no station license shall be transferred or assigned either voluntarily or involuntarily without the consent in writing of the licensing authorities.

"It is hereby ordered that any person desiring to purchase a broadcasting station shall make application for a new license to the commission on the application blank forms. In addition thereto the proposed seller or assigner of the station must also write a letter to the commission to the effect that he desires to sell or transfer this station to the applicant for the above-named license and wishes a license issued to this applicant in place and instead of himself.

"The commission may either grant or refuse to license or grant with modification as to frequency and power."

Gets KFI 200 Nights Across the Continent

Los Angeles.

Officials of KFI recently released a news story bearing the information that G. Edward Elwell, Jr., of Bloomsburg, Pa., had successfully heard that station for 200 consecutive nights. Elwell sent individual reports after each night's reception, and that without exception, these checked exactly with the station's log.

Recent Wave Changes Held No Improvement

Washington.

Engineers of the Bureau of Standards who made measurements for two weeks on station signals did not notice any reduction in interference whatever since April 24 when the new assignment of wavelengths under the temporary permits issued by the Federal Radio Commission became effective.

Chairman William H. G. Bullard, of the Radio Commission, has expressed the opinion that the changes made by his organization have already resulted in a most gratifying improvement in broadcasting conditions."

Dr. J. H. Dellinger, chief of the bureau's radio laboratory, said:

"If such is the case, it has not been apparent to Bureau of Standards observers. Prior to the creation of the Federal Radio Commission they complained because of difficulty they were having in making station measurements, due to interference.

"Our observers say that has not been the slightest reduction in interference, and that conditions are just as bad as they were before.

"I do not mean to make it appear as if we are dissatisfied with the work of the Radio Commission. They have a very hard job on their hands, one that will require considerable time to work out.

"In spite of the difficulties confronting them, I have not the slightest doubt that they will provide a satisfactory solution for the broadcasting problem. They are tackling the job in a business-like way and there should be a great improvement in reception this coming Winter.

Sharing Transmitters Advocated by Caldwell

In a talk over WOR, Newark, N. J., O. H. Caldwell, Federal Radio Commissioner, suggested that small stations consolidate. Locals could combine on one transmitter, so that the heavy expense of a station idle part of the time, due to sharing of wavelength, would be avoided. There would be one studio for two or more stations, but separate call letters or name for each station.

"To encourage such consolidation of broadcast stations," said Mr. Caldwell, "the commission will now authorize supplementary call letters for the same transmitter, so that, for example, a church, a newspaper and a department store, although actually using the same expensive transmitter, will be identified by listeners as three separate stations, each creating its own good-will and prestige. In this way first cost and operative expenses can be reduced and several ineffective and incompetent stations replaced by a single capable operating outfit."

6,000,000 Sets

The speaker said there are 6,000,000 receivers in use and these serve 25,000,000 persons. Of the 680 stations licensed, only 200 or 300 are regularly listened to, he asserted.

"There is no doubt that the Radio Commission has a big job ahead of it," said Mr. Caldwell, "but before the commission has finished its task there will be still another and bigger job ahead for the radio industry, that is the job of putting adequate radio service into every one of America's 22,000,000 homes. What will it avail our public to have good broadcast programs and clear, undisturbed reception if only a small fraction of our citizens have radio sets in their homes, as at present?

Industries Compared

"So far, only a start has been made on this huge task of equipping the American family with radio. To date, we have fitted up only 6,000,000 homes with radios, as against 18,000,000 automobiles, 15,000,000 electric-lighted homes and 8,000,000 phonographs. The public is buying radio sets at the rate of only 1,750,000 a year, near half of which go to replacement, so that the net sales to new purchasers number only 1,000,000 sets a year.

"On the radio horizon today are two new inventions or developments which may mean much in the next decade—television and wired-wireless, or guided radio over electric light wires. Television is yet limited in scope, but the future is bright in radio."

FULL TIME OR WE QUIT AIR, WNYC'S STAND

WNYC, operated by the City of New York, is opposed to sharing a wavelength with any other station. Overtures were made by WMCA and WGCP. All three stations were notified by the Radio Commission to "find a partner."

Christie Bohnsack, director of WNYC, said:

"We have been approached by the managements of two stations with the suggestion that the Federal Radio Commission advised them to make arrangements with WNYC to divide time on our wave. We are not looking for a fight. We fully realize the problems which the control board faces. However, the City of New York is big enough to run full time on an exclusive wavelength. If not, we'll shut down. Why should the city divide time with a commercial station? We want to help the commission in every way possible but in doing so we do not want any entanglements."

He went to Washington to plead with the Commission and after the hearing it seemed he would succeed.

Stations Vote on Names To Replace Call Letters

The idea of having broadcasting stations known by names, instead of by call letters, after having been broached time and time again before the National Association of Broadcasters, has come to the fore, and stands a good chance of succeeding. The association has sent a blank ballot to all stations. The following bulletin accompanied each ballot:

"On many occasions during the past few months, during informal discussions among our members, and occasionally during official hearings, the question of continuing the designation of a station by announcement of its call letters over the air has attracted keen interest.

"The use of combinations of letters to designate a radio station originated properly in 'Point to Point' communication some years back, and as a natural outgrowth of this, with the advent of broadcasting stations this type of designation has been continued. It was never specifically designed for radiophone broadcasting stations.

"It is a well-known fact that due to the phonetic similarity of many letters in the alphabet (for example, B may sound like D, E, P or T) the average owner of a radio receiving set makes many mistakes in identifying the station he has tuned, which in turn causes the credit due that station to be entirely misplaced.

"At this point, those who favor abolishing call letters immediately advance the argument that the sole reason for a station existing is to create personality for itself, and immediately draw the analogy between the station and a boat or a yacht. For official records, the Government designates all vessels under a license form, as, for instance, KX-109. However, immediately, regardless of whether it is a pleasure or commercial craft, its owner christens it with an appropriate name which lends personality to the ship, and the license designation of letters and numbers is never given further consideration with the license to operate.

"From this analogy, the proponents of the idea ask, 'Why is not an announcement, such as The Mayflower, Cincinnati, of more value to the station and easier to identify than the announcement, This is Station WBDT?' The first is at once suggestive of a personality and entirely distinguishable while the latter is negative and easily confused.

"The opponents of such an idea point out that hundreds of thousands of dollars have been spent, in many instances building up the prestige of a certain combination of letters, which in some cases correspond to the trade slogan of the owner of a station. Undoubtedly such stations would be slow to considerably favorably the idea of relinquishing their call letters.

"However, the discussions have been so frequent and active by both sides, that it is with the thought of determining what the real consensus of opinion is that your vote is asked on the enclosed ballot."

WCGU A NEW STATION

WCGU, a new station in New York, has studios at Broadway and Forty-eighth Street, while the transmitter is at Sea Gate.

Smith Out as Director; Jeske Gets WBBM Job

Chicago.

Kelly Smith has resigned as director of WBBM. Mr. Smith was director since the corporation began broadcasting a year ago. He has returned to the radio advertising department, of which he was formerly a member.

Fred L. Jeske has been appointed director to succeed Mr. Smith. For the past year Mr. Jeske has been a staff member of the station as baritone entertainer and has been announcer of the informal request programs.

WLW PROGRAM FROM ZOO

WLW, the Crosley station in Cincinnati, will broadcast a special series of programs from the Cincinnati Zoological Park from the opening date on Sunday next, to the closing on September 11. Pessella's and Wheelock's Bands, and William J. Kopp's orchestra will furnish much of the entertainment. Light opera staged by the Cincinnati Conservatory of Music will also be broadcast.

RUSSIA ADDS A STATION

Moscow.

The Soviet Government recently installed a powerful transmitting station on Cape Desire, which juts out into the Arctic zone west of Archangel, Siberia. The station will be used primarily to keep in touch with explorers entering this region.

WARS Won't Share Wave; Sharply Warned by Board

Washington.

WARS, located at Brighton Beach, Coney Island, was warned by the Radio Commission to obey the order to share its 1,340 frequency with WBMS, Union City, N. J. The Commission sent WARS the following telegram after being angered by the defiance by the station:

"Reports have reached commission that stations sharing 1,340 kilocycle channel have been broadcasting simultaneously without regard to each other's program hours.

"This channel was assigned you for public service, and if conduct complained of continues, destroying the possibility of such service, the channel will be withdrawn and assigned to other applicants.

"Advise immediately what arrangements you are making for sharing time with other station, beginning tonight."

A THOUGHT FOR THE WEEK

THERE'S many a man today who can talk glibly of Chopin, Beethoven and Mascagni, but who, before radio struck deep into his consciousness, surmised that Bach made beer and had a hazy impression that Damrosch was the champion chess player.

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

Member, Radio Publishers Association

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

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ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 3¼" D. C.	231 lines	150.00
¼ Page, 4½" D. C.	115 lines	75.00
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

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52 consecutive issues	20%
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WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

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

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Stock Is Being Sold For Baird Television

Organization in England of a company devoted to the wireless transmission of photographs and moving pictures, known as the Baird Television Development Co., Ltd., has been reported to the Department of Commerce from the Trade Commissioner at London, H. S. Fox.

He states that the bulk of the capital of the new organization consists of 100,000 shares of preferred stock at £1 each, while ordinary shares at one shilling each have a total of £25,000.

C. E. MOUNTFORD MOVES

C. E. Mountford, manufacturer of the well-known line of Kroblak resistors, has moved into new quarters at 30-32 Sullivan Street, New York City, with tripled floor space, most modern time-savings and cost-reducing machinery.

MARCH of EVENTS

A NEW way of sending out program waves, by frequency modulation, has been developed by the Westinghouse Electric & Manufacturing Company and used successfully at KDKA. It affords twenty times as many channels or broadcasting frequecies within the present confines, so holds forth hope of accommodating all who would broadcast, present or future.

But is does not offer an **easy** solution of that particular problem. While under the new method .5 kc, i.e., 500 cycles, will be sufficient frequency range for a station to work in, nearly all receivers in use today are not suitable for such fine tuning, such selectivity, such sharpness. With 5,000 cycle power modulation, in use today, the two sides of the wave account for the 10,000 cycles, or 10 kc minimum. Require twenty times as much precision in tuning as present conditions compel, and you will find the broadcast receiver of today in the same category as the short-wave set that you build, which not only demands the nicest sort of tuning but also makes you exercise your ingenuity in the beginning to find where stations of known frequency come in.

Some fans who have built short-wave sets, for instance, have spent as much as a whole hour trying to locate the KDKA short wave on their dials. While the reasons for the two situations—short waves, and frequency modulation within 500 cycles—are exactly opposite, the effect is the same.

Frequency modulation is not only an important, accomplished fact but it holds forth great promise for the future. It takes the neighborhood curse off superpower, it enables great economy of operation at high or low power, it improves quality and facilitates distance-reaching.

It is the best 20-to-1 shot that has been written on the radio board in years.

* * *

IN a balloon, 35,000 feet up, Capt. Hawthorne C. Gray, of the Army Air Service, flying from Scott Field, Ill., heard programs from two broadcasting stations on a little set. Thus the terrific cold of that altitude did not prevent reception, indeed did not even mar it, for the signals were crisp and clear. The last station signed off when he was that high. Thereafter he proceeded to 42,470 feet, breaking all records for any type of flying device.

Next time he will probably arrange his start so that he will have the full benefit of broadcast reception at whatever altitude he reaches.

The operation of radio in balloons no doubt soon will take on the same importance from the safety viewpoint as it does in planes that try to cross the Atlantic. Nungesser discarded his set before he started, Chamberlin and Bertaud installed one before time to hop off, prompted no doubt by the baffling loss of the plucky Frenchman and his navigator.

* * *

TWO-WAY conversations between office desk and soaring plane are proven practical and in fact can be picked up by a broadcasting station and sent out to fans at large. An example was the recent talk between Dr. George K. Burgess, director of the Bureau of Standards, and W. B. Scott, head of the Aircraft Division of the Ford Motor Company. WRC, Washington, D. C., put the talk on the air, by pickup and rebroadcast.

When bigger and mightier planes are made and cross-ocean flights cease to be sensational novelties the voices of pilots and navigators, and even passengers, speeding 200 miles an hour in air as they near Europe, will be picked up on short waves by United States stations and broadcast to the multitude, until the novelty wears off. After that, trans-Atlantic, or rather, world-wide radiophone stations will be installed on planes, so that persons aboard may talk to remote parts of the earth, or to friends 2,000 miles away, while the radio wave goes the other way 'round the world, 23,000 miles.

* * *

IT now develops that John T. Adams, not the politician, but the head of a musical bureau, first suggested to Atwater Kent that the now famous music hour be put on the air. Similarity and inferiority of programs prompted the idea, but when it was communicated to Mr. Kent no doubt his acceptance was based on different motives. Nevertheless, an important weekly feature was thus inaugurated. No great credit need be wasted on Mr. Adams for having conceived the idea. It was a rather ordinary thought. But much credit is due him for having gotten Mr. Kent to accept it.

Most of us are full of ideas but do little or nothing to put them into practice. It is the victory that makes the thought worth while. Otherwise it is of no greater value than a dream.

* * *

TWO New York stations, after announcing that they would broadcast condensations of the play "Spread Eagle," withdrew the announcement and substituted something uncontroversial. The play is a tirade against war and pictures the United States in a war with Mexico, selfishly instigated by capitalism. After announcement and renouncement by WEAF the same procedure was followed by WGL, and the subject of radio censorship again was made timely for debate.

Opposition from many sources, particularly veterans' organizations, was responsible for the cancellations.

As an author I would deplore the blow to a free forum that such refusal constitutes. As a radio listener I would like to hear the play broadcast. As a producer of the stage play I would rejoice in the publicity resulting from the play being a subject of censorship debate. As a stockholder in a station that planned such a broadcast I would think twice whether it was advisable to antagonize a large body of listeners. As the sole owner of a station I would not permit the broadcasting of anything that I knew in advance would be offensive to many of the listeners. Yet as a play producer you could not stop me—short of an injunction—from putting the play on the boards.

Appreciation of the other fellow's problems and point of view makes life easier, pleasanter and more worth while. The same measure of appreciation should be extended to the various media of expression. Day by day we learn of the finer distinctions existing between the newspaper, the stage, the cinema and the radio. We learn more and more how easy it is for radio to trespass, since it comes to the listener, whereas the audience goes to the theatre and the reader visits the newsstand.

—Herman Bernard

TWO CITIES LINKED

The cities of Sydney and Adelaide, Australia, have been linked for the first time by a carrier telegraph system.

KENT PROGRAM ORIGIN IS LAID TO J. T. ADAMS

Like many other things, the birth of the Atwater Kent Radio Hour was something of an accident. John T. Adams, president of the Wolfsohn Musical Bureau of New York, had a radio receiving set in his home. One night, while entertaining friends, he turned it on. One of the guests voiced the opinion that there was a continued sameness in the programs and that there was no new feature of note on the air to attract listeners. That gave Mr. Adams the nucleus of an idea. Why not have the great stars of the concert and operatic world broadcast? Surely their names would prove attractive and radio listeners would tune-in to an extent never before realized. However, there were many obstacles in the path of accomplishments, not the least of which was the finding of a sponsor with forethought enough to contribute such a program to radio listeners. In addition, there was a decided and determined antipathy towards radio on the part of concert managers, and a reluctance on the part of the artists themselves to sing or play for an invisible audience.

"If I had thought that radio would hurt our artists, I surely never would have started the series or worked on my idea in the first place." Mr. Adams said recently in commenting upon the close of the second Atwater Kent Radio Series. I believe radio will help any artist by enlarging his or her audience and create curiosity, if used judicially, but whether it would be wise for any well-known artist to broadcast too frequently may still be open to question."

A. Atwater Kent of Philadelphia, manufacturer of the radio receiving set which bears his name, saw the significance of Mr. Adams' idea and at once arranged to place Sunday evening concerts of this type on the air.

These made radio history. Artist after artist who was known before but as a name became a vivid and living personality whose voice entered simultaneously into vast assembly halls, suburban apartments and the detached farm houses of the smallest hamlets.

Victor Herbert's Memory Honored in Tribute

In memory of Victor Herbert, the American composer whose operettas are classed among the best of their kind, the American Society of Composers, Authors and Publishers arranged a memorial service in the Crystal Room of the Ritz Carleton Hotel, New York City, the proceedings of which the National Broadcasting Company put on the air through its Red Network.

The program, the second of its kind to go on the air, was the annual tribute of the society. Gene Buck, president of the society, presided before the microphone. He and Augustus Thomas, noted playwright, gave brief addresses concerning the life and works of Herbert.

The list of artists and musical organizations which participated in the tribute comprised many of the most renowned of the present day. Among these were "Roxy," John Philip Sousa, Caroline Andrews, Russian Cathedral Choir, Paul Whiteman, the Atwater Kent Orchestra, under the direction of Louis Edlin; Anita Lowell, Frank Moulan, Alville Harrold, Rafael Diaz, Gladys Rice, Harry Van Duzee, Max Bendix, Jerome Kern, Nathan Franko, Raymond Hubbell, Silvio Hein and Leon Rothier.

IN ITALY, SHE TALKS TO U. S.

(Harris & Ewing)

ELIZABETH M. ZANDONINI, with the special short wave receiver which aided her in holding constant two-way communication with her friends in Washington, D. C., from Milan, Italy, where she was visiting.

Using a specially constructed and designed receiver and aided by the transmitting station in Milan, Elizabeth M. Zandonini, who for the past six years has been connected with the radio laboratory of the Bureau of Standards in Washington, on a recent visit to her native city in Italy maintained constant two-way communication with her friends in Washington. She employed a 35-foot vertical pole as an antenna. Plug-in coils enabled her to switch from one wave to another.

Miss Zandonini is well known in amateur transmitting circles, being a member of the American Radio Relay League, and vice-president of the Washington Radio Club. She also owns station 3CDQ, which has an output of 100 watts.

Balloonist Hears Stations in Record 42,470 Foot Rise

CHICAGO.

Capt. Hawthorne C. Gray, Army Air Service, in a free balloon in which he took off from Scott Field, Ill., listened to KSD and KMOX, St. Louis stations, on a small set, until he reached an altitude of 35,000 feet. The temperature was far below zero, but reception was very clear. When he got that high the stations signed off, and he proceeded to a height of 42,470 feet, thus setting a world record for any type of aircraft. The record is acknowledged by the War Department (12,944 meters).

The Bureau of Standards calibrated the instruments used by Capt. Gray in his remarkable flight. This record will be sent to Paris for final international verification by the Aeronautique Internationale.

The altitude exceeds by 1,650 feet the record for airplanes, which was held by M. Callizo, of France. It is 7,037 feet more than the record for free balloons, established in 1901 by Suring and Verson, Germans.

When Capt. Gray was descending the balloon started such a rapid drop 8,000 feet above ground that he climbed out and used his parachute to get to earth, landing in a plowed field.

The free balloon was located near a clump of trees by an aviator from Scott Field. This aviator removed the recording instruments, the readings on which form the basis of the claim for the altitude record.

FARRAND TELLS OF VIBRATION AREA IN CONES

Not all of the surface of a cone speaker as used in radio work vibrates with every note the speaker gives out, according to C. L. Farrand, inventor of the cone speaker for radio work and president of the Farrand Company of New York.

In theory, according to Mr. Farrand, it might seem that the entire area of the cone speaker would vibrate with every note the speaker gives out, but this is not entirely the case. A cone of a given size will vibrate through its entirety only if the frequency of the note is sufficiently low. As the frequency of the note is increased, that is as it mounts the musical scale in tone, the outer portion of the cone will tend to remain stationary, and at extremely high frequencies only the inner portion of the cone will move.

"Thus," he explains, "if a cone is built several feet in diameter the central portion of the cone will act at the higher frequencies, around 3,000 to 5,000 cycles, while as the frequency is lowered the active area of the cone will progressively increase. The lower the tone, the more speaker area is required to give out its tone in better, fuller, rounder shape.

"It has been noticed that in the larger type of cones the lower frequencies or bass notes are more evenly produced," Mr. Farrand concluded.

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

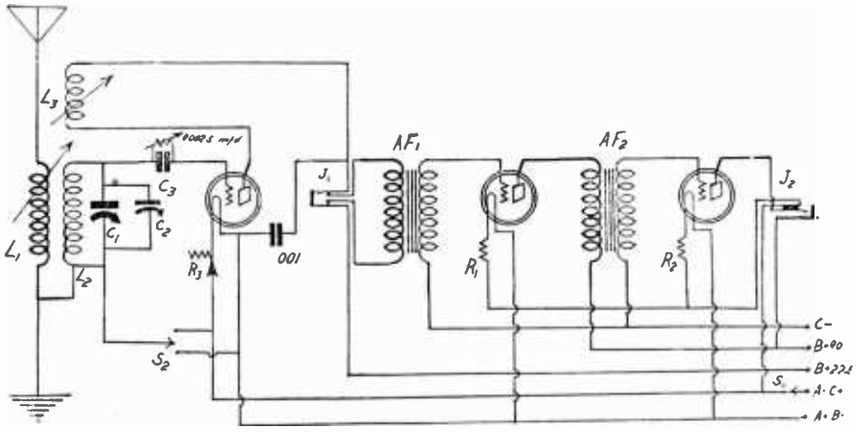

FIG. 536

The circuit diagram of the 3-tube regenerative receiver utilizing a 3-circuit tuner with a variable primary, and a novel switching arrangement, which permits the use of either the —00 or —01A type tubes.

I WOULD appreciate the circuit diagram of a three-tube regenerative receiver, employing a three-circuit tuner with a variable primary, and two stages of transformer audio frequency amplification. I have 1¾ and 3 inch diameter tubings, some No. 22 double cotton-covered wire, a 20-ohm rheostat, two 1A Amperites, a single circuit filament control jack, a .0005 mfd. variable condenser, a General Radio 50 mmfd. microdenser, two low ratio audio transformers, a double circuit jack, two filament switches, and a variable grid leak.—JOSEPH YURON, Detroit, Mich.

The circuit diagram of such a set is shown in Fig. 536. L1 is the variable primary, which consists of twenty turns, wound on a piece of 1¾-inch diameter tubing. L2 is the secondary which consists of 45 turns wound on the 3-inch diameter tubing. The tickler, L3, consists of 36 turns, also wound on a 1¾-inch diameter tubing. Do not wind both the primary and the tickler on one tubing. When placing them, they should each be at the farthest ends of the secondary. No. 22 double cotton-covered wire is used to wind the primary and secondary. The tickler is wound with No. 26 single silk-covered wire. C1 is the .0005 mfd. variable condenser, while across it is shunted the microdenser, C2. The variable grid leak is indicated by the zig-zag lines across the .00025 mfd. fixed condenser in series with the grid post of the detector tube socket. J1 is the double circuit jack, placed at the detector output. The filament of the detector tube is controlled by the 20-ohm rheostat. The audio filaments are controlled by the Amperites you have. The tubes used here should be of the —01A type. J2 is the filament control jack. S1 is a filament switch, which can be used or left out. S2 is the other filament switch, which permits the use of an —00 or —01A type tube, by switching from a positive return to a negative return, or vice versa. The C battery used has a voltage of 4½.

* * *

MY FRIEND has a five-tube tuned radio frequency receiver, containing two tuned radio frequency stages, a regenerative detector and two transformer audio stages. His set works great, and I would like to build one just like it. Now the only thing that I am not clear on are the coils. He uses spider weave coils. I would like to wind my coils on tubing, two and three-quarter inches in diameter, instead. The primaries of his coils consist of fifteen turns. The secondaries consist of 70 turns.

No. 22 double cotton covered wire is used. He uses .00035 mfd. variable condensers. Will I get just as good results with the tubular type coils?—SAMUEL LERON, Newark, N. J.

The primaries when wound on the tubing, should also consist of fifteen turns, while the secondaries consist of seventy turns, using No. 22 double cotton covered wire. Use .00035 mfd. variable condensers. The results will be just as satisfactory.

* * *

FOR THE past year I have been using a one-tube regenerative reflex receiver, using, of course, a crystal as a detector. The results were great, until a month ago, when the signals became very weak. They have been that way ever since. I have installed a new B battery, checked up on my A battery, inspected the antenna and ground, as well as the coils, condensers and audio transformer. Could the fault lie in the crystal? It is of the fixed type and has been in the set, ever since it was first hooked up.

(2)—The signals are not loud enough, anyhow, to operate a speaker. I was thinking, therefore, of installing a couple of stages of double impedance coupling. Is this all right?—MORRIS HELMWORTH, Koogler, N. M.

(1)—Put in a new crystal. Clean off the socket prongs, and be sure that the contact between the tube prongs and the socket is perfect. Check up on variable condenser contacts. Dust may have accumulated and although the contact appears to be good, an electrical test will prove otherwise.

(2)—Yes.

* * *

WHILE VISITING my cousins a couple of weeks ago, I was shown a circuit diagram of a six-tube receiver, using three stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupling. The circuit is novel, in that the primaries of the second, third and fourth transformers are variable, all being hooked up on a single shaft. The number of turns on the primaries is also quite large, twenty being used. The rest of the circuit is standard, with a single rheostat controlling all the RF filaments, and ballasts for the rest of the tubes, and a variable resistance in the RF plate lead. I would like to build this set. Would it be advisable to go ahead?—LEONARD ROOS, Wily, Va.

Yes, you should get excellent results from a set of this type.

* * *

I **HAVE** a five-tube receiver, consisting of two stages of tuned radio frequency amplification, a crystal detector coupled by a untuned transformer and three stages of resistance coupled audio frequency amplification. I am going to rebuild this set and would like to have a few tips, before doing so.

(1)—Would I get better results if I installed a tuned radio frequency transformer in the detector stage?

(2)—If so, how would a single condenser in the antenna stage and a double condenser in the second RF and detector stage work out?

(3)—I have a couple of 15 mmfd. midget condensers Could these be used in any way?—KENNETH H. LOWMAN, Charleroi, Penn.

(1)—Yes.

(2)—Very well.

(3)—You can place them on across the secondary windings of both the second and third radio frequency transformer, using them to balance up circuits.

* * *

I HAVE a three-tube reflex. I would like to know if I could change this set into a straight four-tube set, using the transformer now used in the reflex stage, in an extra audio stage.

(2)—If I used —01A tubes in both audio circuits, could I use a ½ ampere ballast resistor to control the filaments?—THOMAS NORTON, Frederick, S. D.

(1 and 2)—Yes.

* * *

COULD I increase the oscillatory action of my detector tube, in which a variometer is used for regeneration, by inserting a .00025 mfd. fixed condenser across the terminals of the variometers?

(2)—I am using two stages of transformer audio coupling. Will I get louder results from three stages of resistance coupled audio, using —01A tubes?

(3)—I can only get stations up to 500 meters. How could I get the stations up to 550 meters?—KENDALL H. KING, Broadway, N. J.

(1)—Yes.

(2)—No. Just about equal.

(3)—Add seven turns to the secondary winding of your coil.

* * *

A FRIEND and I recently constructed the six-tube receiver described in the Radio University columns of the March 26 issue of Radio World. The tuning is quite critical. Would a rheostat in the RF filament leads help any?

(2)—I can take the first tube out on local stations. Is this characteristic of this type of set?

(3)—Can a loop be used?

(4)—Could I add another stage of transformer coupled audio?—MAXWELL ZARNOTT, San Diego, Calif.

(1)—Yes. Use a 20-ohm rheostat.

(2)—Yes.

(3)—Yes. It will have to be hooked in the second stage, though, since there is no tuning control in the first stage. Insert a filament switch in series with one of the filament leads of the first tube, so that the filament circuit may be broken when the loop is to be used.

(4)—No. Too much distortion would result.

* * *

I HAVE built a two-tube receiver using a tuned stage of radio frequency amplification and a regenerative detector. It is similar to the two-tuber shown in the April 23 issue, under the Radio University columns. The set is hard to control. What should be done?

(2)—Can any form of audio frequency amplification be added?

(3)—How will a three stage resistance coupled amplifier work?

(4)—I am using —01A tubes. Is that all right?

(5)—I inserted a filament switch in series with the negative leg of the filament. There was none in the hookup and I thought this to be an error. Was I right?—THOMAS PELWOR, Astoria, L. I., N. Y.

(1)—Insert a 20-ohm rheostat in series with the negative leg of the filament, taking out the ballast resistor. Also insert a 2000 ohm variable resistor in series with the B plus RF lead. If you find that after these insertions, the set is still hard to control, take off a couple of turns on the tickler.

(3)—O. K.

(2, 4 and 5.)—Yes.

* * *

I WISH to construct the radio frequency and detector circuit shown on page 7 of the April 30 issue of RADIO WORLD, in which a special neutralizing scheme is used.

(1)—Can separate variable condensers be used, instead of the three-section one prescribed?

(2)—Would I get any better results with another stage of tuned radio frequency amplification?

(3)—I have a two stage transformer coupled audio amplifier. Can this be used?

(4)—Can all the parts for the complete set, including the audio amplifier, be placed in a seven by twenty four inch cabinet?

(5)—I note that a fixed grid leak is used. Can this be supplanted by a variable grid leak?—ARTHUR J. KOCH, Athens, Ga.

(1)—Yes.

(2)—No.

(3, 4 and 5)—Yes.

* * *

I HAVE the circuit diagram of a two-stage transformer coupled audio frequency amplifier. The filaments of both tubes are connected to separate ballast resistors, yet the plates are connected to a common plate terminal. There is provision for a C battery on the last tube. I would like to use a —01A tube in the first stage and a —71 in the second stage. Is this hook up all right?—LOUIS MUNN, Adams, Ill.

No. You will have to break the B plus lead, bringing the plates of both tubes to separate posts. It wouldn't hurt to install a C battery for the first AF tube.

* * *

I WOULD like to build the four-tube receiver shown in the Radio University columns of the Nov. 6 issue of RADIO WORLD. Please show a panel layout for this set, using Remler condensers with dials, and a filament switch. the potentiometer and the second double circuit jack being left out.

(2)—Explain how to hook up the radio frequency tube without the potentiometer.

(3)—How would the filament switch be wired in?—LEON MULROOM, Macon, Ga.

(1)—The panel layout is shown in Fig. 537. A seven by twenty-four inch panel is used. The condensers are placed at left. The four rheostats are placed in a row. Underneath the first rheostat, which is in the radio frequency circuit, the filament switch is placed. The inductance switch for the primary coil in the antenna circuit, is placed underneath the detector filament rheostat. The first double circuit jack is next. The single circuit jack is underneath the last audio filament rheostat.

(2)—The connection of L2, which is the secondary coil, which went to the arm of the potentiometer, is now brought to the minus A post, or the arm of the radio frequency rheostat.

(3)—The plus A, minus B post, lead is broken.

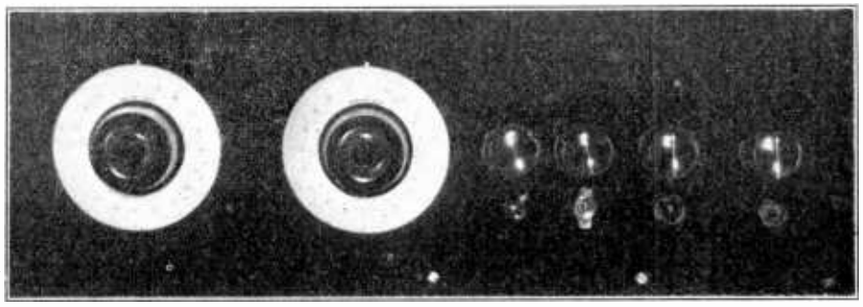

FIG. 537
The panel layout requested by Leon Mulroom.

The switch is then inserted in the broken lead.

* * *

IN REFERENCE to the five-tube Diamond of the Air.

(1)—Should the 1A Amperite be used in the last filament audio circuit, when the 112 tube is used there?

(2)—If I use a block of batteries which give me 135 volts, could I tap off for a 45 volt supply, or is it necessary to install a separate 45 volt B battery?—FRANCIS M. LOSTERS, Jersey City, N. J.

(1)—No. Use a 112 Amperite. The filament of this tube draws ½ ampere, while the 1A only passes ¼ ampere.

(2)—No, you can use the 45-volt portion of the batch of batteries giving you 135 volts.

* * *

I HAVE a five-tube RF receiver. Now, I cannot get stations below 400 meters.

(1)—Could this be due to the 150 foot antenna which I use? My friends tell me this is so.

(2)—They also tell me that if I install a .00025 mfd. fixed condenser in series with the antenna, this trouble will be cured. Is this also true?—MICHAEL JOSEPHS, Cincinnati, O.

(1 and 2)—Yes.

* * *

I RECENTLY built a four-tube set, employing a regenerative detector with the three-circuit tuner, and three stages of resistance coupled audio frequency amplification. The results on the detector are excellent, but I cannot get a thing on the output. As a matter of fact I cannot even get the B battery click. Double circuit jacks are used on the detector circuit output and the first audio circuit output. Could anyhing be the matter here?—EDGAR L. JOHNSON, Porland, Ore.

The trouble seems to be defective contact between the inner and outer terminals of the double circuit jacks. It may also be possible that you have the terminals on the second jack reversed, so that when the plug is inserted, contact is not made with plate and B plus.

I HAVE a Freed-Eisemann five-tube Neutrodyne, which I would like to make more selective. Could I use the three circuit tuner system, outlined by J. E. Anderson in the Jan. 8 issue of RADIO WORLD?

(2)—If so, please describe how to hook in. A single winding is used in the antenna circuit, as you probably know.—HENRY S. PASTORS, Troy, N. Y.

(1 and 2)—This system cannot be used. However the fixed condenser in series and the coil—variable condenser systems can be.

* * *

I HAVE a four-tube reflex. The first tube is reflexed, the second is non-regenerative and the last two are transformer coupled audio amplifiers. The filaments of the reflexed and the detector tubes are controlled by twenty-ohm rheostats. The —01A tubes are used throughout. The filaments of the last two audio tubes are controlled by a ½ ampere ballast resistor.

(1)—Would it be advisable to add another stage of radio frequency amplification?

(2)—Is this set adaptable to loop operation?

(3)—I might want to change this set into a portable. Could I use 199 tubes with success?

(4)—Would regeneration make the set hard to tune?—FRANKLIN JULIAN, Los Angeles, Calif.

(1)—No. The set would become very erratic.

(2)—Yes. The loop which should be matched to the variable condenser shunted across the secondary winding of the radio frequency transformer, is connected across the variable condenser terminals. When doing this the secondary windings are disconnected from the circuit. Of course, you cannot expect much volume and distance when using the loop.

(3)—Yes, although the signals will not be very loud. It will be necessary to insert two new ballasts in the audio filament circuit, one for each tube.

(4)—Yes.

REFLEXED SET USES 3 TUBES

(*Concluded from page 5*)

with a .00037 Karas straight line frequency condenser. The other coil, L3L4L5, was an Aero No. OS-55, tuned with a .0005 mfd. Karas condenser.

A home-constructed coil for L1L2 should have the following specifications: 12-turn primary, ¼-inch space, then a 58-turn secondary, both wound on a tubing 3 inches in diameter and using No. 20 double cotton covered wire. This coil would serve for a .0.0037 or .00035 mfd. condenser. But if .0005 mfd. is to be used here, too, reduce the primary turns to 10 and reduce the secondary turns to 50.

If a three-circuit tuner is to be converted for use in this circuit, the former tickler coil may be used as the variable primary L3, while the secondary is left intact. On top of the secondary, at the end opposite to the one where the variable primary is, wind 20 turns of No. 26 double silk covered wire, for L5. Be sure to connect this coil in series aiding. That is, the plate of the detector tube is connected to the terminal of L5 that corresponds in point of relative position with the grid connection to L4, and the two windings are in the same direction.

If a three-circuit form is to be used, and wire put on, wind the 20 turns of No. 26 double silk covered wire (L5) at the end opposite to the one where the rotary form is, then leave ¼ inch space and wind the secondary (L4), using No. 20 double cotton covered wire, the turns being the same number for the respective condenser values as specified for L2, and then putting 14 turns of No. 26 double silk covered wire on the tickler, 7 turns on each side of where the shaft pierces the rotor form.

The choke coil L6 may be wound with No. 30 single silk covered wire, and consists of 120 turns on a two-inch diameter. Otherwise, a commercial RF choke coil may be used. The inductance value is not critical, so almost any commercial RF choke may be employed.

As for the audio transformers, if of different ratios, the lower ratio may be preferred for the first stage (AF1), because of the likelihood that the primary impedance is higher. This assumes that the lower ratio was obtained in the manufacture of the transformer by increasing the primary turns rather than by decreasing the secondary turns.

The receiver is very selective, has obtained excellent results on distance, and produces a tone quality which is fixed rather by the design characteristics of the audio transformers than by any arrangement in the circuit itself, so it will pay you to use good audio transformers.

TALK TO 'PLANE IS BROADCAST

Washington.

A striking demonstration of the developments which have been achieved in radio communication was given when a conversation between occupants of an airplane and the head of the Commerce Department's Bureau of Standards, seated in his office, was broadcast by a regular commercial radio station for the benefit of all listeners within the range of the station.

The participants in this broadcast conversation were Dr. George K. Burgess, director of the Bureau of Standards, and W. B. Stout, head of the Aircraft Division of the Ford Motor Company. Two days before, telephonic and radio communication was carried on between the Assistant Secretary of Commerce for Aeronautics, W. P. MacCracken, Jr., and occupants of an airplane en route from Quantico, Virginia, to Bolling Field at Washington. This conversation, however, was not broadcast.

Broadcast by WRC

The conversation between Dr. Burgess and Mr. Stout took place about 12:10 p. m. and was broadcast through WRC. After the announcer had explained the details of the demonstration to the radio audience, Dr. Burgess requested a telephone operator to establish a connection with airplane N3 and the conversation ensued.

During the course of the conversation Dr. Burgess explained, for the benefit of the radio listeners, the significance of the experiment and the extent to which the Department of Commerce is assisting in the development of commercial aviation. The United States now has a network of more than 8,000 miles of airways, on which regular flights are made every day, carrying mail, express and passengers. The Department of Commerce has the responsibility of providing aids to navigation on these airways and has determined that these aids shall consist of a weather information system, lights for night flying and radio aids.

Radio Aids

"The development of the radio aids has been entrusted to the Bureau of Standards," stated Dr. Burgess. "They are three in number: the directive radio beacon, which provides an aerial trolley to keep air traffic on its course; marker beacons, which are small radio transmitters marking fixed points, much like milestones; and radio telephony. The Government will establish ground stations for sending radio telephone messages to the airplanes and as time goes on the airplanes will more and more be equipped with radio telephone transmitters, so that it will eventually become common for air travelers to telephone to their friends on the ground, in the fashion which has been demonstrated to you today."

New Armor AC Tube

The new Armor AC 100 tube, which takes alternating current direct from the light socket, thus eliminating A batteries, is now being distributed by the 20th Century Radio Corporation, 104 Flatbush Avenue, Brooklyn, N. Y. It is claimed for this tube that the objectionable AC hum has been successfully diminished to a point where it is not noticeable. The tube can be used for a detector or an amplifier.

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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. B. 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. Eliminator in a Cash Box, by Paul B. 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. B. 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. B. Anderson.

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

Dec. 25—A New Coupling Device, by J. B. 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. B. 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. B. Anderson.

Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight into Resistors, by J. B. 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. B. 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. B. 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 Astrakan. 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. B. Anderson. How To Figure Resistors, by Frank Logan. The 4-tube Universal, by Herman Bernard, (Part 1.)

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

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