MARCH 8
1930

**SHORT-WAVE ADAPTER PICTURE DIAGRAM**

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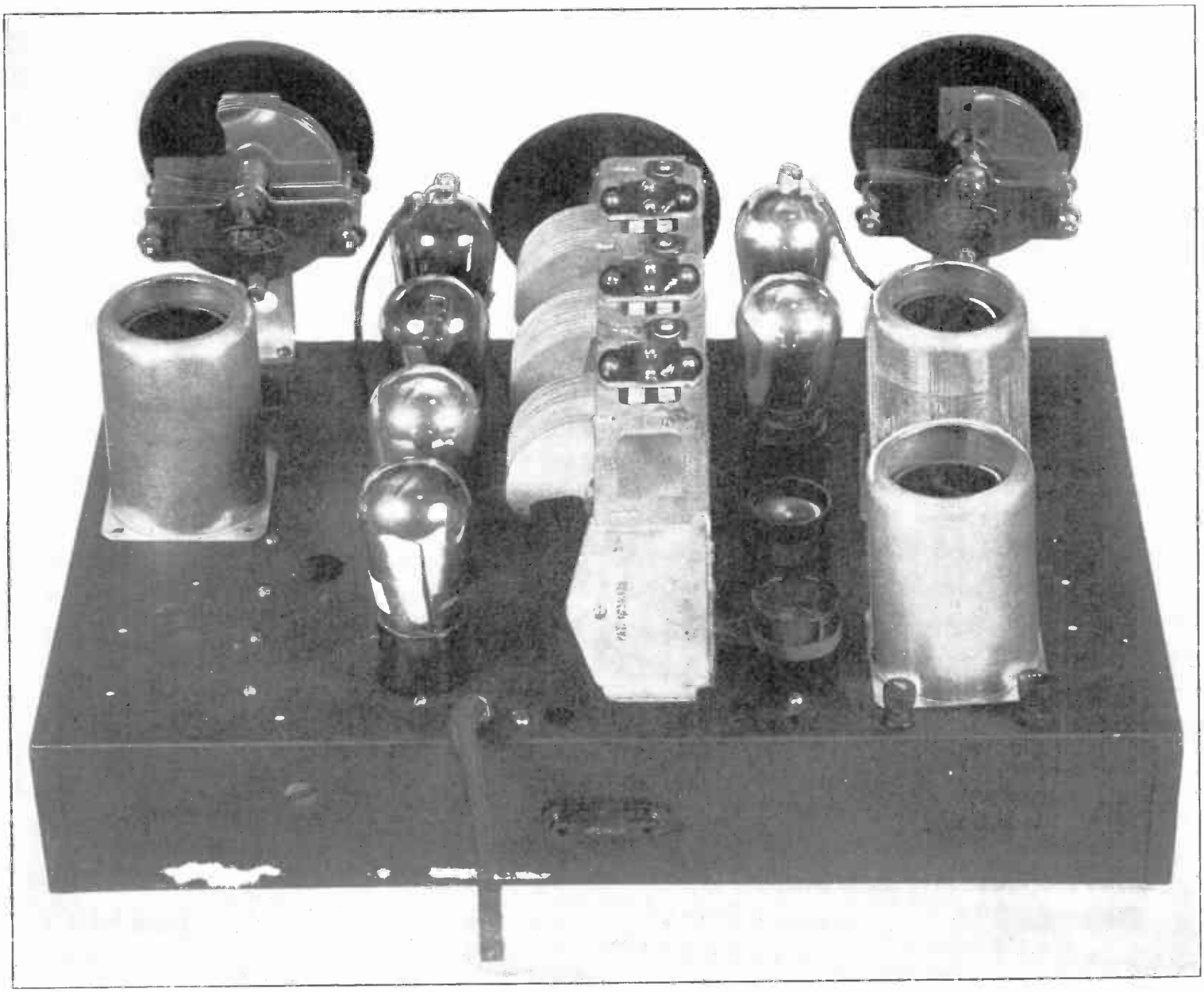
# DUAL PURPOSE BATTERY SET



A Screen Grid Receiver Excellent on Broadcast Waves and That Tunes in Short Waves as Well. See page 5.

# Eighth Anniversary Number

## of RADIO WORLD — *Issue of March 29th*

THE first national radio weekly, and for the last several years the only one, RADIO WORLD will be eight years old soon, and will publish an especially attractive and interesting number in celebration of the event. Contributors, editors and national advertisers, because of the special significance of this issue, and the extra-large distribution it will enjoy, have selected this issue as one worthy of their very best. The result will be something of predominating value to reader and advertiser alike.

One of the principal technical articles will deal with short-wave adapters for all types of AC and battery-operated sets, for one to three tubes, including some new ones of remarkable performance. There will be ten circuit diagrams on this article alone.

"Shielded Coil Design for Screen Grid Receivers" is the topic of another article.

"Answers to Questions That Can't Be Answered" will deal with familiar questions that defy a definite, accurate answer, but which are asked time and again, and the interesting reasons for their unanswerability are set forth.

"A Four Tube Receiver You Can Put in Your Pocket" will be set forth constructionally, as a complete answer to the demand for compactness.

"Audio Coupling Methods" will be another of the technical articles, of which there will be a fascinating profusion.

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# A Dual Purpose Set

## Tunes in Broadcasts by TRF and Also Short Waves

*By Donald Masters*

SHORT wave adapters and short wave receivers have always had a strong appeal to radio enthusiasts in all categories because of the enormous carrying powers of frequencies above the broadcast band. Unfortunately, short wave adapters have not been as successful as enthusiasts have been led to believe. Short wave receivers, as a rule, have given expected results for those who had patience enough to make them do all of which they are capable, but the greatest interest, in point of numbers of fans, has been for adapters. It is not far from

### LIST OF PARTS

C1, C10, C11—Three .01 mfd. condensers.
C2, C4—Two .00015 mfd. variable condensers.
C3—One 80 mmfd. trimmer condenser.
C5, C9—Two .00025 mfd. grid condensers.
C6, C7, C8—Three section gang condenser, .00035 mfd. each, with trimmers CT1, CT2, CT3.
C14—One .00025 by-pass condenser.
C2, C13—Two 1 mfd. condensers, 200 volt test.
L1, L2, L3, L4—Three pairs of short-wave plug-in coils.
L5L6, L7L8, L9L10—Three screen grid coils with open-top shields (SH-3, with shields).
R1—4 ohms.
R2—30 ohms.
R3—30 ohms.
R4—4 ohms.
R5—0.1 megohm.
R6—2 megohms.
R7—2 ohms.
R8—0.25 megohm.
R9—2 megohms.
Rh—30 ohm switch rheostat.
Three dials, one knob.
Two brackets.
Drilled, socketed sub-panel.
Six binding posts.
A, B, and C batteries.
Tubes: one 201A, Two 222, one 240 and two 112A.

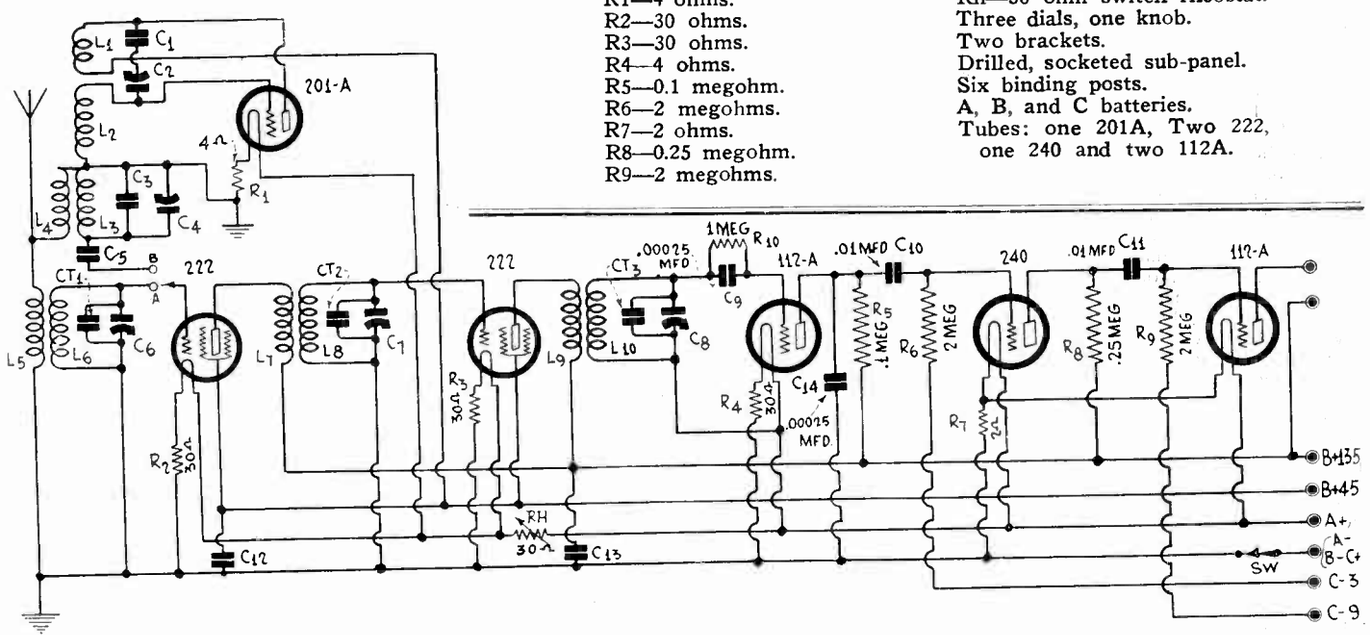



FIG. 1
THIS DIAGRAM SHOWS A COMBINATION OF A BROADCAST RECEIVER AND A SHORT WAVE TUNER AND OSCILLATOR FOR CONVERTING A BROADCAST RECEIVER INTO A SHORT WAVE SUPER-HETERODYNE.

the truth to say that such adapters have been generally unsatisfactory.

After the facts have compelled one to admit this condition, and knowing the enormous potentialities of the high frequencies, one naturally asks why the adapters do not function satisfactorily.

The answer is not difficult to find. All that is necessary is to examine the receiving circuit after the adapter has been connected to the broadcast receiver. Usually one finds that it consists of a regenerative circuit in the high frequency level followed by an audio amplifier of the usual type. Such a circuit is not at all satisfactory for broadcast reception, so why should it be at higher frequencies. There is no reason why it should be. Moreover, the adaptation, that is, the method of connecting the high frequency, regenerative detector to the audio amplifier, is not made under optimum conditions so far as the higher frequency is concerned. The result is inevitable, and it is not what has been claimed for the circuit, although it is exactly what one should expect after a little consideration. There is not enough R.F. amplification.

One of the most promising methods of receiving short wave stations and utilizing the existing broadcast receiver is that of converting the high frequency signals to

(*Continued on next page*)

# Dependable Service in T

## High-Gain RF Makes Dual Perfor

signals of a lower frequency which can be received on the broadcast receiver. That is to say, to set up an oscillator and a modulator operating at the high frequency and adjusting the beat so that it falls within the tuning range of the broadcast receiver. When that is done nothing of the broadcast receiver is discarded while short wave signals are being received, as is done when ordinary adapters are used, and in order to receive short wave signals it is only necessary to produce a beat frequency signal of the same intensity as the intensity of the weakest broadcast station to which the receiver will respond. This should not be very difficult.

This type of short wave adapter has another advantage. Most broadcast receivers are more sensitive at certain frequencies than at others. Therefore since the beat frequency may be selected at will it is possible to select that for which the broadcast receiver is most responsive. This might be a frequency near the upper limit of the tuning range, which, in many instances, may be just above the broadcast band, say at 1,700 kilocycles. Indeed, the broadcast receiver may be "trimmed" so that the sensitivity at this particular frequency is very great.

### Previous Applications

It will be realized that this method of receiving short wave signals amounts to super-heterodyne reception. The broadcast radio frequency tuner becomes the intermediate frequency tuner and that frequency to which the broadcast receiver is tuned becomes the intermediate frequency. Advantages of this method could be enumerated almost without limit. It may be added that the usual disadvantages of the super-heterodyne method are of little consequence when the intermediate frequency is so high that it falls in or above the broadcast band.

Sporadic efforts have been made many times in the past to popularize the Super-heterodyne method of receiving short waves in conjunction with the broadcast receiver, but little sustained interest has been aroused. There seems to be no good reason for this, unless it be that the manufacturers avoid the Super-heterodyne in every form because of patent conditions. This, however, should in no way deter those who build their own from parts. The method really deserves careful consideration by all those who own broadcast receivers of any kind and who at the same time are interested in short wave reception.

### A Different Accent

It is a fact that with very simple radio receivers designed for short wave reception only it is nothing unusual to receive stations from far corners of the earth, not with faint headphone intensity but with fair loudspeaker volume. How much more, then, can be expected when the amplification inherent in the broadcast radio frequency amplifier is added? Simple tests indicate that signals that were just barely audible close to the loudspeaker with the conventional short wave receiver become easily overload the loudspeaker when the Super-heterodyne method of reception is used, without changing the audio frequency amplifier at all. The difference, of course, is due to the radio frequency amplification in the broadcast receiver used as an intermediate frequency amplifier. That the signals should be so much stronger should cause no wonderment for is not the broadcast receiver operated at its optimum adjustment.

It is true that a few experimenters have tried this method of short wave reception and have reported that no results were obtained. Such reports have also been made of standard receivers used in millions of homes. It is so easy to say that a receiver is no good and so difficult to admit that a few mistakes have been made, or that a few critical faults have crept into a circuit despite carefulness on the part of the builder. The theory of the short wave Super-heterodyne receiver, used as an adapter with the standard broadcast receiver, is as sound as that of the ordinary Super-heterodyne receiver, and no one has the temerity to say that this receiver, correctly built, is "not there." Lives there a man with so little imagination and so little ambition that he has not dreamt of the day that he could boast of a Super-heterodyne? If there does he comes in the switch-turning category of radio fan, not in the class that is thrilled by a voice from far-away places, by a voice that speaks in a different accent or a different language.

The Super-heterodyne short wave adapter will bring in the strange voices as no other receiver, for it will reach out for the waves that emanate from radio stations the world over. It will widen the reception range of the short wave receiver as the broadcast Super-heterodyne widens the range of the ordinary broadcast receiver.

Naturally, the reception range of every receiver of this type will not be the same, for it depends on the sensitivity of the broadcast receiver. If the adapter is placed ahead of a broadcast Super-heterodyne—and it can be in many of them without change—the range will be very wide indeed. If it is placed in front of a three tube circuit, even if regenerative, it will not be any better than the range of that receiver without the adapter, if as good, because the range-widening amplifier is not in it. If the adapter is placed ahead of a multi-tube screen grid receiver the reception range will not be much inferior to the range when the adapter is used with a Super-heterodyne. In determining the short wave reception range we must consider the potentialities of the receiver in front of which it is placed.

### Two Receivers in One Box

So keen is the interest in short wave reception that many fans are considering the advisability of building two receivers into the same cabinet. How can this be done? They want to know. It is indeed a simple matter, especially if we apply the Super-heterodyne method. In Fig. 1 is a complete diagram of a dual receiver designed to be operated on filament batteries. As will be seen, this is no more complex than any other six-tube receiver. This receiver, however, is not really a six-tube receiver so far as broadcast reception is concerned. It is a five-tuber for broadcast reception and a six-tuber for short wave reception.

The arrangement of the parts for this dual receiver may be seen from the accompanying photographs, which show how this particular set was built by one engineer. But let us return to the diagram to find out how the circuit works.

### Receiving Short Waves

In the grid lead of the first tube is a switch by means of which either the tuned circuit L6C6 or the condenser C5 can be picked up. When L6C6 is picked up the upper tube may just as well be taken out of its socket for it is not functioning. The receiver is connected for receiving broadcast stations. It then contains a tuner of three resonant circuits all controlled by the same shaft. Following the detector is a standard resistance-coupled amplifier having one high mu tube and one power tube.

When the grid lead switch is set to pick up C5 the circuit becomes a Super-heterodyne for short wave reception. C5 acts as grid condenser for the short wave modulator, the first lower tube serving this purpose now. The grid leak is omitted for it was found that better results were obtained without one.

The antenna is shown as connected to two coils, L4 and L5. In practice only one should be connected at a time. Hence two binding posts may be provided, one for each coil, or a simple switch arrangement may be used.

The upper tube is the short wave oscillator, L1 and L2 being the plate and grid coils, respectively. These are tuned with C2, a small variable condenser mounted on the panel. C1 is connected in series in order to reduce the capacity of the variable condenser C2 to a value consistent with the frequency to be covered. Note that the oscillating circuit is completed through C12 and the ground.

When the circuit is arranged for short wave reception there are two intermediate tuners, the first being eliminated by the switching arrangement. It was found experimentally that satisfactory short wave reception could be obtained with only the two intermediates.

### Practical Suggestions

All the parts are to be mounted on a metal sub-panel specially provided with mounting holes for the sockets and the tuning condensers. Mount eight four-prong sockets as shown in the photographs. Six of these sockets are for the tubes and two for the high frequency coils L1L2 and L3L4, since these coils must be of the plug-in type in order to accommodate different short wave tuning ranges.

In wiring it is advisable to complete the filament circuit first, including, of course, the rheostats and the various ballast resistors. Then the coils of the broadcast portion of the receiver should be wired up and after that the condensers. Having completed this the coils and the condensers of the short wave adjunct should be wired.

Really, there is nothing unusual about the receiver except the combination of a short wave tuner and an oscillator with a broadcast receiver. It is this combination which transforms the circuit into a Super-heterodyne receiver for short waves.

The present circuit is designed for battery operation but it will work with any source of pure DC. When a B supply unit is available that can be used with the assurance that it will work, provided, of course, that it is a good one. It must be realized that the audio amplifier in the circuit is resistance coupled, which demands especially good filtering in the B supply unit. And this filtering should be done mainly with large by-pass condensers.

### Suggested Changes

Should motorboating be encountered with the B. supply that is available the best remedy is more capacity across the voltage taps on the voltage divider. If this fails to remedy any trouble that may be met, recourse must be taken to smaller grid leaks for R6 and R9. There is no case of motorboating which is so serious that it cannot be remedied by reducing the values of the grid leaks. But do not use low values of grid leaks unless motor-

# wo Fields by One Receiver

## mance Possible in Screen Grid Design

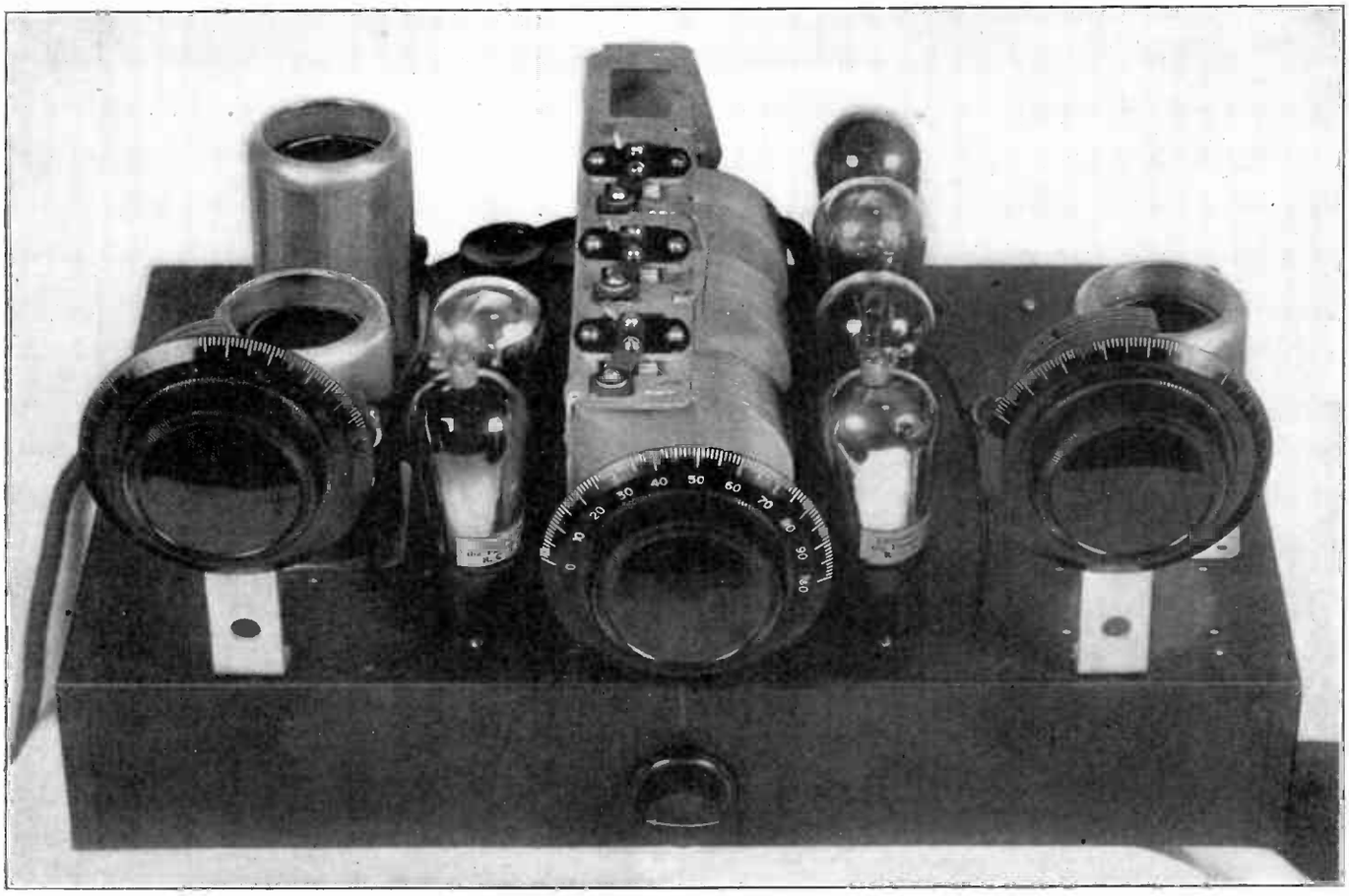


FIG. 2
FRONT VIEW OF THE DUAL-PURPOSE RECEIVER SHOWING THE PANEL LAYOUT AS WELL AS THE LAYOUT OF THE PARTS ON THE SUB-PANEL.

boating makes it necessary, for low values of grid leaks nullify in part the special virtues of the resistance coupled amplifier.

Those who are experimentally inclined, and that must include all who would build a dual purpose receiver, might try altering some of the connections and values, aside from those suggested as cures for possible motorboating. For example, the by-pass condenser in the plate circuit of the detector is given as .00025 mfd. Different results will be obtained if this condenser is larger, and it may be that those results will be more satisfactory. A larger value for one thing will make the circuit more sensitive but it will also reduce the amplification on the high audio frequencies. Another change that may be found desirable is to reverse the connections of the primary of the tuner following the first tube. If this change is made do not judge its effect immediately, but first readjust the trimmer condenser on the tuning condenser following it. When the primary of one of the coils is reversed the field of that coil is also reversed and stray couplings will be different. Whether the results will be an improvement will depend on which way the connections were made in the first place.

# Low Notes for Realism

If the low notes must be reproduced in order to make the reproduction a little more nearly realistic, it may be done by using a large baffle board which will put a brake on the armature on the extremely low frequencies. Such a brake would prevent the armature from rattling yet bring out the low notes strongly. The braking, or damping would also level out the response characteristic in case there were any resonance effect on the low note region, and therefore it would make the overall response more satisfactory all around. It would not be necessary to reduce the amplification on the middle notes in order to prevent the speaker from running away on the sub-audible frequencies.

A real difficulty avoided when the amplification on the low notes is suppressed is motorboating. This is really due to a combination of high amplification on the low notes and regenerative resonance effect. While motorboating can always be prevented by using enough by-pass capacity in the B supply and across the various sections of the voltage divider, it is practically impossible to do so when the disturbance occurs on a sub-audible frequency, because the capacities needed would be enormous. A better way of avoiding it, though somewhat of a makeshift, is to reduce the amplification on the low notes in such manner that there is no appreciable reduction in the amplification in the audio frequency range. The simplest way of doing this is to put a condenser of small value in the grid lead of one of the amplifiers and then using a grid leak of a comparatively low value.

Much of the overloading that occurs in an amplifier and in the loudspeaker is due to resonance at some frequency, introduced accidentally or intentionally. The amplifier and the speaker may be quite able to carry the volume down to the lowest audible note as long as only true amplification is involved, yet they may appear to be greatly overloaded just because of some resonance effect. This resonance may be due to a condition in the B supply, a tuning effect in the coupling units, a resonance peak in the characteristic of the speaker, or it may be due to a condition in the room in which the speaker is. Any resonant condition in the bass range gives rise to apparent richness in low notes, and at the same time unsatisfactory reproduction. This should not be counted against the receiver. If the resonance is eliminated so that the amplification is even, though it may be dropping on the low notes, the reproduction will sound more nearly realistic.

When the resonance has been eliminated, the amplification on all the low notes may be increased materially without overloading at any point, and the reproduction will be still more nearly realistic.

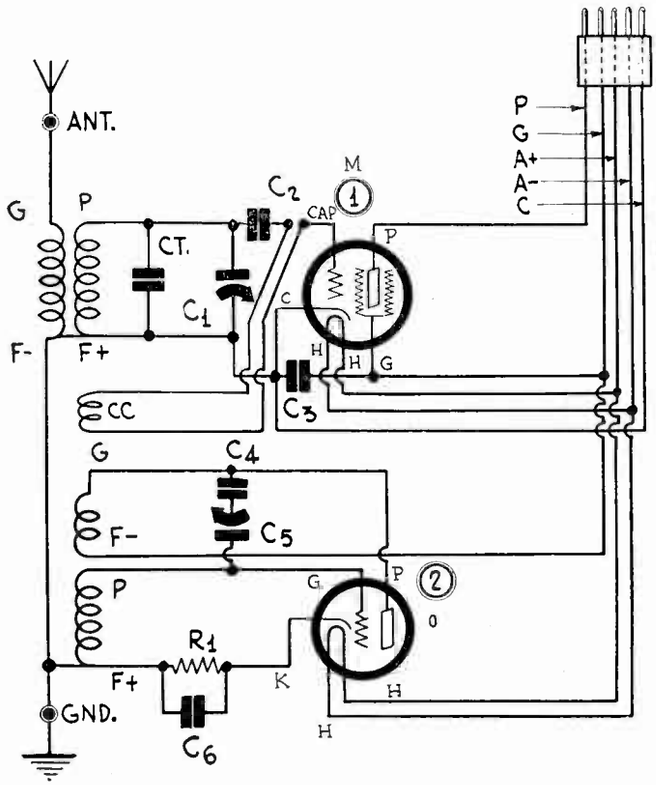
The low notes are essential to realistic reproduction provided that they are not exaggerated either over the entire low note range or at one or more frequencies.

# Mounting and Wiring AC

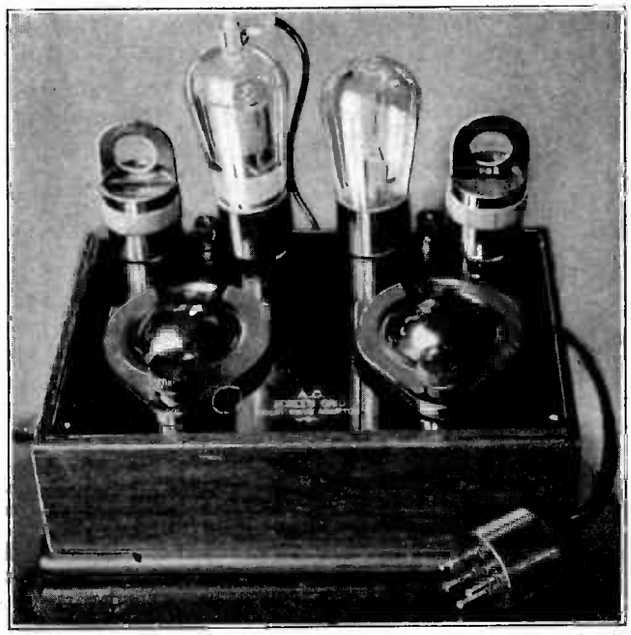
## Device Useful in Conjunction with any

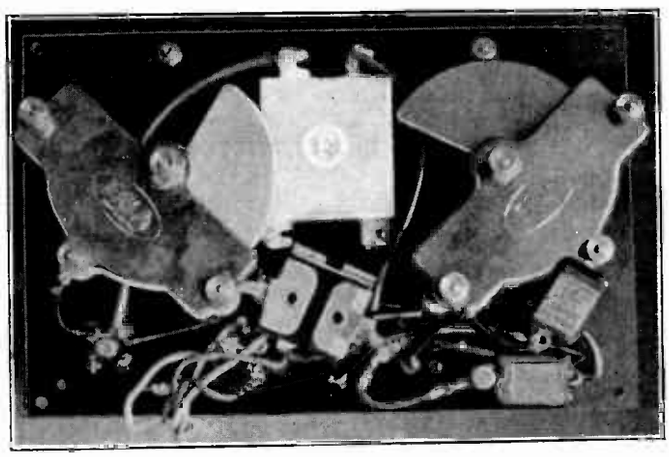
*By Capt. Peter*

**Contributing**




AN EXTRA COUPLING COIL, CC, IS SHOWN IN THIS SCHEMATIC DIAGRAM OF A SHORT-WAVE ADAPTER FOR AN AC SCREEN GRID RECEIVER.





VIEWS OF THE ADAPTER ON A 8⅜ x 5½ INCH PANEL IN AND OUT OF A CABINET.

*[Part I of this article was published last week, in the March 1st issue. The final installment follows.—Editor.]*

AN AC short-wave adapter that really works, even under what may be termed adverse conditions, is welcome indeed. When it is an adapter that uses in corelationship a receiver substantially in the entirety, the benefit is twice welcome, since ordinarily adapters rely on a certain formation of the detector circuit into which they plug, and if the detector circuit is not as intended, no short-wave signals are heard. For instance, a regeneration condenser is usually connected from plate to the grid coil, but if a detector bypass condenser is in the receiver from plate to ground, very likely there will be no regeneration, hence no short-wave reception.

The present adapter, as was stated in last week's issue, tunes in the short waves, and converts them to an intermediate frequency, which is amplified by the receiver. The tuning circuits of the receiver are made resonant to some high frequency, higher than any broadcast frequency, if possible, and that same setting of the receiver is used whenever the adapter is plugged in, to maintain the same dial settings for the same stations, time after time, on the adapter.

### Real Results From Two IF Stages

The first tube of the AC receiver must be a 224, and this adapter is not useful on any receiver that does not fulfill this requirement. This 224 is removed from the first RF socket and placed in the modulator socket (1) of the adapter. Then a 227 tube, required additionally, is placed in the oscillator socket (2) of the adapter. So you have a short wave mixer that uses plug-in coils, directions for making which coils were described last week.

The intermediate channel will consist of one fewer than the number of RF stages in the receiver, and while results will be obtained even if the RF of the receiver consists of only two stages, leaving just one intermediate channel, these results are only fair. Real results are obtained when the receiver has three stages of RF, resulting in two stages of intermediate amplification.

The present instalment will deal principally with the mounting of parts and with the actual wiring itself. While the adapter is small, and there are not many connections, the very fact of compactness requires especial attention to the connections, especially to make them most effective. Also, the fact that four-prong (UX) tube sockets are used for holding the plug-in coils, and five-prong (UY) sockets for the two tubes, may cause some confusion to novices. However, the full-scale picture diagram of the wiring, published herewith, should clear up those points.

Especially the mechanical features are important, as a few odd ones arise.

The panel used was 8⅜ x 5½ inches, and the picture diagram, centered thereon, will give adequate definition of where to locate holes and parts.

### Tuning Condensers Set Back

The tuning condensers are mounted on the panel with the aid of their single hole mounting feature, but are set back about ¼" by the use of special washers between the back of the panel and the front of the condenser. The reason is that a 1 mfd. bypass condenser would be touched by the moving plates of both tuning condensers were not this clearance afforded.

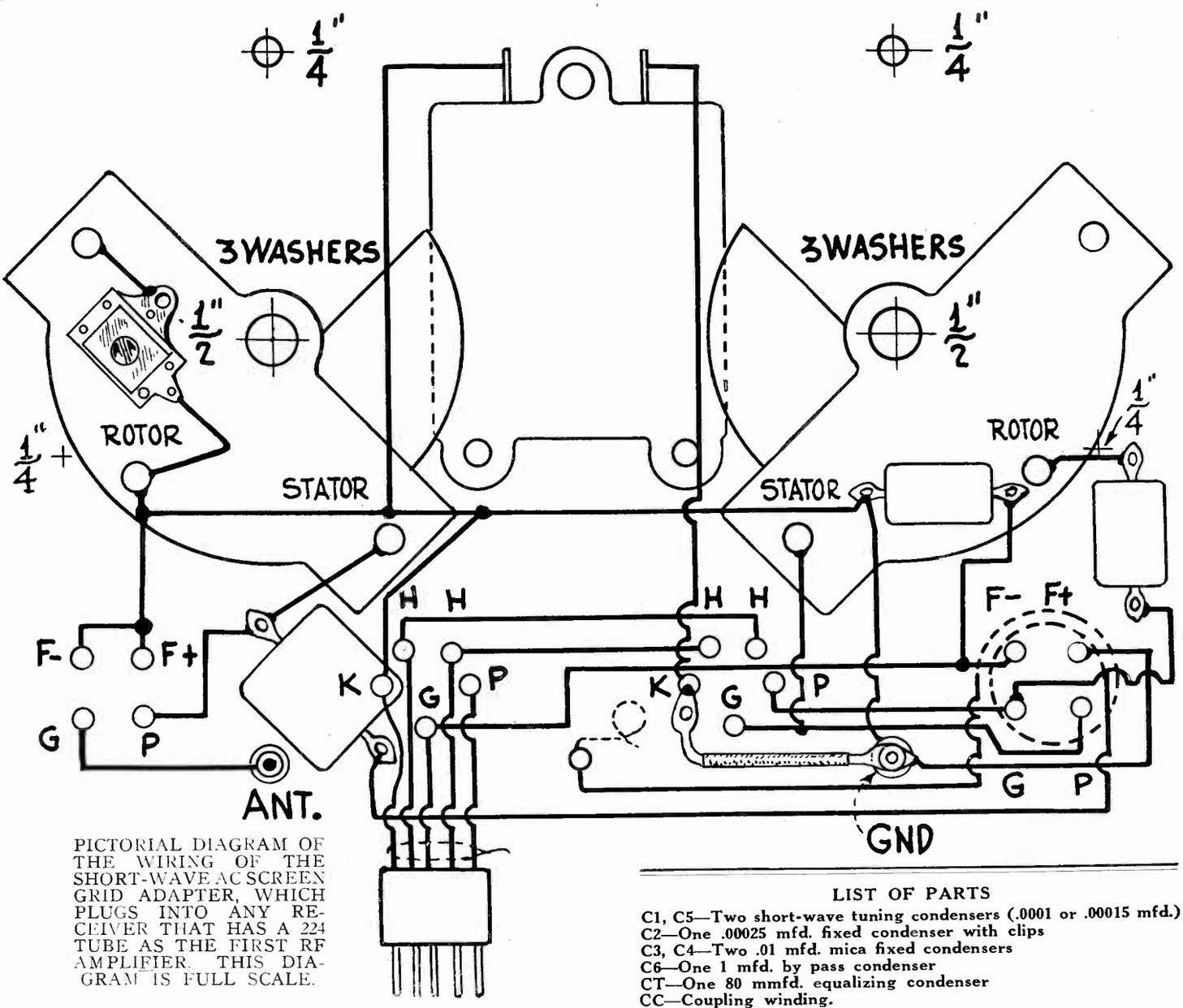
If the rotors of the prescribed condensers do not turn easily with finger pressure, adjust the moving plates. At front of the condenser bushing is a circular nut, which should be tightened

# S G Short Wave Adapter

## Receiver That Has 224 as First RF Tube

*V. O'Rourke*

**Editor**




PICTORIAL DIAGRAM OF THE WIRING OF THE SHORT-WAVE AC SCREEN GRID ADAPTER, WHICH PLUGS INTO ANY RECEIVER THAT HAS A 224 TUBE AS THE FIRST RF AMPLIFIER. THIS DIAGRAM IS FULL SCALE.

down when the correct relative position of the rotor is established. At rear is a bushing with set-screw built in, a butterfly lockwasher, a thumbscrew and a tightening nut. By adjusting the thumbscrew and tightening down the nut, then restoring the butterfly and set-screw device, the adjustment will be completed. The plates should turn around freely without touching.

The dials are mounted next. They are pressed onto the condenser shafts. If the shaft will not pass, or if the dial slips on too loosely, thus not engaging the shaft, remove the scale from the dial, by prying upward toward the window, and at the same time outward. The scale will come off, as it is held by a phosphor bronze spring. Tighten or loosen the nut you find there, depending on what condition you desire to remedy. Try putting on the scale alone, and when this is all right, restore the scale to the dial and put on the dial on the condenser.

The holes for receiving the three mounting screws of the dial are purposely oversized, so that adequate leeway will be afforded, thus preventing the dial from binding. The panel hole for the condenser bushing is ½ inch, which is 1/16 inch oversized, to elaborate on this precaution. But when the condenser is properly tightened down and the dial likewise there will be full freedom of motion.

Only two of the dial mounting holes are easily accessible. The third is partly obstructed by a binding post on the tuning condenser, in each instance. One of the three holes of each dial also is used for mounting the 1 mfd. bypass condenser, so before tightening down all the dial nuts, put this condenser in place.

To attach the obstructed nut, hold the panel perfectly flat, put the nut flat on your finger, hold the nut sideways on top of the screw, and then use the screw-driver to push the nut flat and hold it there. Then with a pointed knife, toothpick, match or anything else, you can start the nut, finishing it by working a screwdriver against one corner after another as the nut is

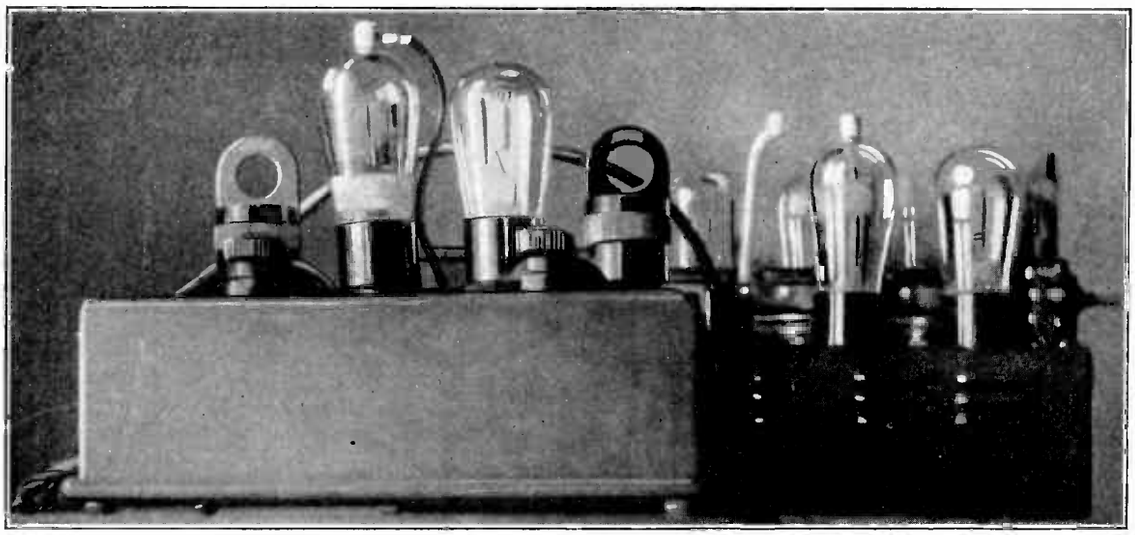
*(Continued on next page)*

### LIST OF PARTS

**C1, C5—Two short-wave tuning condensers (.0001 or .00015 mfd.)**
**C2—One .00025 mfd. fixed condenser with clips**
**C3, C4—Two .01 mfd. mica fixed condensers**
**C6—One 1 mfd. by pass condenser**
**CT—One 80 mmfd. equalizing condenser**
**CC—Coupling winding.**
**R-—One 800 ohm. wire-wound biasing resistor**
**Ant., Gnd.—Two binding posts**
**Two sets of short-wave plug-in coils, three coils to a set, total six coils**
**One AC short-wave adapter cable, five-prong plug at one end.**
**Two four-prong sockets (for coils)**
**Two five-prong sockets (for tubes)**
**One grid clip**
**Two vernier dials**
**One panel and cabinet**
**Six extending washers**

# Operation o

## How Oscillation is Assured



THE ADAPTER HOOKED UP TO A TWO-STAGE SCREEN GRID RF RECEIVER, THE 6-TUBE NJ-30 OF THE JACKSON LABORATORIES, ON WHICH IT WORKED FAIRLY WELL. THE SIXTH TUBE IS THE 280.

(*Continued from preceding page*)

driven home. The mounting of this nut is greatly facilitated if it is done first, among the three, and the dial is not pushed all the way home, for then the screw can be brought up to the panel, against which the nut is held, and the starting done that way.

### Cutaway Plates Come Out First

When the condensers and dials are mounted be sure that the motion is easy, and that the condenser turns whenever the dial is turned. Now work each dial knob, turning it to the right, in clockwise direction, which makes the numbers turn the other way, but to increase in numerical reading. When you come to 100 on the dial stop, and, holding the knob, turn the rotor plates of the condenser until they are entirely enmeshed. When you start to unmesh the cutaway side of the rotor should come out first.

Mount the antenna and ground binding posts with a lug between the panel and the fastening nut.

The sockets are mounted on the panel at the factory, but if you are to make your own panel, mount the sockets so they will occupy the positions shown in the picture diagram. There are four sockets. Two, of the four-prong or UX type, are at extreme left and right, and two, of the five-prong or UY type, are in between. The one at left is M, for the modulator, or socket No. 1 in the schematic diagram, to receive the 224 tube. The one at right, also UY, is O for oscillator, socket No. 2, for the supplementary 227 tube.

The sockets are mounted (top view) so that the filament posts of the coil sockets are and the heater contacts of the tube sockets are toward you, the tubes at rear, sockets themselves at rear. Hence as to the tube sockets, cathode is at left, plate at right, grid or screen grid at rear, heaters at front. When the panel is turned downside up, this is done by tipping toward or away from you, not left to right, so the sockets come near you and the cathodes and plates, as well as the G and P springs of the coil sockets, maintain the same left-and-right position are when the panel is upside down. But the filament and heater prongs are now toward the rear, and the grid or screen grid prongs toward the front.

The "filament" springs of the coil sockets, of course, have nothing to do with any filaments, but receive two prongs of the plug-in coils, the end of the primary and the end of the secondary.

To repeat the idea of relative positions, the sockets are in the same order when you look at the bottom as when you look at the top; left to right, modulator coil, modulator tube (224), oscillator tube (227) and oscillator coil.

By their relative positions the two coils couple. This coupling is enough to produce good results where the receiver used has at least three stages of radio-frequency amplification. It makes no difference whether the first stage is tuned in the receiver, as it becomes the modulator and is tuned by the adapter,

This coupling may be made stronger by returning some of the modulator grid voltage to the oscillator and taking some of the oscillator voltage into the grid circuit. How this is done the schematic diagram shows clearly. It is not imperative in all instances to use this additional coupling but it is just as well to include it, as no harm can result. The extra winding is a permanent fixture, and is built into the subpanel. The dotted circle around the oscillator socket in the picture diagram shows the location, the dots signifying that the coil is on top of the panel.

### Get This Coil in Right

When coils are plugged into and taken out of the oscillator socket, the coupling winding remains there, being a fixture, so the coupling is effective on all coils. The picture diagram includes this extra coupling coil, which may consist of from 6 to 12 turns of any insulated wire, No. 18 to 23, on 1¼" diameter.

The connection to the extra winding is made from the control grid of the 224 modulator, a flexible lead with grip cap that passes through the panel to the top to reach the tube. The other side of this coupling coil goes to one side of the grid condenser, the other side of which condenser goes to the stator of the modulator tuning condenser and to the P terminal of the left-hand or modulator coil socket. These directions are specially given, so that the coupling coil will not be put in the wrong place, and the tuning condenser and its coil adjunct will not be connected to the flexible lead that penetrates the panel. This flexible lead goes to one side of the coupling coil as stated, and the other side of the coupling coil goes to the grid condenser. Knot the flexible lead underneath and on top to prevent play.

No leak is shown in the modulator, as the 224 proved more sensitive without one. However, the specified grid condenser has leak clips and a leak may be inserted experimentally. Anything from .5 to 5 meg. may be tried. If the tube were a 227 the leak would be far superior, but evidently there is stray leakage in the 224 tube, and if your tube has little, you might try the leak. If you do, have the grid condenser on the tuning condenser with clips downward, that is, toward the panel.

The socket second from left has to take the cable leads besides the other leads, but there is room on the lugs of the socket springs. The combined connections may be made with one soldering operation if the leads to the lugs of this socket are held in place by friction until you are ready to wire in the cable, which is the last piece of wiring.

The cable has a five-prong plug at one end, to go into the first RF socket of the receiver and has marked or colored terminals at the other end. The markings are to be removed, if any exist, but as much of the wire retained as possible. Don't simply snip off the markers. Rather, unsolder them. As you do so, tie an identifying tag on each lead, or note the identities of the leads in respect to the different colors of the wire insulation. Write down this code.

Pass the cable through the hole in the cabinet, which is at the left side, and tie a single knot in three of the leads, and in the two others also as one operation, just where the cable's common covering enters. Thus any outside pressure on the cable will be taken up by the knots, and will not injure the connections to the socket.

### Table as Guide

The following table may guide you in the event you use the same cable I did:

| *Cable Marker* | *Color Identification* | *Connections to 224 Socket* |
|---|---|---|
| **A+** | **brown** | **heater** |
| **A—** | **slate** | **heater** |
| **G** | **blue** | **screen grid** |
| **P** | **red** | **plate** |
| **C** | **yellow** | **cathode** |

Still discussing the cable and its adjuncts, the heater terminals of the 224 socket are connected by insulated wire of No. 18 size, or stranded equivalent, to the heaters of terminals of the oscillator socket, or use AC cable. The screen grid post of the 224, the socket that takes the cable, goes also to the F— terminal of the oscillator coil. P does not connect to any point except the plate of the 224 tube, because it carries the intermediate carrier fre-

# f Adapter
## and Stations Are Tuned in

quency to the receiver. C goes to the 224 cathode, which is grounded, as the 227 cathode goes to a resistor.

Secure the panel to the cabinet with four wood screws. You are nearly ready to tune in.

**Directions for Operation**

To operate the adapter in conjunction with your receiver, do the following:

(1)—Remove the antenna connection from the binding post of your receiver and place it instead on the antenna post of the adapter. Do likewise with the ground connection to the ground post of the adapter. The receiver itself remains grounded this way, because the 224 cathode is grounded, and this lead goes to the ground post of your receiver through the wiring of the receiver itself.

(2)—Remove the 224, first RF tube from your receiver, leave the grid clip hang free and clear of obstruction, unconnected anywhere, and put this tube in the modulator socket of the adapter, connecting the grid clip of the adapter to the cap of the 224.

(3)—Insert the cable plug in the vacated first RF socket.

(4)—Insert a 227 tube in the remaining tube socket of the adapter. This tube you can not remove from your receiver, but must supply additionally.

(5)—Insert the No. 2 coils in the oscillator and modulator coil sockets.

(6)—Turn on the switch of your receiver. Wait one minute.

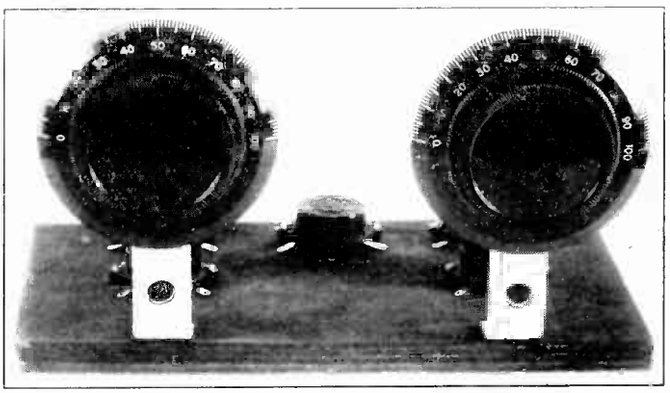
(7)—Tune in.

**Trouble Shooting**

The chief sources of trouble are not in the adapter at all, but in the receiver. If the plate screen grid voltage on the 224 is not 50 volts or more you may not get oscillation, hence will hear nothing. If no oscillation is present, test this voltage. If it is under 50 volts, reverse the oscillator coil connections, so that G and F minus go in the plate circuit and P and F plus in the grid circuit. This puts the larger winding in the plate circuit and improves the chances of oscillation.

However, the 227 tube may be weak. Be sure you use a tube that is a good oscillator.

You can test for oscillation with a moist finger. You know where to get the moisture. The oscillator condenser will cause a decided "plop" when earphones are used, when the moist finger touches either stator or rotor, but the louder plop will be at the stator. Not just a faint response should be present, but a keen lively sound. You can make and break contact of the finger to the oscillator and imitate the reception of code, when the oscillation is present.



AN EXPERIMENTAL SET-UP FOR THE ADAPTER ON A BREADBOARD.

The voltage on the adapter tubes should be at least 2 volts on the heaters. It is obvious that an extra tube is being lighted from the 2.5 volt secondary, and this extra drain may reduce the voltage, but it should be at least 2 volts. If it is not, or if it changes a little from time to time, either the power transformer will not stand the overload, in which case the voltage on the 227 heater in particular is too low to produce oscillation, or there is a loose or poor contact at the socket, between the cable lead and heater prongs of either tube, or a poor socket in the receiver. If no oscillation results, due to too low plate current, you may run the oscillator B lead (usually F minus of the oscillator coil) independently to a higher B voltage, if accessible. If this is not possible, and the heater voltage is less than 2 volts, while the 227 plate voltage is under 50, the adapter is not suited to your receiver. This condition will prevail in relatively few instances, as the adapter was tried out on sixteen different receivers of modern vintage and worked on all of them.

When changing coils, turn off the juice. If you don't, the oscillator grid may block. Sometimes you can bring the grid back into service by lightly tapping the 227. The grid blocking will not injure the tube, only delay return of oscillation for half a minute or so.

# Four Short Waves Juggled at Once

Radio juggling is developing into a fine art at Schenectady, N. Y.

Recently signals from three short wave stations up in the air at the same time were handled by WGY with all the ease and faultless grace of a vaudeville juggler.

Listeners tuned to WGY's wavelength sat back and enjoyed the performance though at times they were hopelessly jumbled as to time and season. The signals originated in the Summer and in the winter, in the daytime and night. Signals starting out tonight were heard this morning, and signals originating tomorrow arrived today.

**Gale and Snow, Sun and Flowers**

"The sun has been up two hours here, the wind is blowing a gale, snow is piling into impassable drifts, and automobiles are abandoned at the roadside this fine Winter's morning," a voice from W2XAF, near Schenectady, N. Y., announced one recent morning about 8:30.

"I'm never going to shovel another flake of snow." came from W6XN, at Oakland, California. "We won't see the sun for another hour this Tuesday morning, but the weather, as always in California, is very comfortable."

"Snow sounds good to us," came a voice from VK2ME, Sydney, Australia. "It's bedtime here, 11:30, Tuesday night, but many folks are down at the beach enjoying surf bathing and trying to get relief from 90 degrees temperature and the oppressive humidity of this mid-Summer night."

Then a yawn is heard from 2YA, Wellington, New Zealand.

"It's about time for us to sign off; 12:30 Wednesday morning and delightful Summer weather. Snow? What is snow?"

Sometimes the speakers became a bit confused. A Schenectady speaker thought he was addressing a chap in Oakland, only to find that it was Australia answering him and Oakland laughing at the mistake.

Two weeks ago, radio engineers of the General Electric Company established a working, experimental schedule with engineers of the Amalgamated Wireless Australasia, Ltd., of Sydney, Australia. On successive Tuesday mornings, starting at 5:00 o'clock Eastern Standard Time, a two-way talking circuit was established.

Schenectady talked through W2XAF, the 31.48 meter station, and Sydney engineers, A. S. MacDonald and P. M. Farmer, talked through VK2ME, the 28.8 meter station.

Recently the operator at 2YA, at Wellington, New Zealand, came on the air, with Sydney and Schenectady and then W6XN, the General Electric short-wave station at Oakland, came in, making it a four-party line, with all parties on at once, exchanging greetings, discussing weather and time. Sydney tried to get London in and was heard calling the London station, but the English signals didn't behave well enough.

This four-party circuit was not as simple as it sounds, for W6XN at Oakland, Calif., at one time could not hear W2XAF at Schenectady. The trouble was adjusted, however, by getting W2XAF, as rebroadcast by VK2ME, Sydney. In other words, Oakland heard Schenectady after the signal had traveled across the American continent once and the Pacific Ocean twice, a distance of 17,000 miles, to get a signal originating 3,000 miles away. Messages from Schenectady to Oakland were relayed by Sydney.

**Put on Broadcast Wave, Also**

2YA, at Wellington, New Zealand, transmitted on its long wave to Sydney and was rebroadcast by VK2ME on a short wave. W2XAF's rebroadcast of VK2ME'S rebroadcast of 2YA was heard by Wellington, and VK2ME addressed Wellington by way of W2XAF, the voice traveling twice across the Pacific and the American continent to reach Wellington, 1,200 miles away.

So far as the average listener was concerned, this whole interesting radio experiment might have escaped him entirely, as it was conducted on the higher frequencies. However, WGY, the General Electric Company's long wave station, went on the air on 790 kilocycles, and the program became available to broadcast receivers.

# Short Waves' Enemy

## Magnetic Storms, Laid to Sun Spots, Sap Energy

AN enemy more difficult to cope with than static confronts radio engineers when they venture into the field of international program exchanges, according to C. W. Horn, general engineer of the National Broadcasting Company. The new enemy is the so-called magnetic storm.

"We have known for many years that the magnetic storms affect land-line communications to quite an extent and influence delicate instruments, such as ships' compasses," said Mr. Horn. "However, it is only in recent years, since the advent of long-distance radio communication, particularly on short waves, that we have noticed any great effect from this source.

### Increase Long, Decrease Short Wave Signals

"It is a peculiar fact that the magnetic disturbances act differently in the case of long waves. Dr. L. W. Austin, of the Bureau of Standards, who has been making measurements for many years on long waves, reports a general increase in signal strength at about the time that magnetic disturbances take place.

"We have found that these disturbances react in just the opposite manner on short waves. That is, they reduce the signal strength very greatly and seem to offer impedance to the passage of the wave."

The uncertainty as to when magnetic storms may be expected makes it difficult to plan trans-Atlantic program exchanges in advance, Horn explained. Twice within a recent week the National Broadcasting Company's attempts to relay European programs in this country were defeated by magnetic storms, which attacked the programs coming from England and Germany, and made it impossible to pick them up on this side of the ocean.

### Distinguished from Static

Static is an enemy which engineers believe can be partly conquered. Static does not reduce the strength of the signals, but is an interference, manifesting itself in the form of noise.

It is conceivable that programs might be broadcast at such high power that the interference from static might be reduced to a point where it would not be objectionable. In other words, static might not be eliminated, but it might possibly be weak in ratio compared with the signal strength.

No one really knows much about the causes of magnetic storms, according to Horn, but there seems to be a general belief among scientists that the sun spots, of which so much has been heard in the last few years, are responsible to a large degree. During the periods of greatest sun spot activity the earth is bombarded by streams of electrons which react upon the magnetic lines of force surrounding the earth. The aurora borealis is believed to be associated in some manner with these phenomena.

### Abound When Sun Spots Appear

During the last several years, during which very high sun spot activity has been noticed, there has also been a large number of these magnetic storms. Astronomers' records, according to Horn, show that the periods of greatest sun spot activity evidently run in cycles of approximately eleven years. The activity is now on the decline, and for the next five or six years improved conditions in radio reception are to be expected.

"This gives us a great deal of hope," said Horn, "and a breathing spell during which scientists and engineers will actively pursue their investigations, and perhaps find a way of overcoming some of Nature's eccentric and irresponsible behavior."

The United States Coast and Geodetic Survey, at its observatory at Cheltenham, Md., has made many studies of the magnetic storms, and their reports on these and other natural phenomena have been widely used by NBC engineers in working up their plans for international broadcasts.

### Important to Understand

Whatever knowledge can be gained in this field is much more valuable than reports of probable weather conditions, Horn points out, for the worst that can be expected of the weather is sharp electrical storms resulting in static. Observations of the weather are of value only insofar as variations in weather may possibly be caused by the same agency that affects long-distance radio transmission: The sun spots.

Failure of programs originating on the other side of the Atlantic, and transmitted to this country on short waves, to arrive at a high enough volume level to permit rebroadcasting is less likely during the next few years than in the year just past, according to Horn, although such attacks by magnetic storms are not likely to cease entirely.

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# *Manufacturers' Plight Dissected by Commissioner*

**By HAROLD A. LAFOUNT**
**Member, Federal Radio Commission**

The radio industry which has been undergoing the most drastic economic depression of its brief history, caused jointly by overproduction and the stock market upheaval of last Fall, gradually is returning to a normal stabilized basis.

Advices from the industry indicate that the period of cut prices and distress merchandising is about ended, and that last year's surplus stocks, which amounted to nearly 1,500,000 receiving sets alone, largely have been disposed of. Production has been curtailed somewhat by a cooperative movement within the industry so that its economic equilibrium may be regained.

### New High Level Reached

The receiving set industry has been going through its first real transition period as a direct result of conditions during the last quarter of 1929. The steady rise in sales and general industrial development which has characterized the industry since its beginning less than eight years ago, stopped abruptly, but despite this, the industry as a whole reached a new high level during the entire year 1929.

Quite a few of the companies were forced out of the business, while practically the entire industry suffered, but evidently the crisis has been passed and manufacturers, with renewed vigor, are pursuing their crafts with a keener understanding of the vagaries of business, as a result of this first face-to-face encounter with bad business.

### Reasons for Distress

A combination of circumstances threw the radio industry into the plight from which it now so successfully is emerging. Along with American industry generally, it was tumbled into economic distress by the gyrations of the speculative market last Fall. This seriously affected semi-luxury buying on the part of the public, and a radio set is considered a semi-luxury by most people.

Then there was the inevitable situation that develops in every new industry which grips and fascinates the public. Radio manufacturers had been reaping rich harvests during the fat days of merchandising, and new interests were attracted into this field. Some of them did not belong in it. The result was overproduction.

But this condition alone did not bring about the critical situation. Coupled with it came the stock market crash. The production capacity of the numerous companies in the business was estimated at about 15,000,000 sets annually. The normal demand was around 4,000,000 sets.

### Era of Cut Prices

Immediately there began the era of cut prices on the some 1,500,000 sets on hand. The reports from the industry state these surplus stocks largely have been liquidated, whereas, previous forecasts were that several months longer would be required.

Statistics compiled by the industry were that 40 per cent of the some 300 set and accessory manufacturers became involved in financial difficulties following the depression. Thirty-five per cent resorted to price-cutting to rid themselves of surplus stocks, while the remaining 25 per cent maintained their price levels.

—"The United States Daily."

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# 8th Anniversary Number, March 29th, 1930

# A 25-Cycle Oscillator

## It is Used to Drive Filaments of DC Tubes

*By Henry Burston Lodge*

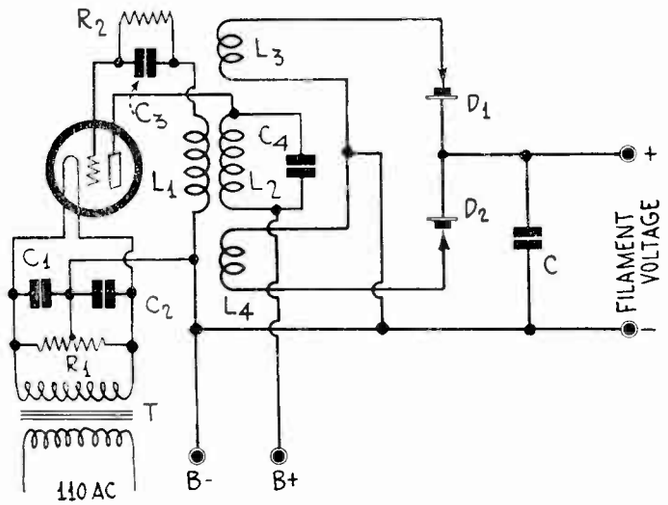


FIG. 1
THE CIRCUIT OF THE OSCILLATOR, RECTIFIER, AND THE FILTER OF THE 25-KC RECTIFIED FILAMENT SUPPLY DEVISED BY HUGH A. BROWN AND LLOYD P. MORRIS.

AS was announced in last week's issue of RADIO WORLD, Hugh A. Brown and Lloyd P. Morris, of the University of Illinois, have described a new type of filament supply in which a 25-cycle oscillator is used to generate a current of this frequency, which is later rectified and filtered for use on the filaments of ordinary DC tubes.

There has always been a considerable interest in filament supplies of this general nature but not many who have experimented with them have had much success. Much of the work has been done on high frequencies, around 3,000 kc, but previously little had been done on low frequencies. Some may recall that in the December 1st, 1928, issue of RADIO WORLD a system was described using a 10 kc frequency with which to heat the filaments directly. This scheme is different from that described by Brown and Morris, although the frequency used is of the same order of magnitude. Many of those who tried this 10 kc scheme had difficulty because the oscillator tube would not function when the load was put on. Some adjustments are necessary before the system will work, and of course, the load must not exceed that which the oscillator can support.

### Renewed Interest

The system developed by Brown and Morris is certain to renew the interest in this type of supply and for that reason we will describe it more in detail.

The essential circuit is given in Fig. 1. It consists of an oscillator, using one or more 210 tubes, a dry type rectifier in full wave connection, and a simple filter consisting only of a large condenser. In the figure T is a step-down transformer working between 110 and 7.5 volts. This may be a separate transformer or if a 7.5 volt winding is available on the power supply transformer this can be used.

A center-tapped resistor, R1, is connected across the 7.5-volt winding as is customary when power tubes are heated with alternating current. The value of this resistor is not at all critical and may have a value of 30 ohms, with the tap as near the center as possible. Two condensers, C1 and C2, are connected across the halves of this resistor. These condensers should have such a value that the impedance is low for 25,000-cycle current and high for 60-cycle current. One microfarad units are suitable.

The values of the grid lead elements R2 and C3 are not critical either. R2 may have a resistance of 10,000 ohms and C3 a capacity of .0025 mfd.

### The Oscillator Coil

Correct design of the oscillator is an important feature in the circuit. The tuned plate type of oscillator is used because this, according to Brown and Morris, is more stable than any of the other types and will oscillate when the full rated load is put on it.

There are four windings on the oscillator coil, L2 for the tuned circuit, L1 for the grid, and two equal windings, L3 and L4, for the load or rectifier circuit. All these windings are bank wound for compactness. L1 contains 90 turns and is wound outside the tuned winding L2. The inside diameter of L1 is about the same as the outside diameter of L2 and is 4.5 inches. The outside diameter of L1 is 5.5 inches. The inside diameter of L2 is 2.5 inches and is that of a bakelite tube of that size. The two pick-up coils are also wound on the 2.5-inch tubing in such a manner that they can slide to and from the tuned winding. The outside diameter of the pick-up coils is 4 inches. L2 is tuned with a .1 mfd. condenser, C4.

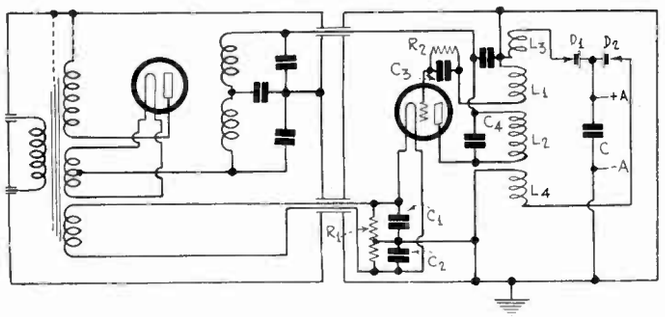


FIG. 2
THIS SHOWS THE COMPLETE CIRCUIT, INCLUDING THE B SUPPLY FOR THE OSCILLATOR, OF THE BROWN AND MORRIS 25-KC FILAMENT SUPPLY. THE RECTANGLES INDICATE COPPER SHIELDING SURROUNDING THE TWO UNITS. NOTE ALSO THE SHIELDED CONNECTING LEAD.

The size of wire to use on the rectifiers that are obtained, on the load that the circuit is expected to sustain, and the voltage that is available for the plate of the oscillator tube. Specific information on this point will be given in the near future for particular circuits.

The degree of coupling between the oscillator coil and the two pick-up coils has an important bearing on the power that the device will deliver. There is one particular coupling which gives maximum output. For this reason the two pick-up coils are mounted so that they can be moved with respect to the tuned winding. With the aid of a voltmeter and an ammeter in the load circuit it is easy to find the coupling which gives greatest output. If the device is to deliver current at six volts the adjustment of the coupling should be made until the current is greatest, keeping the voltage as six volts. The two pick-up coils should be equal and they should always be placed symmetrically with respect to the tuned coil.

### Filtering the Output

It was found by Brown and Morris that single large condenser provided adequate filtering of the rectified 25,000-cycle current. This worked better, they found, than a filter consisting of series chokes and shunt condensers, the reason being that it was difficult to design a choke-filter having a sufficiently low impedance.

Extreme precautions had to be taken against heterodyning. The higher harmonics of the 25 kc frequency would beat with the carrier frequencies and cause interference. This trouble was overcome by placing the various components of the supply in copper shields and by suitable grounding. Fig. 2 is a diagram of the complete unit essentially as Brown and Morris gave it. The designations in this circuit correspond with those in Fig. 1.

The left hand compartment of Fig. 2 contains the B supply for the oscillator tube. It consists of a half-way rectifier of the mercury vapor type, namely the UX-866. The by-pass condencers have had the usual values of 2, 2, and 4 mfd. The first filter choke had an inductance of 50 henries and the second an inductance of 10 henries. The capacity of the B supply should be about 100 ma at a voltage of from 350 to 400 volts.

### Efficiency of Device

The efficiency of this filament supply compares favorably with that of rectified 60-cycle supply. It requires from 50 to 80 watts input to the power tube of the 25-kc oscillator, but it is less efficient than direct heating with alternating current. Considering that the results with the new supply are as good as those obtained with storage battery supply for the filaments.

# Practical Adjustments in

## Change Made in One Place Affects Several

*By J. E.*

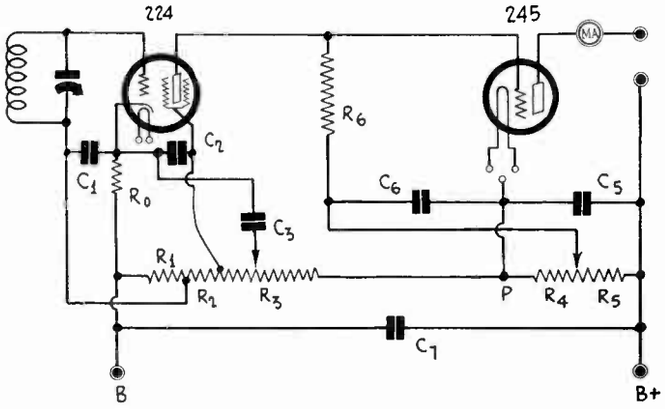


FIG. 1
THE LOFTIN-WHITE NON-REACTIVE AMPLIFIER IS CHARACTERIZED BY A HUM-BUCKING CONDENSER C3, A CATHODE LEAD RESISTANCE R0 OF HIGH VALUE.

EVER since the Loftin-White amplifier first was published there has been a steady stream of questions about it. What is the best value for this resistor, what the best value for that? Will the Loftin-White amplifier give better quality than this receiver; will it give more amplication than that? What is the very best capacity for this condenser, and what for the other? What should the voltage be on the circuit to give the very best results?

Shakespeare anticipated all these questions, odd as they may seem, and gave the right answer by saying "As You Like It."

The idea seems to be that the Loftin-White circuit operates as it does because of a particularly happy combination of resistances, condensers and voltages. It is true that the combination of these factors must be right, but there are millions of combinations that are right, and it cannot be said that one is better than any other. Of course, there are limitations but these should not worry any one.

### Queer Antics

The circuit is apt to perform some very queer antics when the various parameters are varied, acrobatics which may cause some wonderment, disillusionment, encouragement, achievement or abandonment.

Let us talk about the circuit a little while to find out the reason for some of the acrobatics and the functions of the various parts. But before proceeding let us emphasize that there are millions of combinations of voltages, capacities, resistors which will work. When that is realized there should be no question at all why Shakespeare gave the right answer to the many questions asked.

Let us begin by saying that the local voltage available should be high, that the circuit will not work at all satisfactorily unless the total voltage is approximately equal to the sum of the plate voltages that would be applied to the two tubes in the typical circuit in Fig. 1. That should dispose of the frequent question, "I have a B eliminator giving 300 volts. What should the values of the resistors be to give the best results?" "As you like it," must be the answer. But the best results will be intolerably bad. They will be much better when the voltage is 450 volts or thereabouts.

Lest there be any misunderstanding, let us say that the voltage should be 250 volts for the 245 tube and 200 volts for the 224 tube, the sum of which makes 450, according to the latest rules for addition. It is no crime, though, to make the voltage higher, for better results do not injure anyone.

### When They Are Useful

In discussing a Loftin-White amplifier it is often convenient to work backwards. It is so in this case. So let us consider R4 and R5. These resistors are really not necessary. If they are not needed why then are they used? For convenience. But it is not absolutely essential that we use every convenience. In one set of "inside information" emanating from the Loftin-White laboratory R4 was made 50,000 ohms and R5 was made 100,000 ohms. These are excellent values, especially in view of the fact that they can in many instances be taken out without the slightest appreciable effect on the operation, provided that R6 is connected to the center tap of the filament of the 245 tube.

We did not say in all instances. Sometimes they are useful, notably when the plate current in the 245 happens to be too small. We shall consider that point in greater detail later.

When R4 and R5 are used the voltage drop across them should be 250 volts, for a 245 tube. If they are not used the voltage between the two points connected by them should still be 250 volts. That is to say, the voltage drop across C5 should be 250 volts. We hasten to modify that assertion. The voltage should be 250 volts if that is the voltage we wish to apply in the plate circuit of the 245 tube. If we choose, we can use either a higher or a lower voltage. The 250 is recommended when it is convenient to use it.

It will be found that, when R4 and R5 are used, if we move the return of R6 to the right on R4, R5, that is, toward the positive, the plate current in the power tube will increase, and if we move it in the opposite direction it will decrease. It is convenient to remember that. In effect the return of R6 can be moved toward the positive by increasing R5, or by decreasing R5, or by doing both, or by sliding the return toward the positive on a single resistor making up R4 and R5.

### Plate Voltage on 224

The applied plate voltage on the 224 is the sum of the voltage drops in R1, R2, R3 and R4, diminished by the voltage drop in Ro. If this voltage is increased there is, as a rule, a decrease in the plate current of the power tube. This is because there is an increase in the current through R6 and hence an increase in the bias on the power tube. Nearly all of the adjustment centers on getting the right current to flow through R6, or in getting the right bias on the power tube, which amounts to the same thing.

Now let us talk about Ro. It has two main functions. First, to stabilize the circuit; second, to give the screen grid tube the correct bias. We are not confined to any given bias on this tube provided we neither make it too large nor too small. It is customary to use 1.5 volts negative. It frequently happens that 1.5 volts is not enough, but that is only when we select a given screen voltage and stick to that. In that case we can vary the screen voltage, make it low enough to make a bias of 1.5 volts all right.

If we make Ro large the circuit becomes comparatively stable, an end which must be achieved. But if we make it very large the bias becomes too large and we have to do something about that. Not only does the bias become too large but some of the available voltage is tossed away for no other reason than to achieve stability. We can easily make the circuit so stable that it will not function. Hence we have to compromise a little. We use no greater stability than is necessary and so we save as much of the total available voltage as we may.

When the resistance Ro has a suitable value the bias is too large. Therefore it becomes necessary to return the control grid of the 224 to a point on the voltage divider which is positive with respect to the negative terminal of the B supply. We have to go up just 1.5 volts less than the drop in Ro. That means that the drop in Ro should be 1.5 volts greater than the drop in R1 if we are to retain a bias of 1.5 volts on the tube.

### Adjusting the Bias

The grid return seems to be made to a fixed point on the voltage divider. If it is made to a movable tap R1 can be made any desired value without altering the total value of the resistance. Suppose we use 100,000 ohms for Ro. The drop in it is, let us say, 11.5 volts. That being the case, we have to make the drop in R1 10 volts. We just slide the grid return on the voltage divider until we get this drop in R1.

Now suppose we put a 50,000 ohm resistor for Ro. This value is all right. However, the drop in it will be less than 11.5 volts. Suppose it is only 8 volts. This is still too high so we have to make the drop in R1 6.5 volts. The grid return will have to be made closer to B minus than it was before.

What will happen to the current in the power tube when Ro is changed? Suppose we increase it. The bias on the 224 will increase and the plate current through R6 will decrease. Hence the bias on the power tube will decrease and the plate current will increase. This conclusion is based on the supposition that nothing but the value of Ro is changed. Now suppose Ro is decreased. Everything dependent on the bias will change in the opposite and consequently the plate current in the power tube will decrease. This again is on the supposition that only the bias on the 224 was changed.

Now let us see what will happen to the power tube plate current when the grid return on the 224 is changed, leaving everything else in the status quo. Moving the return to the left, that is, decreasing R1, increases the bias on the screen grid tube. We

# Loftin-White Amplifiers

## Other Constants— How to Solve Problems

*Anderson*

found before that this results in an increase in the plate current in the 245. If the grid return is moved to the right, the opposite effect is obtained all around and the plate current of the power tube becomes smaller.

### Effect of Screen Voltage

Changing the screen voltage on the 224 has similar effects on the current in the power tube. Increasing the screen voltage, leaving everything else as before, increases the current in R6 and hence decreases the plate current in the power tube. Decreasing the screen voltage produces the opposite effect. The screen voltage is increased when the screen return is moved to the right on the voltage divider and it is decreased when the return is moved in the opposite direction.

In arriving at the effect on the plate current of the power tube of various changes in the circuit we have repeatedly stated that the result was on the supposition that nothing else changed. The reason for this is that other changes may occur which may work in the opposite direction to the change immediately under consideration. For example, when the drop in R1 is changed by changing the value of this resistance there will be a change in the current flowing through that resistance due to the change in the plate current. When R1 is increased, as we found, the plate current in the power tube decreases. This, in turn, decreases the voltage drop in R1. Hence the reflected change works in the opposite direction to the intentional change and it becomes necessary to change the value of R1 more in order to effect a given change in the plate current.

Another effect of the same type results in changing the value of R4 with respect to R5. Suppose the return of R6 is moved toward the positive. The plate voltage on the screen grid tube results, which, in turn, increases the current through R6 and also the bias on the power tube. This would decrease the plate current in the power tube. But when R4 is increased in the manner stated the effective bias is increased by the increase in the drop in R4. This tends to increase the plate current. Hence the single change effected by increasing R4 with respect to R5 introduces two opposing effects. Usually the effect of increasing the current is the stronger. This is in part due to the fact that the increase in the current through R6 also increases the drop in Ro.

### Functions of the Condensers

C1 by-passes all current changes due to the signal voltage changes in the two resistors Ro and R1. It prevents feed back and aids in stabilizing the circuit. The effect of this condenser can be observed on the milliameter in the plate circuit of the power tube.

C2 serves a similar purpose with respect to the screen grid. It maintains this element at a potential determined by the direct current drops, mainly the drop in R2. C3 has a different purpose. It is the hum-bucker. Its best position on R-3 must be found by trial. It is only a question of finding the point where the hum is zero or minimum.

C6 serves only to by-pass R4. If R6 is returned to P this condenser is not necessary since it has nothing to by-pass. If, however, R4 is used C6 should be a large condenser, say 4 mfd. C5 need not be larger than 2 mfd. but if the circuit will not work unless a condenser is used in this position, whether R4, R5 is used or not. C7 is a part of the B supply filter. More will be said about that later.

The values of C1 and C2 should be 2 mfd. each. C3 should be about 0.1 mfd.

### Practical Adjustments

When building a circuit of this kind it is best to decide on certain fixed values for some of the resistors. For example, Ro can be chosen 50,000 ohms. There is no need for changing it, because, as we have seen, when it is changed many other changes have to be made to compensate for it. Another resistance that can be selected arbitrarily is R4R5. If it is used at all it should be in the form of a potentiometer so that the return of R6 may be put at any point desired. But it is simpler not to use R4R5. If it is used at all it should be in the form of a potentiometer so that the return of R6 may be put at any point desired. But it is simpler not to use R4R5. When it is not, R6 is connected to P and C6 is omitted.

Another resistor that may be selected without reference to adjustments is R6. This may be a half megohm resistor. Now all we have to do is to select the values of R1, R2 and R3. The first thing to do is to select a value for the sum of these resistors. This is done by taking into consideration the total voltage available and the current that will flow.

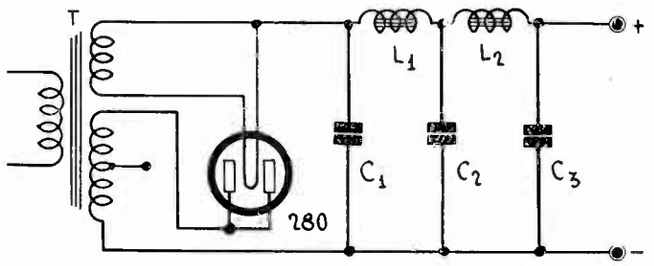


FIG. 2
A READY-BUILT B SUPPLY OF LOW VOLTAGE CAN BE ADAPTED FOR USE IN THE LOFTIN-WHITE CIRCUIT BY CONVERTING IT INTO A HALF-WAVE RECTIFIER AS HERE ILLUSTRATED.

We have assumed that the total voltage available is 450 volts and that the voltage on the plate of the power tube should be 250 volts. This leaves a voltage of 200 for the 224. When the voltage on the plate of the power tube is 250 volts and the bias is right the current will be 32 milliamperes. Currents taken by the 224 may be neglected because they are small compared with 32 milliamperes. If we divide 200 by .032 we get 6,250 ohms for the sum of R1, R2 and R3.

There is no one commercial resistor of this value. Hence the resistance has to be made up of different units in series. However, a 6,000 ohm unit can be obtained easily and there is no reason why this should not be used.

There are three different connections to this resistor and the position of each has to be found experimentally. For that reason it is advisable that the resistor R-R2R3 be one having sliders to which the three leads may be connected. Then it is simply a question of moving the sliders around until the plate current in the power tube is 32 milliamperes and the amplification is satisfactory, judging by the quality.

Ordinary voltmeters are of little use in making the adjustments because they take so much current that true readings cannot be obtained. This is particularly true of the grid bias on the 224, measuring across C1. The screen voltage can be measured with fair accuracy across R2, but there is no way of telling just what the voltage should be to give the best adjustment. Therefore even a correct reading will not help.

A vacuum tube voltmeter would aid in determining the bias on the first tube but such an instrument is complex. A simple method of adjusting the bias on this tube is to use a dry cell of 1.5 volts. Open the grid return of this tube, that is where it connects with R1R2. Then connect the dry cell across C1. Note the reading on the milliammeter in the plate circuit of the power tube. We have now fixed the grid bias on the first tube to the desired value and it remains to adjust the screen voltage until the plate current in the power tube has the desired value, 32 milliamperes. This is done by sliding the screen return on R2R3.

When this has been one the dry cell may be removed and the grid return connected to R1R2. The plate current in the power tube will change one way or the other. Now without making any other adjustment move the grid return of the 224 until the current in the power tube is 32 milliamperes. The bias on the grid of the 224 is then 1.5 volts as it should be. The circuit should now be in perfect adjustment as far as the voltages are concerned.

The only remaining adjustment is that of the hum-bucker. This is moved about the resistance R3, or on the other resistors if necessary, until the hum in the output is minimum.

It may be that the dual function of the 224 will be served better if the bias on the 224 is different from 1.5 volts. It is a simple matter to try various voltages by adjusting the grid return.

### The B Supply and Filter

Many who are interested in the Loftin-White amplifier are of the opinion that a modest B supply is essential, that only a single choke and small condensers should be used. It cannot be emphasized too strongly that the better the B supply the better the amplifier will work. This is true for this circuit as for all others. If one choke works well in regards to hum, two will work better. If a coil of low inductance works well, one of high inductance will work better, provided the resistance is not too high. If filter condensers of one microfarad work well, condensers of four microfarads will work better. Use the best B supply and filter available. The main requirement, though, is that the voltage be high.

# 1930 Electrical Code Out

## Underwriters Promulgate Rates Affecting Receivers

*The 1930 National Electric Code, containing the regulations of the National Board of Fire Underwriters, for electric wiring and apparatus, as recommended by the National Fire Protection Association, was issued recently. It has been approved by the American Standards Association. The regulations are now in effect. The sections relating to radio receiver installation are as follows, and are printed herewith by permission and courtesy of the National Board of Fire Underwriters:*

### ARTICLE 37— RADIO EQUIPMENT

**3701. General.**

a. The requirements of this article shall neither apply to equipment installed on shipboard, nor to antennas used for coupling carrier current to line conductors; but shall be deemed to be additional to, or amendatory of, those prescribed in Articles 1 to 19, inclusive, of this code.

b. Transformers, voltage reducers, keys and other devices employed shall be of types expressly approved for radio reception transmission.

c. Methods of wiring from the source of power to and between devices, related to apparatus connected to interior wiring systems, shall be in accordance with the rules covering permanent or portable fixtures, devices and applinances.

It is recommended that the authority enforcing this code be freely consulted as to the specific methods to be followed in any case of doubt relative to installation of antenna and counter-poise conductors, and that the National Safety Code, Part 5, be followed.

**3702. For Receiving Stations Only.**

a. Antenna and counterpoise conductor sizes shall be not less than No. 14 if of copper or No. 17 if of bronze or copper-clad steel. Antenna and counterpoise conductors outside buildings shall be kept well away from all electric light or power wires of any circuit of more than 600 volts, and from railway, trolley or feeder wires, so as to avoid the possibility of contact between the antenna or counterpoise and such wires under accidental conditions.

b. Antenna and counterpoise where placed in proximity to electric light or power wires of less than 600 volts, or signal wires, shall be constructed and installed in a strong and durable manner, and shall be so located and provided with suitable clearances as to prevent accidental contact with such wires by sagging or swinging. c. Splices and joints in the antenna span shall be soldered unless made with approved splicing devices.

d. The preceding paragraphs, a, b and c, shall not apply to light and power circuits used as receiving antenna, but the devices used to connect the light and power wires to radio receiving sets shall be of approved type.

e. Lead-in conductors, that is, conductors from antennas to sets, shall be of copper, approved copper-clad steel or other metal which will not corrode excessively, and in no case shall they be smaller than No. 14, except that bronze or copper-clad steel not less than No. 17 may be used.

f. Lead-in conductors from the antenna to the first building attachment shall conform to the requirements for antennas similarly located. Lead-in conductors from the first building attachment to the building entrance shall, except as specified in the following paragraph, be installed and maintained so that they cannot swing closer to open supply conductors than the following distances:

Supply wires 0 to 600 volts..... 2 feet
Supply wires exceeding 600 volts.....10 feet

Where all conductors involved are supported so as to insure a permanent separation and the supply wires do not exceed 150 volts to ground, the clearance may be reduced to not less than 4 inches. Lead-in conductors on the outside of buildings shall not come nearer than the clearances specified above to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor which will maintain permanent separation. The non-conductor shall be in addition to any insulating covering on the wire.

g. Each lead-in conductor shall enter the building through a non-combustible, non-absorptive, insulating bushing slanting upward toward the inside or by means of an approved device designed to give adequate insulation and protection. The lead-in conductor from the building entrance to the set shall have rubber insulation approved for voltages 0-600 (Type R).

h. Each lead-in conductor shall be provided with an approved protective device (lightning arrester) which will operate at a voltage of 500 volts or less, properly connected and located either inside the building at some point between the entrance and the set which is convenient to a ground, or outside the building, as near as practicable to the point of entrance. The protector shall not be placed in the immediate vicinity of easily ignitable stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

i. If an antenna grounding switch is employed, it shall in its closed position form a shunt around the protective device. The switch should be placed in the most direct line between the lead-in conductor and the point where the grounding connection is made. Such a switch shall not be used as a substitute for the protective device.

j. If fuses are used, they shall not be placed in the circuit from the antenna through the protective device to the ground.

k. The protective grounding conductor may be bare and shall be of copper, bronze or approved copper-clad steel. The protective grounding conductor shall be not smaller nor have less conductance per unit of length, than the lead-in conductor, and in no case shall be smaller than No. 14 if of copper nor smaller than No. 17 if of bronze or copper-clad steel. The protective grounding conductor shall be run in as straight a line as possible from the protective device to a good permanent ground. The ground connections shall be made to a cold-water pipe pipe where such pipe is available and is in service and connected to the street mains. An outlet pipe from a water tank fed from a street main or a well may be used, provided such outlet pipe is adequately bonded to the inlet pipe connected to the street water main or well. If water pipes are not available, ground connections may be made to a grounded steel frame of a building or to an artificial ground such as a galvanized iron pipe or a rod driven into permanently damp earth or to a metal plate or other body of metal buried similarly. Gas piping shall not be used for the ground.

l. The protective grounding conductor shall be guarded where exposed to mechanical injury. An approved ground clamp shall be used where the protective grounding conductor is connected to pipes or piping.

m. The protective grounding conductor may be run either inside or outside the building. The protective grounding conductor and ground, installed as prescribed in the preceding paragraphs k and l, may be used as the operating ground.

It is recommended that in this case the operating grounding conductor be connected to the ground terminal of the protective device.

If desired, a separate operating grounding connection and ground may be used, this operating grounding conductor being either bare or provided with an insulated covering.

n. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than 2 inches to any electric light or power wire not in conduit unless separated therefrom by some continuous and firmly fixed non-conductor, such as porcelain tubes or approved flexible tubing, making a permanent separation. This non-conductor shall be in addition to any regular insulating covering on the wire.

o. Storage-battery leads shall consist of conductors having approved rubber insulation. The circuit from a filament, "A," storage battery of more than 20 ampere-hours capacity NEMA rating, shall be properly protected by a fuse or circuit-breaker rated at not more than 15 amperes. The circuit from a plate, "B," storage-battery shall be properly protected by a fuse or circuit-breaker rated at not more than 1 ampere in the negative lead. Fuses or circuit-breakers shall be located not more than 18 inches along the wire from a battery terminal.

*Section 3703 of the code deals with transmitting stations only. It specifies that antenna and counterpoise conductors outside buildings shall be kept well away from all electric wires of any circuit of more than 600 volts, so as to avoid the possibility of accidental contact.*

*Antenna wire sizes are specified according to the voltage and power of the station and according to the nature of the conductor.*

*Splices and joints should be made with approved splicing devices or should be soldered.*

*Antenna and counterpoise conductors shall be effectively and permanently grounded at all times when the station is not in actual operation and unattended, by a conductor as large as the lead-in, and in no case smaller than No. 14.*

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### WORTH THINKING OVER

IF old Omar Khayyam were here to sing it all over again amid the dryness of 1930:

*Here with a Loaf of Bread beneath the Bough,*
*A Radio, a Book of Verse—and Thou*
*Beside me singing in the Wilderness—*
*And Wilderness is Paradise enow.*

# A DX Fan Speaks Up

## Finds Manufactured Sets Outclassed and Real Fun Enjoyed

*By M. U. Wallach*

[*A debate on the topic, "Resolved, That Distance Reception is Worth While," was published in the February 22d issue. Herman Bernard took the affirmative, Charles Norton Salmon the negative. Mr. Wallach, the author of the following text, has contributed articles to* RADIO WORLD *and, as his dis discourse shows, is a highly experienced and well-informed radioist.—Editor.*]

IN the February 22nd issue of Radio World a very interesting page has been devoted to the affirmative and negative opinions as to whether distant reception is really worth while.

The thousands of Radio World readers are probably of the opinion that the debate, on paper, has been closed without their respective opinions having been invited. My belief is that you have started something that will arouse a controversy on the subject. Set manufacturers are not thoroughly familiar with the wants of the radio public and a page in RADIO WORLD devoted to open discussion of this momentous question would undoubtedly be of sufficient interest to them to insure the reading of all articles submitted to you.

I would like to know if this is a "private fight" or if it is a battle royal. If it is the latter I would like to submit my opinion along with many others bound to come.

### Built More Than 100 Sets

During the past eight years I have constructed over one hundred radio receivers and believe that I am in a position to judge, to some extent, as to whether the listening public is interested in the reception of distant stations, or not.

I have come in contact with dozens of radio fans who have constructed their own receivers and dozens who have not. They are all primarily interested in one thing—the reception of far distant stations. Now if Mr. Salmon, who has really written a most commendable article, would sound out dealers who sell manufactured sets exclusively, a surprise would be in store for him. I mention dealers who would give honest opinions only, not those merely interested in making a sale.

They would tell him that 99 out of every hundred purchasers and prospective purchasers of radio receivers invariably ask the same question—"Will this receiver tune in distant stations?" They probably would not tell him that many sales are lost due to the inability of the set to receive distant programs. Mr. Salmon might receive another surprise if he knew that many of the question askers are women and that they are far more interested in distant reception than commonly believed.

### Where Manufacturers Stand

Many of my friends own manufactured receivers. Many of them have "rolled their own." Some of the manufactured sets have good tone quality, some decidedly poor, but when the owners of these sets bring forth their log of distant stations they swell with pride.

I have heard many of these receivers in operation and partly agree with Mr. Salmon in this respect. The reception, on these sets, left much to be desired. In many cases the receivers were fairly old. They were sensitive and fairly selective, but lacked tone quality. The sets used by the "Home Constructor's Guild" (purely fictitious) outperformed the manufactured ones by a wide margin. They brought in all the distant stations received on the other sets with a few extra ones for good measure and with a superior tone quality.

Now let us move on the modern receiver. Suppose we ask Mr. Salmon a question. Why do radio manufacturers make receivers using from seven to ten tubes? Perhaps it might be best to answer it. Surely not for local reception. One does not need a multi-tube receiver for this purpose. It is done to insure sensitivity, selectivity, better tone quality through a purer signal being delivered to the amplifier, and last but certainly not least, to enable the owner to "cut through" local stations and receive distant ones.

### Quality, Too

This can be done *without* cutting the much-discussed sidebands. And the manufacturer goes one step further. He *advertises* all these fine points to acquaint the buying public with the merits of his product. Manufacturers consider the question of distant reception important enough continually to refer to it in both their advertising and certainly in their printed matter.

Herman Bernard mentions in his argument that there are but four or five manufactured receivers capable of consistent distant reception. From my own experience and that of others I would cut this figure down to two. The home constructor has the advantage over the purchaser of a manufactured receiver. Time is a great factor. If a receiver does not operate in a satisfactory manner the builder of it can either alter it or rebuild it entirely. The manufacturer cannot afford to do this. It would result in a prohibitive cost to the purchaser. Then again the manufacturer must have mass production in order to bring his costs down. The home constructor is limited only by his pocket book and his ability.

Mr. Salmon is under the impression that the Federal Radio Commission does not recognize distant reception as important, yet it is reallocating some frequencies for the sole purpose of claring these bands to afford better distant reception. For one who is so apparently well posted Mr. Salmon should read newspapers carefully. Some of his questions will be answered by disinterested parties.

### The Jungle Hue

One point that Mr. Salmon brings out is worthy of consideration. That of a "jungle hue of heterodynes." And where do they occur? Mostly between 1250 and 1500 kilocycles. The band where small stations are nested—some with just sufficient power to serve a small community. These stations are unimportant and for that very reason have been assigned to an unimportant allocation.

And please remember, Mr. Salmon, that the Federal Radio Commission had a lot to do with this. Now, honestly, Mr. Salmon, have you ever listened to a real distant station coming through the loudspeaker with volume and local quality? I'll bet you haven't or you would have been thrilled by it.

Imagine hearing an announcer say, "This is KFI, Los Angeles," or another in broken English telling you that station XEX, in Mexico City, wants the world to listen to its fine military band. Well, I have heard such announcements clearly and WITH TONE QUALITY.

Let me cite an instance of what can be accomplished with a sensitive receiver. One evening I arrived home too late to listen to a very popular program which is being broadcast daily by a New York chain station. Knowing that this particular program is broadcast later in the evening, for the benefit of Southern and Western listeners, I waited until the time for the broadcast.

### More and More of It

I easily picked it up *clearly* from a distant Southern station, listened to another part of it from a station in Texas, and heard the end of it from a station in California. When I say that it was clearly received I actually mean it. Some guests, in my home, thought the program, to which they had listened much earlier in the evening, was being broadcast a second time by the New York station. They could hardly believe that it came from very far away.

Another test was equally gratifying. I tuned in a very popular program being sent out by a local station. It was a chain hook-up. My guests first heard it from New York. I then deliberately tuned in the same program from a station in California and listened until it was brought to a close. The entertainers were clearly heard and while California was not coming in with auditorium volume, it was loud enough to satisfy anyone—and with excellent quality. This can easily be verified.

Mr. Salmon, have you ever tried to get a station when an S. O. S. prevented the local broadcasters from doing their stuff? If you have, the distant station must have been a Godsend.

The circuit I am using was constructed at home. It has three screen grid tubes used in the RF stages, a power detector and a push-pull 245 amplifier.

To receive local and distant stations with *real tone quality* put the very best that money can buy into the amplifier—it may cost a bit more but the results are worth it, and it will help to accomplish what Mr. Salmon says "can't be done" and that is to give tone quality to the distant station as well as the local one.

# Resolved, That Law N

## Affirmative

*By H. Pavel*

IS IT necessary to reproduce the low notes in a radio receiver in order to create the illusion of reality? If so, what should the lowest reproduced note be and what relative intensity should it have? There is considerable difference of opinion on this subject both in technical and lay circles.

Technically, realistic reproduction cannot be achieved unless all the audible notes are reprodued in exactly the same proportion as they existed in the original sound complex. That is to say, a receiver must have an overall straight frequency characteristic so that there is no discrimination whatsoever among notes of different frequencies because of the difference in frequency. This requirement of the receiver is based on the supposition that the transmitter has an equally good characteristic in respect to frequency, and the only practical way of conducting broadcasting is and receiver, as nearly perfect as possible.
and reeiver, as nearly perfect as possible.

### Technical Versus Practical

But are the technical requirements alone sufficient to judge the quality as interpreted by the listener? No, there are also psychological factors that enter. The term "illusion of reality" is distinctly psychological in significance. It is quite possible that the illusion of reality may be created by a receiving system which is quite different from a system that meets the technical requirements. If this were not so there would be no difference of opinion on the question of low notes.

There are also practical considerations which enter to affect the problem. For example, is it practicable to build a receiver which meets the linear requirements imposed by the technical definition of perfect reproduction? It is not. In order to have an amplifier that is capable of equal response over the entire audio scale it would be necessary to build it on a scale which would be quite impractical. It would have to be laid out on a scale so large that the lowest audible note could be reproduced with the same amplitude as the highest. This would require true power tubes in the audio amplifier and not those comparatively small tubes now used in amplifiers, such as the 250, for example. Or it would require miniature reproduction on a power level so low that the higher notes would scarcely be audible, if the low notes were not to overload the tubes in the audio amplifier.

No one can gainsay that low notes are required to make the reproduced signals sound natural. If they are not present and if they are not of considerable magnitude the reproduced signals will sound thin and tinny. They will sound just like the old phonograp before electrically records were introduced.

Unfortunately psychology enters to upset matters. A person will listen for a week to a receiver that is woefully lacking in bass note reproduction and then he will rave about the lifelike quality. "I can understand every word the announcer says," he boasts. "An orchestra sounds just like it were in the same room," he adds. "It is really magnificent." Even the technical expert will be deceived by his ears. Only the trained musician is immune from such deception! Is he? If he is, many a trained musician is a small liar for a big fee. The fact is that the musician has the same kind of ears as anyboby else.

### Deception No Excuse

But the case with which the human ear deceives an individual is no excuse for having receivers that are not capable of low note reproduction. The received music and speech are not realistic just because the listener has become accustomed to a certain non-realistic quality. The reproduction either is or is not a true copy of the original and a listener's thinking does not change it one way or the other.

In order to have a realistic reproduction of orchestra or band music it is necessary that the bass notes from the piano, the bass viol, the tuba, the bass drum and other low pitch instruments come out in full strength. It is not sufficient that these notes be present in imagination only, or that only the higher harmonics of the notes be actually present. Neither is it sufficient that they be present in such feeble proportion that it is necessary to crawl into the speaker to hear them. They must boom out just as they do at the origin. There is not one receiver in a thousand which brings them out in full relative strength.

How is it, some may remark, that many modern receivers are all bass and no treble? Don't these receivers contain enough bass to make the reproduction realistic if low notes are essential to make it so? Yet it is a fact that some of these receivers are not at all realistic. Does that not show that bass reproduction spoils the realism rather than makes it?

Not at all. These receivers do not reproduce true bass. They overemphasize certain notes in the low register in order to make them appear effective on the bass notes. Many of them don't even go below 60 cycles at all. Moreover, they fail to give the illusion of realism because they lack the very high audio frequencies as well as the very low. They are simply boomers on some frequency in the bass range. These are the receivers that drive sensitive people to the verge of insanity.

### Comparative Test

There are many simple tests which may be applied to receivers for determining whether or not the bass notes contribute anything worth while to the reproduction, and all of these tests must be of a comparative nature applied quickly so as to preclude the psychological factors from nullifying the effect. One simple test is to place a dynamic speaker up against a large baffle board and arranging it so that it may be tipped away from the board. When the speaker is mounted against the baffle the low notes come out with strength; when the speaker is tipped back the low notes are quite ineffective. No one who observes the difference fails to be impressed by the value of the low notes. Many a baffle board has been sold on this simple test.

Another test of the same nature is to cut in and out a small condenser in series with the speaker. The circuit must be arranged so that no direct current will normally flow through the speaker. Then connect a small condenser, say .1 mfd. or less in series with the speaker or with the secondary of the output transformer. Provide a shunt which may be connected quickly across the condenser. By alternately making and breaking the shunt a quick comparison of the different outputs will be obtained. When the condenser is in series the quality will be weak and tinny; when it is short-circuited the quality will be rich and satisfying. No one making this test will leave the condenser in, nor will he use a small condenser if one must be used for any reason.

Still another test that is frequently very effective is to put a condenser of large value across the grid bias resistor of the power tube and quickly to remove it. When the condenser is across the resistor the quality will be rich in low notes and satisfying. When the condenser is not across the resistor the quality will be thin and unpleasant. If the bias resistor is serving a 171A tube or one requiring the same order of resistance, the condenser used in the test should not be less than 4 mfd. and preferably it should be as high as 16mfd. This test is also very convincing, and no one making it will be fooled by the forgetfulness of his ears.

Once a person has become accustomed to reproduction which is really good, not only on the bass notes but also on the high, he will not easily be satisfied with anything that is not so good. He has to hear poor reproduction for quite a while before he will fail to be conscious of the deficiency. And he will remember the low notes longer than he will the high, for it is only on speech that the highest audible notes really contribute much to the realism.

### Limits of Low Note Reproduction

While low note reproduction is essential to create the illusion or reality there are many practical limitations on bass note amplification. One is that most loudspeakers respond more strongly on a certain low note than on notes in the middle register. If all the essential low notes are amplified in their relative proportion it may be that the speaker will overload at some low frequency before the volume on other notes is satisfactorily high. Then again certain amplifiers are so constructed that they amplify too well on a certain low frequency note, and it may be that this will result in overloading not only the speaker but also the power tubes. Unsatisfactory reproduction will result, and this is likely to be ascribed to the low notes rather than to the limitations of the amplifier and the speaker.

Another limitation lies in the nature of the low notes. For a given intensity the amplitude of a low note is much greater than the amplitude of a high note. Therefore the grid and plate signal voltages and the armature of the loudspeaker must swing much more widely for the low notes than for the high. This is likely to cause distortion in the amplifier tubes and rattling of the speaker on all low notes. This should not be counted against the low notes but rather against the physical limitations of the receiver. Because of these limitations of the amplifier and the speaker it may be that the signals will sound better when the low notes are relatively suppressed than when they are amplified in their true proportion. But what sounds better because of the absence of electrical and mechanical distortion does not possess greater realism.

Still another limitation on the receiver regarding low note reproduction is the presence of hum. If the amplifier and the speaker are capable of equal amplification for all notes the hum on the low notes is likely to be excessive, and again it may be preferable to suppress the bass notes in order to suppress at the same time the hum which may be objectionable. However, this expedient, which is used by most receiver manufacturers, does not make the reproduction more realistic. Quite the reverse.

# Notes Are Important

## Negative

*By M. Mareno*

NO greater error was ever committed in radio than the unreasonable accentuation of low notes. In the early days of radio low notes were absent from the output. Transformers used in amplifiers were in effect tuned circuits which not only did not amplify below about 100 cycles but which actually introduced losses. Speakers were quite incapable of reproducing any notes below about 300 cycles and very little at 500 cycles. The result was tinniness and phonograph-like reproduction. Radio engineers began to demand greater amplification on the low notes and greater efficiency in the speaker. Technical writers on radio spread the gospel of low notes. The result at first was a great improvement.

The betterment did not last long. Everybody became converted to the idea that low notes were essential to good quality, and like all converts they became overenthusiastic about their new faith. A radio receiver, or any part thereof, was judged solely by its capability of bringing out the low notes. Manufacturers of receivers, transformers, condensers, tuning coils, speakers, and all other parts seized upon the popular deception and advertised everything because of its low note capability. But the manufacturers of those parts which had any bearing on the low notes did not stop with the advertising. They actually designed and built parts and receivers so as to emphasize the bass. The treble was entirely forgotten in the rapid nose dive into the bass region of the scale. Not only were the high notes forgotten, but they were entirely left behind.

### Resonance Introduced

One of the methods used for obtaining bass was to introduce resonance, sometimes in the audio coupling devices, sometimes in the loudspeaker, sometimes in both. Again, the tuned circuits were made so selective that nothing but the bass came through. And to emphasize the bass at the expense of the high frequencies by-pass condensers were put across the line here and there to make certain that there should be plenty of boominess in the output.

What was the result of all this nonsense? Good quality according to the converts to the new gospel, and the converts included practically everybody interested in radio. Attrocious and unintelligible quality according to those who knew the difference between good and bad.

Why is the quality attrocious? Because the reproduction is obviously distorted by the accentuation of the bass at the expense of the high. Because all who listen to the stuff, and who are not laboring under the delusion of the new gospel, can tell that there is no semblance between the original and the reproduction. Because speech is practically unintelligible.

### Troubles From Low Notes

When the output tubes of the amplifier are large enough to sustain the low notes, the receiver becomes a nuisance in the neighborhood. The bass notes can be heard for a city block or through several apartments. The building and the air become saturated with booms which drive neighbors to distraction. It is largely because of this that authorities in many places have taken steps to curtail the use of radio and to limit the power used.

When the output tubes are not capable of sustaining the low notes there is serious overloading in addition to the bass racket, and overloading is not conducive to good quality. Neither is it soothing to the nerves of those forced to listen to the noise.

If the low notes cannot be had in their true proportion to the high and middle notes it is by far better to suppress them because their absence will not be noticed so quickly as their presence in unreasonable volume. The listening qualities will be much more enjoyable when there is only a small proportion of bass power than when there is too much of it.

When the bass is present in the correct amount there is no question that it is desirable, and that it adds considerably to the value of the reproduction, but when the bass effect is produced by resonance of some kind it becomes intolerable. The general level of the output may be such as just to load up the power amplifier tube on the low notes, but due to some resonance, say at 120 cycles, the level at that frequency may be four times as great as it should be. Whenever the signal contains a note of this frequency, or a note differing but little from it, the loudspeaker will respond excessively and the excessive response will be sustained for a longer period than the duration of the same note in the original. The result is interference with notes of other frequencies which are sounded immediately after the 120-cycle note. The effect will be the same as that of ringing of bells which are not damped, except that the degrees of the din will be somewhat less.

### Excessive Selectivity

Another way in which the bass is accentuated is by making the receiver excessively selective. All the side bands carrying the high and the middle audio frequencies are subdued in the selecting devices and only the bass notes will come through. The manufacturers of such receivers point with pride to the marvelous selectivity, and at the same time boast that there is no side band cutting. The two claims are equivalent to saying that there is perfect side band cutting without any side band cutting at all. Just how much entertainment is there in reproduction which makes it impossible to understand what a speaker is saying without supplying 90 percent of the intelligibility by the imagination? Just how much entertainment is there in a quartette in which only the basso is audible? How much entertainment is there in a reproduction of an orchestral selection when only the bull fiddle and the bass drum can be heard? Fancy listening to Josef Hoffman playing a piano classic when only the notes on the lowest octave are audible! No doubt many would rave about the sounds heard just because a great artist was at the piano!

It is fortunate that most receivers in use are so constructed that great accentuation of the bass notes does not occur. Their efficiency on the low notes is confined largely to the imagination of the listener, a result of skillful propaganda. Even the modern coupling transformers are quite ineffective on notes below 100 cycles. Resistance couplers are also such as to cut off on the low notes, although not to the same extent as the transformers. Speakers contribute to the same suppression of the low notes.

### Not All Deficient

However, not all receivers are deficient on the bass notes. There are entirely too many which have a greater efficiency on the low notes than technical excellence demands. There are too many receivers in which audio resonance around 100 cycles is resorted to, in which box resonance is introduced in the speaker, in which excessive selectivity gives the illusion that true bass note reproduction is realized, in which by-pass condensers are used to eliminate those high frequencies which the selector failed to suppress. And these are the receivers which are heard booming for blocks around, which shakes the windows and floors in apartment houses, which cause the neighbors to complain to city health authorities, which keep people awake long after the time that they should have gone sound asleep.

The physical limitations of the loudspeaker make it impractical to operate a receiver which is exceptionally efficient on the bass notes. Any speaker is designed with a definite limit to the swing of the armature. This limit determines the amplitude of the vibration on the low notes. Suppose it is only one eighth of an inch. For a sound frequency of 100 cycles this may be enough. But suppose the amplifier is capable of amplifying strongly down to 16 cycles. The swing of the armature for the same intensity of sound would be about six times as great as the swing at 100 cycles. It is obvious that if the speaker works near the limit at 100 cycles it will be greatly overloaded at 16 cycles. The armature will hit the pole pieces or the buffers long before the peaks of the movement are reached. The speaker will rattle tremendously and no clear signals can be received.

The rattling obviously begins on frequencies much higher than 16 cycles. If it only rattled on 16 cycles no serious difficulty would arise because a 16-cycle frequency is rarely transmitted. Frequencies between 100 and 30 cycles are frequent and therefore there would be much rattling. It would be especially severe if there were a resonance peak in this range, for at that peak the signal amplitude would be many times greater than the limits of the speaker will stand.

### Avoiding Rattling

In order to avoid rattling on the low notes it would be necessary to turn down the volume so low that the sounds in the middle register would not come through audibly at all.

Obviously it is not necessary to have a circuit capable of amplifying as low as 16 cycles, or even 30 cycles. There are only two or three notes on the piano which come below 30 cycles and no bass voice will come near 30 cycles. We need an amplifier which will handle frequencies down to 30 cycles with fair volume and which will cut off sharply at that point so that frequencies around 20 cycles do not come through at all. If such an amplifier could be designed there would be no need of providing large swing limits of the armature of the speaker since the armature never would be excited at these low frequencies.

Unfortunately, it is not simple to design such an amplifier. Cut-offs usually are not sharp. If the amplifier is made to amplify at 60 cycles as required by true reproduction, it would also amplify at 30 and at 16 cycles.

# WNYC CARRIES WAVE FIGHT TO HIGHEST COURT

Washington.

Joseph A. Devery, Assistant Corporation Counsel of the City of New York, has petitioned the Supreme Court for a writ of certiorari on behalf of WNYC, the broadcasting station owned by the City of New York. This action is an appeal from a decision of the Court of Appeals of the District of Columbia, which court upheld the Radio Commission in denying WNYC full time on the 570 kc channel. This wave is now shared with WMCA of New York.

Contrary to its position taken in the WGY case which is now awaiting the decision of the court, the Commission contends that the Supreme Court has no jurisdiction over the controversy, since the judgment of the Court of Appeals is purely administrative and therefore not subject to review.

**Different Than WGY Plea**

The brief points to the WGY case and states that "on the argument this court, after hearing petitioners on the question of the court's jurisdiction, stated that it did not desire to hear respondent's counsel."

Despite the lack of jurisdiction in the Supreme Court the brief declares that the petitioner is not left without a remedy since it may bring a suit in equity in a district court to enjoin the Commission from enforcing its order.

**Property Right Alleged**

Prior to September 11th, 1928, WNYC had been operating on a frequency of 570 kilocycles with unlimited time, but on that date the Commission announced the reallocation of all broadcasting stations. Under the reallocation WNYC was given the same power, frequency and call letters, but was required to share time with WMCA, which was assigned the same frequency as the petitioner.

The petitioner appealed to the Court of Appeals, raising the contention that the order of the Commission amounted to taking of its property without due process of law in violation of the Constitution.

## Five Vacated Places Filled on RMA Board

The following resigned from the board of directors of the Radio Manufacturers Association: Vern W. Collamore, formerly of Philadelphia; George C. Furness, of New York; A. J. Carter, of Chicago; Major H. H. Frost, of New York, and Jesse B. Hawley, of St. Charles, Illinois.

Mr. Furness will continue as chairman of the statistics Committee. Major Frost also will continue as chairman of the merchandising Committee, and Mr. Hawley as chairman of the Show Committee.

To fill the five vacancies the directors elected unanimously A. T. Haugh, of Rochester, former president; Fred D. Williams, of New York; E. N. Rauland, of Chicago; James M. Skinner, of Philadelphia, and Arthur C. Kleckner, of Racine, Wisconsin.

## *KYW and KNBR Appeal Cases*

Washington.

Appeals from decisions of the Federal Radio Commission were filed in the Court of Appeals of the District of Columbia by the Westinghouse Electric and Manufacturing Company and John Ulrich, the owner of a station in Memphis, Tenn.

The Westinghouse appeal requests that the court issue a stay order against the decision of the Federal Radio Commission regulating its time limit and require the Commission to allow the company to operate KYW, located at Addison, Du Page County, Illinois, at 1,020 kilocycles on a power of 10,000 watts between the hours of 6 a. m. and 3:30 a. m.

The appeal also asks for the right to use the old apparatus of KYW in the event of interruptions in the service of the new 10,000-watt station due to storms or other causes. This service is asked for on the same frequency at 5,000 watts and without the restraints imposed upon the station by its license. It is also asked that no license be allowed to issue from the Commission to other parties on this particular frequency.

# NEW FIELDS AID BATTERY SALES

While certain new uses for B batteries have come into existence of late, the battery-operated radio receiver is by far the largest and most important B battery user, and from all present indications will continue to be so for a long time to come, according to a recent survey compiled by E. E. Horine, of National Carbon Company.

Well over half of the battery-operated receivers are in towns and cities, the remainder being on farms and in rural communities where central station power is not available, the survey developed. Mr. Horine said:

"The rural market is running the city market a close second and is gradually gaining on it."

The talking moving picture theatre is the largest of the non-radio users of B batteries. This market is growing rapidly. Additional theatres are being wired for sound almost daily, and practically all such theatres use B batteries.

Automobile radio and radio installations aboard pleasure boats are other uses which may develop a large demand for B batteries.

Police radio patrol systems are being adopted by certain of the larger municipalities. Each radio-equipped squad car requires three or four 45-volt B batteries and renewals must be made at comparatively frequent intervals because of the almost continuous nature of the service.

Aircraft radio is still in its infancy, but gives promise of growing to important proportions in time. Battery-operated beam and beacon receivers as navigation aids already are being used by commercial air transport companies, and it requires no great stretch of the imagination to visualize the air of the future congested with privately owned planes, all radio equipped to give traffic signals and to aid in landing.

# WISCONSIN AIRS PLEA TO BOARD FOR ITS QUOTA

Washington.

Declaring that Wisconsin is "indisputably below her quota in broadcasting facilities," the delegation of Representatives from that State appeared before the Federal Radio Commission and demanded a just share of channels in proportion to its population.

Representative Charles A. Kading of Watertown, spokesman of the delegation, declared the State is the thirteenth largest in the Nation, yet it does not have a cleared or national channel. On the basis of its population, he said, it is "unquestionably entitled to one of these channels." He said also that it is under its quota as to regional channel assignments, but has its numerical share of "local" channel assignments.

**No Application Filed**

The Vice Chairman of the Commission, E. O. Sykes, pointed out that no station in Wisconsin yet has applied for one of the eight cleared channels allocated to the fourth or middle western zone, and for that reason the State has never been accorded such a facility.

The radio law, he declared, provides that the Commission shall distribute facilities among the States and zones only in so far as there are applications.

Representative William H. Stafford, Milwaukee, declared the broadcasting situation in Wisconsin "is serious." By recent actions in assigning other stations to the 620 kilocycle regional channel now used by Station WTMJ, operated by The Milwaukee Journal, in Milwaukee, he declared that reception of this station even within the city itself has been "mushed up." Chicago, he declared, has been given the bulk of the radio facilities of the fourth zone, while Wisconsin has been "slighted."

**Chicago No Reason**

"It is matter of a local self-government," said the Congressman. "Just because Milwaukee is only 85 miles from Chicago is no reason why it should be interfered with in radio facilities."

The Chairman of the Commission, Ira E. Robinson, suggested that Wisconsin might obtain a cleared channel assignment if it applied for one of the cleared channels now assigned to Chicago, according to The United States Daily. WTMJ has not sought a cleared channel according to the prescribed procedure of applying for one used by another fourth zone station, but has suggested that the Commission increase the number of cleared channels from 40 to 50, by reducing the separation between regional channels.

**NEGRO REQUEST DENIED**

Washington.

Application of the Kansas City American, Inc., of Kansas City, Mo., a Negro publication, to erect a new broadcasting station to be devoted entirely to the transmission of programs bearing upon the welfare of the Negro, was denied by the Federal Radio Commission.

# SLANDER BILL INTRODUCED IN TEXAS SENATE

Austin, Tex.

A bill defining slander by radio has been introduced in the Legislature by Senator Williams.

The bill states that present laws are inadequate to protect citizens from libelous and slanderous statements by unscrupulous persons in speaking over the radio, and that persons in charge of broadcasting stations are not made responsible by existing laws for libelous and slanderous statements.

It provides that it shall be unlawful for any person to circulate, and for the owner or person in charge of any broadcasting station to permit any person to circulate, by words spoken over the radio of such station, a verbal defamation, the statement conveying the idea of either:

1. That the person to whom it refers has been guilty of some penal offence; or

2. That he has been guilty of some act or omission which, though not a penal offense, is disgraceful to him as a member of society and the natural conclusion of which is to bring him in contempt among honorable persons; or

3. That he has some moral vice, or physical or mental defect or disease which renders him unfit for intercourse with respectable society and such as should cause him to be generally avoided; or

4. That he is naturally of bad or infamous character; or

5. That any person in public office or candidate therefore is dishonest and therefore unworthy of such office, or that while in such office he has been guilty of some malfeasance rendering him unworthy of the place.

The legal difference between libel and slander is that libel is committed by printing or writing and slander by word of mouth.

## Sykes Is Queried On His Son-In-Law

Washington

When Commissioner Eugene O. Sykes appeared before the Senate committee on the Couzens bill he was questioned about a letter sent out by Thomas Stevenson, soliciting broadcasters to subscribe for a radio syndicate service conducted in Washington by Stevenson.

"Are you acquainted with Thomas Stevenson?" asked Senator Couzens.

"I am," was the reply. "He is my son-in-law."

Chairman Couzens read into the record a circular letter offering the Stevenson service to broadcasters, in which it was stated that broadcasters could be "tipped off" on matters before the Commission in the interest of the broadcasters.

"Certainly I know no way of tipping off," Commissioner Sykes said, replying to Chairman Couzens. "I'm very careful, because he is my son-in-law, not to do it."

Senator Dill (Dem.), of Washington, declared he knows Mr. Stevenson well, and that the letter was "simply a high pressure sales argument." Senator Wheeler interposed that he thought Mr. Stevenson had used "unfortunate language."

## *Porto Rico-Cuba Radio is Begun*

Opening of direct communications by radio telegraph between Cuba and Porto Rico has been announced by W. A. Winterbotham, vice-president of R.C.A. Communications, Inc. The terminals of the circuit are at San Juan, Porto Rico, and Santiago de Cuba. The rate between San Juan and Santiago de Cuba is 32 cents a word. The deferred rate will be one half as much. The rate between Porto Rico and other Cuban cities will be the same.

# STATE TAX ON SETS OPPOSED

Charleston, S. C.

J. Gilmore Smith, president of the Charleston board of trade, telegraphed to Dowell E. Patterson, member of the South Carolina house of representatives from Charleston county, a protest against the bill that would impose a $2.50 tax on radios. Mr. Smith acted upon a resolution of the board of trade.

The bill now in the legislature would impose a tax of $2.50 on each radio in use within the state, the fund accumulating from the tax to be applied to the state tuberculosis hospital.

Mr. Smith's telegram follows:

"By resolution, Charleston board of trade, vigorously opposes house bill 1037 which would impose an annual tax of $2.50 upon each and every radio set in use in this state. The state should not tax the radio sets of thousands of poor families in South Carolina, for radio is a social medium which means clean entertainment and real education. Radio is a vital factor in American life. It is swaying and educating the world. To some families it is the only form of amusement and entertainment that they have, and it offers something which does not take people out of their homes. This has immense value, especially for young folks. It transmits to thousands in this state educational discourses, such as scientific and generally cultural lectures, and innumerable bedtime stories for the little ones which are doing so much to lighten the burdens of mothers in a multitude of households. We urge that you and the other members of the Charleston delegation actively oppose the passage of this measure."

# AIR BLACKMAIL CHARGE LAID TO KWK'S OWNER

Washington.

Charges of "radio blackmail" and intimidation by alleged threats to broadcast "false, abusive, derogatory or misleading matter" from his station, were lodged against Thomas Patrick Convey, owner of KWK, at St. Louis, by I. C. W. Benson, treasurer of the Missouri Broadcasting Corp., operators of WIL, also of St. Louis, at a hearing before the Federal Radio Commission.

A formal complaint, preferring these and other charges, was submitted at the hearing on the application of WIL for an increase in power from 100 watts to 1,000 watts, and a change to the 1,350 kilocycles from which channel it seeks to dislodge KWK, operated by the Greater St. Louis Corp., a 1,000 watts power on the 1,350-cycle channel.

**Cites "Victims"**

In the brief it was charged that Mr. Convey, in the past year, has been guilty of the alleged practices. Not alone have they been against individuals, but against agents of the St. Louis American Baseball Club, the St. Louis "Globe-Democrat," and other companies or corporations, says the brief.

These, it was argued, "constitute a very grievous misuse of the agencies and facilities awarded to the said station, a menace to good order and society, and of no public use, convenience, necessity or menace to the social and political welfare of the entire community."

Oral arguments on behalf of both stations were presented at the hearing. For WIL, testimony was introduced purporting to show that Mr. Convey did not expend large amounts of money for the improvement of his station, while it was charged he had advertised to this effect.

**Calls Equipment Unsafe**

Thomas R. McLean, former engineer of KWK, testified for WIL, according to "The United States Daily." He said, under questioning by Herbert Ward and W. D. Jamieson, counsel for WIL, that he had left the employ of Mr. Convey because of "a quarrel," and because Mr. Convey wished him to subscribe to certain statements respecting the equipment of KWK, which he declined to do. The KWK equipment, he declared, "to say the least, was inefficient and unsafe" when he left the station's employ.

## *Federation Votes Resolution Opposing the Zone System*

Cleveland.

At the Fourth Annual Convention of the National Federation of Radio Associations the radio tradesmen attending the convention, some five hundred, unanimously adopted the following resolution:

"WHEREAS: President Hoover, in his last message to Congress, urged that the zone system of allocating wavelengths be abolished entirely in all its phases, and

"WHEREAS, it is agreed by broadcasters, the trade and listeners alike that the system is unsatisfactory and impractical, be it therefore

"RESOLVED, by the National Federation of Radio Associations that the Federal Radio Commission should be given full power and authority to assign wave channels and power according to public interest, convenience and necessity without respect to any zone arrangement and that the zone system be abolished, and

"FURTHERMORE, it is recommended that each individual radio dealer, jobber, manufacturer and association write personally to his congressman and to all senators and representatives from his state urging the abolishment of this cumbersome system, in view of the fact that this question is likely to be brought up in Congress in the near future."

It is the belief of the men within the industry that the radio public will be better served in this manner and that a constructive step forward in remedying some of the broadcasting evils at the present time will be taken by following the plan suggested.

# SYNCHRONIZED WAVE SUFFERS, REPORTS WGY

The simultaneous operation of WGY of Schenectady, N. Y., and KGO of Oakland, Calif., on the same frequency or wavelength during hours of darkness has cut down the effective radius of both stations fully 80 percent., according to Martin P. Rice, manager of broadcasting for the General Electric Company, which company owns both stations.

Mr. Rice submitted a statistical report to the Federal Radio Commission to inform that body the results of a careful investigation on simultaneous operation of two stations on the same wavelength.

WGY and KGO, Mr. Rice explained to the Commission, are ideally located to try the experiment of operating two stations widely separated on the same wavelength. The transmitting antenna of KGO is directive north and south, and the Rocky and Appalachian Mountains form an effective shield between the stations.

**Used Utmost Resources**

The resources of the General Electric Company were used to keep the interference as low as possible. Matched crystals, duplicate amplifiers, temperature control equipment, extreme shielding and careful checking were utilized to keep the signals of the two stations squarely on the assigned frequency.

The result was that the interference created was not as great as would occur should each carrier deviate as much as 200 to 300 cycles.

Mr. Rice's statistical report covered reception of WGY prior to November 11th, 1928, when both stations were put on the 790 kilocycle channel, and since that date. The report shows that while States within the immediate vicinity of WGY and KGO do not suffer greatly because of the simultaneous operation of the stations at 790 kilocycles, parts of the country midway between complain of increased interference.

**Observer Toured Country**

An engineer-observer, employed by the General Electric, toured the country from Schenectady to Oakland, California, returning to Schenectady via the Southern and Atlantic States. On this trip, made between June and August, 1929, questionnaire forms were distributed to radio dealers, experimenters and set owners recommended by dealers in the smaller cities, towns and villages. Eighty-six percent. of the questionnaires were filled out by dealers.

An analysis of these reports shows that in New York, Ohio, Indiana, Illinois and Iowa, only eight percent. reported poor reception from WGY prior to November 11th, 1928, the date on which WGY and KGO began simultaneous operation on the same wavelength. Sixty-two percent. have found poor reception from WGY since November 11th, 1928, and fifty percent. reported a hum on WGY since November 11th, 1928. In the section including the states of New Jersey, eastern Pennsylvania, District of Columbia, and Virginia, there were no reports of poor reception prior to November 11th, and no reports of poor reception or hum since that date.

**Results Elsewhere**

Georgia, South and North Carolina gave no reports of poor reception before November 11th, 1928, and fifty-three percent. reported poor reception, and forty-three percent. recorded a hum since the new allocations.

The rural coverage of KGO, prior to November 11th, 1928, consisted of the States of California, Oregon, Washington, Idaho, Wyoming, Colorado, Utah, Nevada and Arizona. In the area including Iowa, Nebraska, Colorado, Wyoming, Idaho, Utah, Nevada, Arizona and Texas, 88 percent. of the reports show good reception of KGO prior to the date of the reallocation: 72 percent. report poor reception since that time.

In California no reports of poor reception prior to the reallocation date were reported and since that time, poor reception has been noted by thirty-two percent. of those reporting.

With the exception of those in California, eighty-five percent. of the observers in the foregoing States report a hum on the KGO wavelength and 76.5 percent. of the California observers report a hum since the simultaneous operation of WGY and KGO began.

# *WHO and WOC Try 1,000 kc Together*

Washington.

The Federal Radio Commission authorized WHO, Des Moines, Ia., and WOC, Davenport, Ia., both owned by the Central Broadcasting Company, to conduct synchronization tests between these two stations between 2 a.m. and 6:30 a.m., on a frequency of 1,000 kilocycles with 5,000 watts.

The experiments are authorized for a 90-day period, with a view of ascertaining the feasibility of operating two stations on the same frequency, simultaneously, without causing interference.

# CALDWELL AIDS FIGHT ON WGBS

Washington.

Representatives of WNYC, municipal broadcast station of New York, and WMCA, also of New York, have appeared before the Federal Radio Commission to oppose the experimental license granted to WGBS on the 600 kilocycle channel.

Frank D. Scott, attorney for WMCA, protested against the assignment on the ground that 600 kc is separated from the 570 kc wave of that station by only 30 kc while the commission demanded a 50 kc separation. Mr. Scott quoted from an affidavit by O. H. Caldwell, of New York, a former member of the Radio Commission, stating that the assignment of the 600 kc channel to WGBS "is a move toward chaos." Mr. Scott contended that the assignment had been made as a result of political pressure.

Edgar Felix, radio engineer of New York, appeared to protest on the ground that the public objected to the assignment because of interference with other stations, contending that the 30 kc separation was not enough. J. Stewart, representing WCAC at Baltimore also protested on the ground that WGBS interfered with this station, which is also operating on the 570 kc channel.

The case was adjourned to give stations WNYC, WGBS and WICC an opportunity to be heard. WICC, a Bridgeport station, and WMCA had applied for the 600 kc channel.

# NBC ACQUIRES ROOF THEATRE AS BIG STUDIO

The National Broadcasting Company has taken over the entire New Amsterdam Theatre Roof in Times Square, New York City, and transformed it into a broadcast studio as an addition to its quarters at 711 Fifth Avenue.

By this move the New Amsterdam Roof completely loses its identity as a theatre, to become the focal point of NBC's coast-to-coast networks reaching an audience numbered in millions, on the occasion of important broadcasts.

Acquisition of a Times Square studio, NBC officials state, is a relief measure designed to solve the problem of congested studios at the Fifth Avenue headquarters. Desire on the part of sponsors to invite guests to witness their programs, and a nightly stampede of the curious, anxious to see their favorite radio performers at work, are mentioned as factors prompting the move. Admission of the public will be by invitation only.

**$75,000 Spent on Reconstruction**

Engineers and designers of the National Broadcasting Company have been at work since November transforming the former theatre into a radio studio without equal in the world. More than $75,000 has been spent to date on necessary reconstruction and installation of special apparatus, to make the Times Square studio the most elaborate unit in NBC's chain of program facilities throughout the United States.

Audience accommodations in the auditorium remain essentially as they were, but the stage had to be completely rebuilt.

The six-ton curtain of steel and glass, specially sound-proofed, is only one of many innovations employed to make the new Times Square studio unique in the radio world. When this curtain is down, an audience of 600 persons may witness the entire performance on the stage, without danger of a single extraneous sound penetrating to the microphone. Reversely, they could not hear a sound beyond the glass curtain except for the battery of loudspeakers concealed in the old orchestra pit, on both flanks of the U-shaped balcony, and over the proscenium.

**Thirty-two Miles of Wire**

Engineers claim that more than thirty-two miles of wire lines now honeycomb the former New Amsterdam Roof, linking twenty-two microphone outlets in various parts of the house and stage with control boards on the stage, behind the scenes, and up in the former projection booth.

The old projection room, where operators guided the spotlights to follow performers on the stage, would no longer be recognized. This has now become the control room, where engineers will work the mixing panel and microphone faders to blend the sounds from various parts of the studio.

Guests will enter the studio by means of elevators in the lobby of the New Amsterdam Theatre on West Forty-second Street. Broadcasting artists will take elevators from the stage entrance on West Forty-first Street. Formal opening will take place this month.

**WOR EIGHT YEARS OLD**

WOR, of Newark, N. J., owned by the Bamberger Broadcasting Service, Inc., recently celebrated its eighth anniversary. It was founded by L. Bamberger & Co., department store. It operates on 5,000 watts and is one of the "quality group," the others WMAQ, Chicago, WLW, Cincinnati.

# 18 STATIONS ON NEW WAVE FOR BETTER TUNING

Washington.

The eighteen stations specifically ordered on new frequencies by the Federal Radio Commission in its efforts to put an end to crosstalk interference are WFBL, Syracuse, N. Y.; WTNT, Nashville, Tenn.; WLAC, Nashville, Tenn.; KPWF, Westminster, Calif.; WCKY, Covington, Ky.; WORD, WJAZ and WSOA, Chicago; WKBW, Buffalo; KFJF, Oklahoma City; KGA, Spokane, Wash.; WJSV, Mount Vernon Hills, Va.; KSTP, St. Paul, Minn.; WLEY, Lexington, Ky.; WMBO, Auburn, N. Y.; WLEX, Lexington, Mass., and WSSH and WMAF, Boston, Mass.

These changes are now in effect. The commission ordered them made without a hearing as is within its power.

They are to be distinguished from changes in frequencies recommended for 28 clear channel stations. These 28 are asked to report on the proposed changes promptly, as the commission wants to put the plan in effect soon.

The tabulated list of the 18 stations, with their power, past and present frequencies, and time allotment, follows:

(A, power; B, present assignment; C, new assignment; D, time, see numerals below.)

| | A | B | C | D |
|---|---|---|---|---|
| WFBL | 1000 | 1490 | 1360 | 1 |
| WTNT | 5000 | 1490 | 1470 | 2 |
| WLAC | 5000 | 1490 | 1470 | 3 |
| KPWF | 5-10 kw. | 1490 | 1490 | 1 |
| WCKY | 5000 | 1480 | 1490 | 4 |
| WORD | 5000 | 1480 | 1490 | 5 |
| WJAZ | 5000 | 1480 | 1490 | 5 |
| WSOA | 5000 | 1480 | 1490 | 5 |
| WKBW | 5000 | 1470 | 1480 | 1 |
| KFJF | 5000 | 1470 | 1480 | 1 |
| KGA | 5000 | 1470 | 1470 | 1 |
| WJSV | 10000 | 1460 | 1460 | 1 |
| KSTP | 10000 | 1460 | 1460 | 1 |
| WLEY | 100 | 1420 | 1370 | 1 |
| WMBO | 100 | 1370 | 1310 | 1 |
| WLEX | 500 | 1360 | 1410 | 6 |
| WSSH | 500 | 1360 | 1410 | 7 |
| WMAF | 500 | 1360 | 1410 | 8 |

1. Unlimited.
2. Shares with WLAC.
3. Shares with WTNT.
4. Four-sevenths time.
5. One-seventh time.
6. Shares with WSCH and WMAF.
7. Shares with WLEX and WMAF.
8. Shares with WLEX and WSSH.

## New Corporations

Happiness Radio Stores—Atty. J. C. Schop, 2 Lafayette St., New York, N. Y.

Blog-Halem, Radios—Atty. O. Marks, 271 West 125 St., New York, N. Y.

Chain Auction Syndicate, Radio broadcasting—Attys. Moos, Nathan, Imbrey & Levine, 110 Williams St., New York, N. Y.

West Radio Shop, Inc., Englewood, N. J.—Atty. Solomon Goldman, Englewood.

Harkay Radio Co.—Atty. S. Tullman, 1440 Broadway, New York, N. Y.

General Radio & Electric Co., Inc., Ridgewood, N. J.—Atty. Harry A. Wilder, Newark, N. J.

Hines Auto and Radio Supply Co., Asbury Park, N. J.—Attys. Patterson R. Pome & Morgan, Asbury Park, N. J.

Biltmore Radio Sales Corp.—Attys. Selzer & Fischman, Spring Valley, New York, N. Y.

Jackson Radio, Inc., Jersey City, radio supplies—Atty. M. Townsend, Jr., Jersey City, N. Y.

## *Waves Penetrate 300 Feet of Rock*

Radio waves from a broadcasting station 200 miles away have been found, in experiment conducted by the United States Bureau of Mines and the Geological Survey of Canada, to penetrate 300 feet of rock, A. S. Eve of Montreal asserted in a paper read at the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York City. One object of the experiment was to determine the value of such waves in prospecting for underground ore bodies.

Other tests indicated, Mr. Eve declared, that electro-magnetic waves were passing through 900 feet of rock. As a result of these experiments, which were pioneer in character, it was concluded, says the New York Sun, that Morse signals could be sent readily to large areas of a mine if those underground were supplied with receiving coils and headphones.

# MYSTERY PLAYS WIN IN VOTING

As a result of a recent poll of its listeners as to the type of dramatic entertainment preferred, WLTH Players discovered that mystery plays were the most popular form of diversion. In accordance with the demand, the WLTH Little Theatre Players, who represent the first radio little theatre movement, are staging a series of mystery dramas written and directed by Harold Davis Emerson, Ph.D., D.D. The plays are presented each Friday evening at 9:30 P. M over the Brooklyn, N. Y., station Several stations throughout the country have written to WLTH asking for these plays for future broadcasts.

The WLTH Stock Company is headed by three experienced players. Judge Gustam, made his stage debut during the last year of the Augustin Daly Stock company, when that organization was the peak of the theatrical universe. For several years he was under the management of W. A. Brady as the leading man of "Way Down East." He was under the management of A. H. Woods for ten years and was last seen on Broadway in Owen Davis' play "Sinners," which had a run at the Playhouse.

Ida Ellis, the leading woman, after a stock experience in the Middle West, played Kate in "Way Down East" for several seasons. Later she portrayed the little jockey in "Kerry Gow." She followed this with a role in "The Ninety and Nine," and was the featured lead in the only motion picture Ella Wheeler Wilcox wrote. "Are They Born or Made." This was released by Warner Brothers.

Harold Emerson, author of the mystery plays and delineator of the stellar role, received his stage training in the Poli Stock company in Worcester, Mass., and after a successful theatrical career deserted the stage for newspaper work. Later he became affiliated with Vitagraph in a writing capacity. He went over to Warner Brothers when Vitagraph was sold to that company and later became affiliated with Columbia Pictures. As a lecturer on prehistoric America and the Mayans, and as a clergyman, Dr. Emerson has won international repute.

# CHANGES MADE IN FREQUENCY POWER, HOURS

Washington.

The following authorizations were made by the Federal Radio Commission:

Melvin A. McCollom, Dodge City, Kans., granted construction permit to erect new station on 1,210 frequencies with 100 watts.

Herbert Logan Spencer, North Platte, Nebr., granted construction permit for station on 1,430 kc. with 500 watts, daylight only.

KFHO, The Radio Station KFH Co., Wichita, Kans., license to cover construction permit. Station destroyed by fire. To operate on 1,300 kc., 1,000 watts, dividing with WOQ.

KUJ, Columbia Broadcasting Co., Inc., Longview, Wash., license to cover construction permit for installing new equipment, operate on 1,500 k.c., 100 watts power, dividing with KVEP half-time.

### WGBS Permit Extended

WGBS, Gen. Broadcasting System, Inc., Astoria, L. I., license renewed only until decision in this case is reached (but not to exceed 60 days), on 600 kc. experimentally.

KTBS, S. R. Elliott and A. C. Steere, Shreveport, La., license until decision is reached (but not exceeding 60 days).

WIBU, William H. Forest, Poynette, Wis., construction permit to move transmitter and studio from Poynette to Madison, Wis.; change equipment and increase daytime power from 100 to 250 watts.

WSYR, Clive B. Meredith, Syracuse, N. Y., construction permit to change location of transmitter and studio locally in Syracuse, and increase power from 250 to 500 watts, install new equipment and consolidate with WMAC.

WMAC, Clive B. Meredith, Cazenovia, N. Y., construction permit to change location of studio and transmitter from Cazenovia to Syracuse; change equipment, install crystal control and increase power from 250 to 500 watts, and consolidate with WSYR.

### WCDA on 1350 kc

WGAL, WGAL, Inc., Lancaster, Pa., construction permit to move transmitter locally, change equipment and increase power from 15 to 100 watts.

WCDA, Italian Educational Broadcasting Co., New York City, license to cover construction permit for new 1-kw. transmitter, 1,350 kc., 250 watts, divides with KWBQ, WMSG and WBNY.

WEHS, Victor C. Carlson, Evanston, Ill., special authorization to temporarily use transmitter of WHFC.

The following cases were set for hearing but applicant's failed to respond, and default orders have been entered:

KUT, Wm. C. Church, Austin, Tex., involving assignment of license.

KGDR, Wm. C. Church, San Antonio, Tex., license 1,500 kc., 100 watts, unlimited time.

### Other Dispositions

WSOA, Radiophone Broadcasting Corp., Chicago, modification of license 970 kc., 5 kw., limited time sharing with WORD.

WORD, People'sPulpit Assn., Chicago, Ill., modification of license 970 kc., 5 kw., limited time sharing with WSOA.

New, Knoxville Broadcasting Corp., Knoxville, Tenn., C. P. 970 kc., 100 watts, unlimited time.

# ALL MEMBERS OF THE BOARD ARE APPROVED

Washington.

President Hoover renominated the five members of the Federal Radio Commission, Ira E. Robinson, West Virginia; Eugene O. Sykes, Mississippi; Harold A. Lafount, Utah; Charles McK. Saltzman, Iowa, and William D. L. Starbuck, Connecticut. The Senate confirmed all except Mr. Starbuck without delay, but held up his confirmation. However, he was soon confirmed, too.

I. E. Robinson

Chas. McK. Saltzman

H. A. Lafount

W. D. L. Starbuck

E. O. Sykes

Objection to Mr. Starbuck was voiced by Senator Wheeler of Montana. It was said Senator Wheeler wanted to ascertain if Mr. Starbuck had been instrumental in having a vacancy filled in the Board's counsel staff by consultation with Lawrence Richey, a secretary to President Hoover. Mr. Wheeler said that unless Mr. Richey, whom he termed the President's "detective secretary," kept his hands off the Radio Commission there would be an investigation that would be irritating to the White House.

Senator Couzens, chairman of the committee which reported the nominations, had advised the President that as a communications commission might be established within a year it would be advisable to continue in office the present radio board.

"The President did not tell me what he was going to do," remarked Mr. Couzens. "The President never does."

## Literature Wanted

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

RADIO WORLD,
145 West 45th St., N. Y. City.
I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

R. Spencer, P. O. Box 594, City Hall Station, New York, N. Y.
H. Fuller, 1203 James St., Seattle, Wash.
E. Christianson, 1943 So. L St., Tacoma, Wash.
Al's Radio Shop, 207 Tillary St., Brooklyn, N. Y.
C. L. Mauritius, 446-11th Ave., San Francisco, Calif.
Adolf Massman, 5938 Rice St., Chicago, Ill.
V. M. Rachau, 209 Fairmount Ave., Sunbury, Pa.
Carl E. Colander, 23 Stowe St., Jamestown, N. Y.
Geo. F. Middlebrook, 1873 Stratford Ave., Bridgeport, Conn.
R. L. Ballard, Route 1, Box 97, Healdsburg, Calif.
Philip Harvey, 528 S. Center St., Terre Haute, Ind.
Jay Fisher, 2420 Townsend, Detroit, Mich.
R. A. Warner, 2908 Euclid Ave., Cincinnati, Ohio.
Mike Margolio, 876 Bryant Ave., Bronx, New York City
D. Van Lenten, 394 E. 18th St., Paterson, N. J.
Delmer Bucari, 520 Breck St., Scranton, Pa.
Stanley Tipping, 677 Gladstone Ave., Toronto 4, Can.
E. A Clayton, 602 River Ave., Lakewood, N. J.
Julius Solomon, 3421 So. Harwood, Dallas, Tex.
J. W. Tackett, 429½ No. "C" St., Muskogee, Okla.
Francis Evans, 18 Spencer Place., Garfield, N. J.
C. O. Weltmer, Rush Center, Kans.
Al. LeGrand, 197 West 4th St., St. Paul, Minn.
L. A. Bodenhofer, Route 1, Box 177, Sequim, Wash.
Andrew Onhauser, Gen'l. Del'y., Rama, Sask., Canada.
W. F. Davis, Van Vleet, Miss.
Edw. F. Knight, P. O. Box 1535, Indianapolis, Ind.
J. Robert Chandler, Arcade Box No. 1004, Los Angeles, Calif.
C. E. Franke, 132 Pius St., Pittsburgh, Pa.
K-S Radio Laboratories, Knight Studio Bldg., Middleboro, Ky.
Mrs. Helen M. Putty, 315 W. 2nd, Little Rock, Ark.
Claude W. Valentine, 1046 E. 39th St., Los Angeles, Calif.
David H. McDonald, 3503 W. 65th St., Chicago, Ill.
Geo. E. Sharp, 523 Boston Block, Minneapolis, Minn.
Edward J. Darone, 143 W. College Ave., York, Pa.
Frank J. Albrecht, 2704 N. Rampart St., New Orleans, La.
Charles Best, Jr., Silver Grove, Ky.
H. S. Shakelford, Jr., c. o. Crescent Drug Store, Wynnewood, Okla.
Harry J. Schneider, 6115 Edmund St., Philadelphia, Pa.

# *Kent Announces Fourth Audition*

The fourth national audition for amateur singers between the ages of 18 and 25 has been announced by the Atwater Kent Foundation of Philadelphia, sponsor of these nation-wide contests to pick out the best male and female voices.

This year the audition will begin in early May, instead of in August as in former years. The earlier beginning is to permit local contests to be held in a greater number of communities. The total prizes offered amount to $25,000 in addition to various scholarship in recognized musical conservatories for ten of the winners. These will be heard from the WEAF studios in New York in December.

# PROGRAMS SKIP ABOUT COUNTRY IN CHAIN'S ART

By O. B. HANSON

Have you ever wondered what makes it possible for a radio program to skip smoothly from city to city, hundreds of miles apart? Doesn't it stir your imagination to sit comfortably in your own home, and listen to voices in New York and Chicago talk intimately to you as though you were all together in the same room?

This is to explain how the National Broadcasting Company accomplishes such things; how it links its studios in New York, Chicago, Washington, and San Francisco into one giant stage for your entertainment.

At this moment in New York, in the biggest studio of them all, called the "Cathedral studio" is Curt Peterson, the announcer. At his elbow is the little black box found in every studio, with a flip switch at either end and a row of little buttons with a light like a telephone switchboard above every button.

### Picture at Finger Tips

Any studio in the NBC building can be connected at will through a central control room downstairs, where the chief engineer sits at a master control board like the console of a concert organ. There at his finger tips he sees a complete picture of the networks in little colored lights, and from this console radiate the thousands and thousands of miles of telephone wire going out to every station in the NBC System.

Before Curt Peterson flips his switches or presses buttons, a careful process of connecting and switching down in the central control room, and in Chicago, too, has been going on an hour before the program starts. Technical experts that you never hear about take care of these details. All programs do not originate inside a studio. You have listened many times to dance orchestras in different hotels and football broadcasts and inauguration ceremonies and the like.

### Place Doesn't Matter

But Curt Peterson doesn't care where the program comes from. That's for the engineers to worry about days ahead of time. All he cares is whether the program is inside or out. A flip switch on the little black box controls that.

Just a word more to give you an idea of the split-second precision that is necessary so as not to keep you waiting. Haven't you ever marveled at the smooth and casual way your programs jump from place to place?

First of all, Peterson has a pair of earphones which he plugs into the little black box. That way he can listen to any program in any one of the eight NBC studios here, or any program from outside that happens to be coming in at that time.

Just before a program goes on the air from here, Peterson listens to the last of the program ahead of it, and knows that the instant it signs off a light will flash on the black box telling him that it is his turn.

In the same way, they listen in Chicago, and are prepared for the light to flash on the black box there the instant it does. Peterson, by the same token, may listen while Chicago holds the floor, and know just when the light is about to flash.

# Forum

### Disagrees with DeForest on Pentode

IN your February 22d issue Dr. Lee DeForest claims that the new pentode tube, announced by the Ceco Company, is no better than the ordinary triode or the screen grid tube.

DeForest states that, though the tube might have been adaptable back in 1917 or 1918, it is useless today, that the tube would be used as an audio amplifier to supplant the 245 or 250 power tubes now in use, that it is primarily a direct current tube, that the cost of production would be prohibitive, that the reduction of radio frequency tubes would affect the selectivity of the receiver in which these tubes are used by the reduction of the tuned circuits, and that the high vacuum needed in these tubes would be hard to obtain in a large number of tubes which must be necessarily uniform.

He says that the tube is old and that dusting off the nameplate and putting it on the market might be stimulus for weakening the trade.

The tube is a new product, newer than the screen grid tube which was produced before the pentode, in 1917. He seems to be under the impression that the tube is an audio amplifier, whereas it is really a radio frequency amplifier and detector. He also wrote that the tube was for direct current only and could be used in portable and farm receivers. The tube is really an AC radio frequency amplifier which should be used with a high plate voltage of 180 to 250 and the filament consumption is 1.75 amperes.

According to him, the cost and manufacturing difficulties would be great and it would be practically impossible to produce a great number of tubes with any degree of accuracy. The high vacuum which he said would be so hard to produce should not be difficult with the high vacuum now produced with new pumps made by Westinghouse engineers. As far as the cost is considered, large production methods now in use will bring the tubes to the same prices as for the 224 type.

The talk about lessened selectivity because of the loss of one tube and its associated tuning circuit is unconvincing. He must have heard of the Vreeland or Somersalo tuners developed years ago which use the entire tuning system between the antenna and the grid of the first tube.

If there were only one tube used in the radio frequency amplifier the selectivity would not be changed.

It is really an asset to have the tuners out of any circuit which handles plate and grid voltages and I might mention that the radio market is represented with this kind of tuners as well as with the other more popular kinds.

The amplification of this new tube is greater than that of the 224. This is possible because of the use of a screen grid around the cathode and filament assembly which, when supplied with a positive potential, breaks up the cloud of electrons about the cathode and allows the passage of electrons which would otherwise not be able to penetrate clear through the cloud. In all other respects the tube is the same as the four-element tube, but, of course, higher voltage must be applied to the elements.

LYNNE P. WATERMAN,
Detroit, Michigan.

* * *

### Just Ordinary

SOME readers write in, saying your magazine is very poor, others saying that it's great, so I thought you wouldn't mind getting a letter telling the truth. Like most things in this life, there is nothing spectacular about RADIO WORLD. It isn't very good, it isn't very bad, it's just ordinary. You don't print enough news, sometimes. Other times you print too much. The same is true of technical articles. Nothing is done superlatively well by you, nothing atrociously bad. Keep up the indifferent work. I'll spend 15 cents a week to read your weekly provided it doesn't get much worse. WILL BROOKS,
Huntington, N. Y.

* * *

### Advantages of Home-Builts

SOME time ago there appeared in your publication an article in which you were advised to leave off the technical stuff, with the statement that such articles were not desired any more—that home-made radios were a thing of the past.

Home-built radios will never be a thing of the past, and technical articles (if not too much so) and hook-ups are the only part of radio magazines that interest me.

It is with regret that I have watched the loss of interest in radio hook-ups by amateurs. This seemed to start about the time of the introduction of the AC circuits. But I don't know why. It seems to me that the possibilities of the AC circuits are at least on a par with the DC. Maybe it was the added expense necessary for the AC outlay. But with very few exceptions the AC radio can be made to do everything the old battery set did—and a few things besides.

I am not what would be termed an expert, but I have tried the majority of the circuits that have appeared from time to time in RADIO WORLD and "Radio News"—about the only remaining magazines containing "hook-ups," etc. Anyone with sufficient knowledge and patience can build a set out of good parts that will compare favorably with factory sets that cost no less. The advantage is in knowing it is your handiwork and that you may service it intelligently, putting in refinements and making such changes as suit your fancy.

One thing that I don't think that I ever remember of seeing in any magazine—the using of a series filament in AC circuit. My filament transformer didn't have a large enough capacity to run the number of 227s that I desired to use, but I had a 5-volt winding I wasn't using. I found this solved my filament exactly. I didn't have to overload the filament transformer and get excellent results.

C. W. McCOMAS.

* * *

### It's a Play-jure

AN ardent radio bug, fan, nut, or what will you, I buy and read with avidity every radio publication on the stand. From my viewpoint RADIO WORLD is by far the most comprehensive of the lot. I have gotten from its pages in the past year more good, solid information than from all of the balance combined; it is technical without being overly so; the contributors seem to think lucidity equally as important as algebraic equations; there is just enough news intermixed to balance the reading; and last, but not least, there is a noticeable absence of "gyp" ads. No, thanks, I don't smoke.

Now relative to the letter in recent issue over the signature of Joseph Henkin. I fully believe that 99 per cent of your readers are interested in the different circuits you publish. I love to dabble in experimental realms; love to gather equipment and see it grow under my efforts into something of a highly entertaining nature. I have spent hundreds of dollars along that line of endeavor, having built many of the hookups described in your columns. Personally I do not regret the spending of one cent of the amount that has brought me in untold pleasure in sets built.

More than likely from the position he holds, he has had technical training and is sitting pretty. Fair enough. More than likely he is more interested in the news and gossip from other stations. All right, then, let him subscribe for one, or more, of those radio scandal sheets and nestle down in a soft chair in front of the studio panel. But please, Mr. Editor, for the sake of thousands of us, keep right on with the instructive stuff.

ALEX. McLAREN,
Hollywood, Calif.

* * *

### Invalid Enjoys the News

HAVING been a shut-in for almost five years and a bed-ridden invalid at that, never to walk again, according to physicians, I wish to say a word of praise and thank your most valuable and entertaining radio magazine, especially in behalf of the many shut-ins throughout this great land.

I have seen and read many radio magazines since I have been an invalid, but I find none that comes up to RADIO WORLD, especially in the line of news.

I don't believe there is another publication which keeps the public so well posted on the activities of the broadcaster, Radio Commission and other radio news as you do, and news is what the radio fan is interested in. I notice you have been giving us more news of late. I trust you will continue to do so.

Please let me suggest that you discontinue so much technical stuff, and instead give us more news first place in your magazine and on front cover.

A. F. DAY,
Sargent, Kentucky.

* * *

### Give Us More Supers

LAST Fall you ran a series of articles on the Super-heterodyne which interested me greatly. In some of those articles I found answers to many questions that had puzzled me for a long time. One of these cause of repeat tuning points and the so-called image interference resulting from this effect. Your explanation of how to avoid this trouble has already been of much help to me.

I must say that I was disappointed when you stopped the series so suddenly. I do hope that you will resume the discussion on this subject and give us some construction articles of both AC and DC receivers. I am sure that there are many like myself who are watching and waiting for more.

One phase in which I am particularly interested is Super-heterodynes using higher intermediate frequencies, say around 500 kc. In the articles you mentioned many advantages to be obtained by using such high frequencies, notably in suppressing repeats.

MILTON SEARLE,
Chicago, Ill.

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### A THOUGHT FOR THE WEEK

*A NOTED divine devoted a sermon recently to the theme: "How Shall We Keep the American Family Together?" We respectfully suggest that anything which will keep the men home nights will help the dominie to solve the problem—and there's radio, reverend sir! Let's see that every family has a set—and that it's a worthwhile one. But the kind that cuts up and insults our ears with every noise known to a maddened imagination certainly won't keep the old man moored to the homestead.*

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### TEMPLE BOUGHT OUT

Leonard C. Welling, President of the K. W. Radio Company, Inc., New York, representing a syndicate, has purchased the assets of the Temple Corporation, Chicago, Ill. The syndicate will continue operations in the plant. The trade name, Temple, will be continued. Welling has headquarters in Chicago.

RADIO WORLD

Trade Mark U. S. Pat. Off.

**The First and Only National Radio Weekly**
***Eighth* Year**

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

Roland Burke Hennessy, editor; Herman Bernard, business manager and managing editor; J. E. Anderson, technical editor.

## Television's Promise

EVERY now and then we read in the press of some one's prophecy regarding the advent of television.

These articles describe the wonders-to-come, of the use of television in terms of entertainment on the one hand and of the technical difficulties as yet unattained, on the other. We are tempted to the supposedly magnificent treat of seeing prominent persons of the stage, broadcasting and industrial life "strut their stuff" and then at the conclusion of the article resume normal thinking and await the outcome.

We are reminded almost daily, however, of the vast educational movement in some form or other and wonder how many of us have tried to conjure up the actual fact of an experienced teacher in some one subject holding forth on his topic in a schoolroom, imparting knowledge to a group directly in front, and in some isolated spot where perhaps that special talent is not readily available. Television and radio transmission can here play a vital and most valuable part in education.

Television, when we get used to it, will lose most of its scientific aspect for the mass in the street just as the radio and telephone and electric lights have done, for just as truly now as ever, familiarity grows on itself. There must be leaders and planners for the future of television, as in everything else, and thus will the utilitarian demands of the average man spur the scientist on to further conquest.

We are aware that one of the difficult problems confronting television transmission is the available frequency band. At present two possibilities of surmounting the problem present themselves. One is to annex present low wavelength channels for direct transmission, the other is to transmit television programs to key broadcasting stations (our present chain stations) and retransmit to local areas by the usual assigned frequency. If the short-wave transmission channels to foreign countries are used for national broadcasting purposes the ether would be properly balled up and we'd have the old controversy of time allotment to face all over again.

The most interesting problem of all in connection with television is the transmision of colors of the solar spectrum. At the inception of broadcasting we were content with the transmission and reproduction of a comparatively narrow acoustic spectrum and as the transmission art progressed we improved our acoustic reproducers Noteworthy in this advance of engineering effort was the gradual suppression of unwanted acoustic effects, just as to-day a prominent authority praises the engineering ability that was successful in eliminating distortion from television pictures. So ever looking forward, may we hope for the same degree of reality in television as we have commercially succeeded in producing in our radios.

Now it is accepted generally that light waves and radio waves are essentially the same, with a *relatively* small difference in frequency between the primary colors. A selective kind of filter operating on the general principle of substituting an audio frequency for a film color and transmitting thus, and later resolving it into the color again by a reversed process, may be accomplished some day.

Meanwhile all that can be fairly said of commercially practical television is that we're waiting patiently for it, but haven't the slightest idea when it will arrive, nor has any authority named the happy day. He'd better not, else his authoritativeness may become mercilessly impugned.

The recent transmission of television images between America and Australia, some 20,000 miles, round trip, is the beginning of what will ultimately mean commercial transmission of international matter.

The continually recurring radio broadcasts between the U. S. and European countries means that we have definitely entered upon a new phase of commercial relationship.

As in business procedure it is usual to keep records, so will records of televised events be kept for pleasure, including international broadcasts of prominent persons. On particular occasions we have at hand the means of permanently recording words spoken in remote corners of the earth. This definite fact of being able to record spoken words and images, too, is the successful foundation of television and radio as a medium by which the commercial world can safely operate.

And too fidelity of reproduction of photographic images plays a very important part in the preservation of an accurate record. This fact is of especial use to police and other organizations which depend so largely on the making and preservation of accurate records.

As we get more proficient in the art we can easily imagine a type of transmitter which may operate so as to act as an interpreter (a not very far-fetched imagination), whose action might be described roughly as a direct substitution of letters and phrases method. The direct transcription of a foreign language might be too difficult but it is entirely possible to visualize such an arrangement.

And of course the meetings of engineering societies and other events of special and general importance will soon be available to us, transmitted from foreign countries with the ultimate result that both sides of the Atlantic will be united in a common bond of relation.

The present experiments are of profound interest to the men directing and engaging in them but the public can only follow the high lights of their success, and await the opening of the "television service" which it is stated may be on a commercial scale in about blank years or so, to be awfully exact!

## Short Waves Direct

LATELY large chains have been treating us, or trying to treat us, about once a week to foreign reception. Short waves from overseas are intercepted here, and sent out on broadcast wavelengths. Sometimes twice in one day we have been offered such attractions by competing chains, each with a different program. Not always has the program been the most interesting, but it is still a novelty for the general run of listeners to hear anything from overseas, so it is the distance rather than the program that impels one to tune in, yet the program, too, may have its attractions.

This indirect method of hearing short-wave stations is very fine, but it does not compare in fascination and variety to tuning in short waves yourself, when and almost where you please, and even tune for some particular foreign station with some assurance of getting it, night after night, day after day.

There is a plenitude of short-wave stations on the air with programs, in this country, and, of course, these are the ones most likely to be received. Much greater distances can be brought in with speaker volume than on broadcast receivers, and there are many thousands of amateurs and others throughout the country who habitually tune in foreign stations and do not regard that as enough of a feat to justify it as a topic for even breakfast conversation.

Those who build their own receivers are usually far in the van of the users of commercial receivers. Just as the builder of his set had the prized broadcast receiver of a few years ago, so this same class now has the prize short-wave receiver of the day. The short-wave set for tuning in programs can not be said to have reached the commercial set stage at all. And the association of short waves with television lends added charm and promise to the experiments and practice now being conducted by this elect class on short waves.

Some efforts have been made in the past to permit reception of short waves by use of an adapter, but often these efforts have not been successful, although improved forms of adapters just recently broached make the attainment of good results from better adapters relatively simple. The key is the attainment of sufficient amplification at radio frequencies, and avoiding dependence on merely the input of a short-wave regenerative tuner to a receiver's detector grid, without utilization of the receiver's radio frequency channel.

The short waves hold a fascination and a thrill, and receivers and improved adapters to bring them in on the speaker, with good volume, may be built. And who has not the urge?

## Starbuck Confirmed

THE Federal Commissioners have been more than morately successful in the administration of the nation's radio facilities. The Commission has enacted rules and other regulatory provisions with the help of The Institute of Radio Engineers, when highly technical information was necessary.

Now we are treated to the spectacle of delay in confirmation of one of the five members nominated by President Hoover. Happily, the spectacle is of short duration, the objection to Commissioner Starbuck is withdrawn, and the Senate confirms him.

Since the functions of the Commission is basically of a technical nature, the fitness of candidates for office should be and can be easily predetermined.

Commissioner Starbuck deserved no obstruction, for he has considerable engineering knowledge. He is a lawyer by profession.

Why can't we have a board of qualified technical men, with a practical working knowledge of radio transmission requirements, appointed for a long term so that the members can be reasonably sure of finishing what they start?

The brand of political football as at present practised, where Commissioner Starbuck was concerned, was indefensible.

It is stated that the radio board suffers from "White House interference." Now, however, much that may be true, President Hoover certainly knows radio, for he once administered it. What some term his interference may be merely fatherly advice.

Somehow the acts of Commissions redound to the appointing power.

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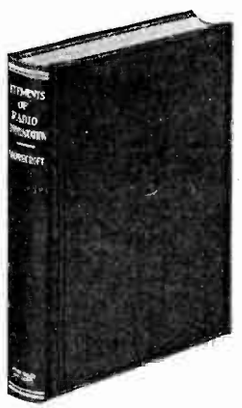

The latest book by Prof. John H. Morecroft, of the Engineering Department of Columbia University, and past president of the Institute of Radio Engineers, is his "Elements of Radio Communication," a book for the novice to enjoy. We regard this as the best elementary book to inform you authoritatively on the technical phases of radio in plain language, without requirement of mathematical knowledge. The book is a complete course on the elements of radio, containing much material never before published. It has 226 pages, 170 illustrations and a complete index. Just out, it is the book of the year in radio. Cloth bound. Order Cat. ME @ .....$3.00

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[NOTE: *The standard book on tubes for advanced students is "The Thermionic Vacuum Tube," by Hendrik Van der Bijl. Order Cat. VDB @*.....$5.00]

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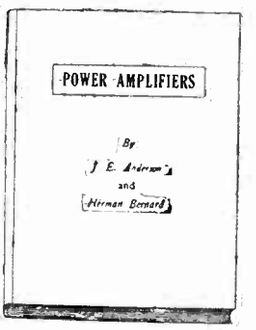
### "Power Amplifiers"




Here is the *first* book to be published on the subject of "Power Amplifiers." Now printing, it is certain to fill a void in radio literature. The whole subject is fully covered in a masterful theoretical discussion of audio amplifiers and power supplies, supplemented by constructional chapters, with complete wiring diagrams and specification of parts. Learn while you build! J. E. Anderson, M. A., technical editor of RADIO WORLD, and Herman Bernard, LL. B., managing editor of RADIO WORLD, both of the Institute of Radio Engineers, have explained fully the phenomena of power amplifiers. Learn all about motorboating and its cures, push-pull theory and practice, grid bias methods and effects, vacuum tubes in audio circuits, AC and battery type AF amplifiers, phase relationships, common impedance, filter systems, by-pass condenser effects, necessities for tone quality, values of coupling constants, and a host of other topics associated with power amplification, including speech amplifiers and "talkie" installations.

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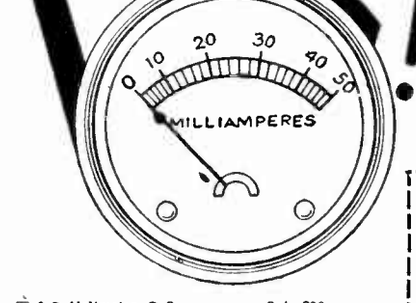


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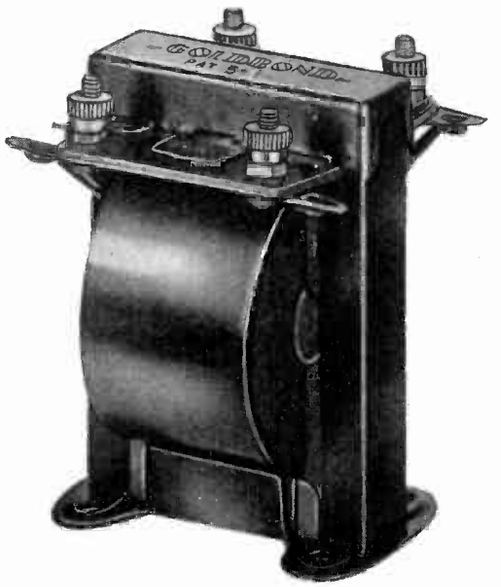
# High Impedance Audio Transformers




A single stretch of copper wire without soldered connections of in-between joints is used on each winding of both transformers. The "Gold Bond" model is illustrated.

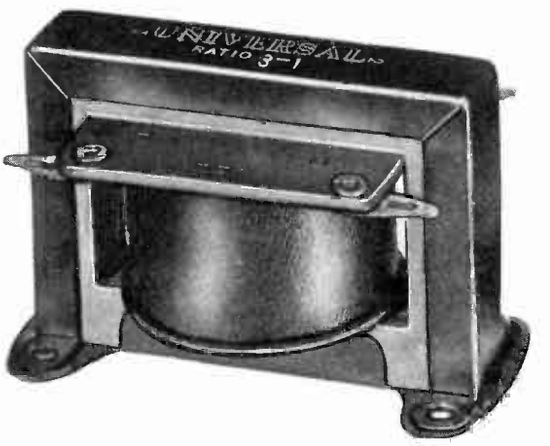
**Order Cat. GB-1-3 for 1-to-3 ratio**
**Order Cat. GB-1-5 for 1-to-5 ratio** **$1.50 each**

Audio frequency coupling transformers with high impedance primaries and secondaries are made in two models and two ratios of each model. At left is the "Gold Bond" shielded type, at right the "Universal" unshielded type for subpanel mounting, overall height 2¼". The ratios are 1-to-3 and 1-to-5, primary to secondary.

The shielded "Gold Bond" model has 4,000 turns on the primary, so the 1-to-3 model has 12,000 secondary turns and the 1-to-5 model 20,000 secondary turns. Extreme compactness and neatness prevail.

The "Universal" model for subpanel mounting has 3,200 primary turns.

Laminations in both are of best silicon steel in a strong steel frame. The coils in both are vacuum impregnated and therefore moisture-proof.




Excellent reproduction of tonal values as supplied by the detector or first audio tube is assured by use of either of the transformers. The "Universal" model illustrated above, is excellent for replacement purposes. Even on this model high plate voltages may be used, with consequent high plate currents, due to the relatively large diameter of wire used.

**Order Cat. UVS-1-3 for 1-to-3 ratio**
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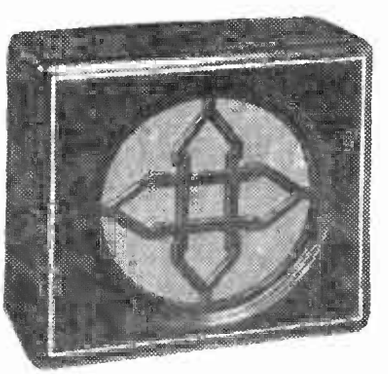
The line input must be 50-60 cycles, 105 to 120 volts. There is a voltage adjuster built in. The magnetic speaker has a matched impedance for the output of the receiver, and is itself housed in a real walnut cabinet with marqueterie inlay.

**FIVE-DAY MONEY-BACK GUARANTEE ON RECEIVER, TUBES AND SPEAKER!**



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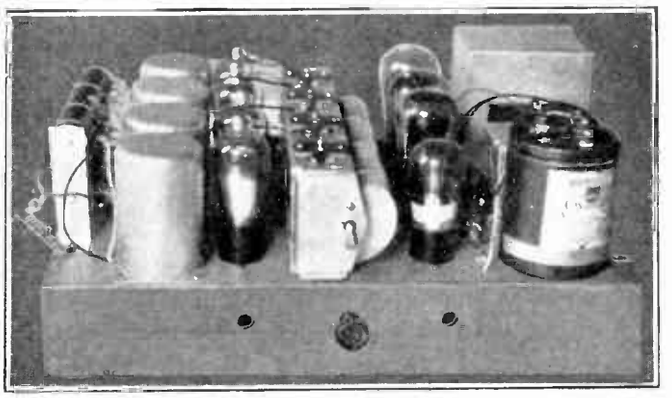

The HB44, assembled, presents in compact form, on a 17½ x 11½" steel chassis, a completely AC operated shielded receiver, using four 224 screen grid tubes, one 227, two 245s in push-pull, and a 280 rectifier, eight tubes all told. Here is the circuit that will bring 'em in from all over the country—and at a price you can afford—$45.59. This price includes EVERYTHING except speaker, cabinet and tubes.

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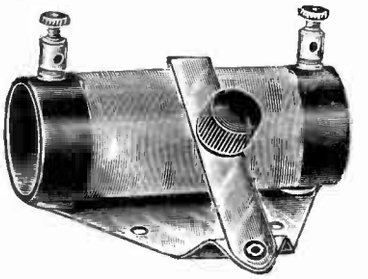

Remove aerial lead from set. Connect aerial instead to one of the binding posts of the Aerial Tuner. Connect the other binding post of the Aerial Tuner to antenna post of your set. Then move the lever of the Aerial Tuner until any weak station comes in loudest. The lever need not be moved for every different frequency tuned in. The Aerial Tuner acts as an antenna loading coil and puts the antenna's frequency at any frequency in the broadcast band that you desire to build up. Price, 85c.

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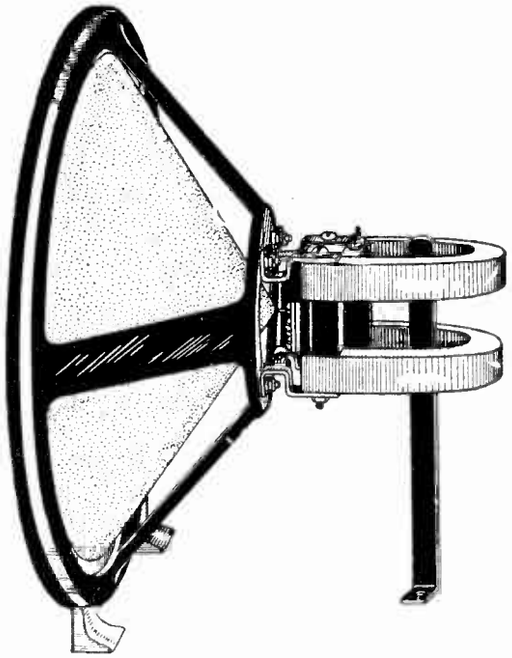
Temple AC Dynamic Model 10, in a beautiful cabinet The speaker chassis is one of the finest made. There are an output transformer and dry rectifier built in. The cabinet has decorated walnut front and back, with carved grille ornament. An AC switch is accessible underneath cabinet Rear is removable for adjustment of resistor knob to match the impedance of your receiver's output tube. Connect plugged AC cable to 110 volts AC, 50 to 60 cycles, and connect tipped cords to speaker post of receiver. This remarkable speaker **Cat. TEM-10 at only**.....

**$15.34**



Farrand Inductor Chassis, consisting of the unit, cone, spider, bracket, assembled, but not in a cabinet.

Model 6-G, 10" extreme diameter of cone front rim ..... **$8.00**

Model 10-G, 12" extreme diameter of cone front rim ..... **$10.00**

Model 10-G-PP for connection to push-pull, requiring no output device, because unit is constructed as a center tapped output impedance. Center tap is yellow and goes to B+. Tipped cords go direct to plates. Outside diameter 12"..... **$11.00**

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**Velvet B Eliminator** **$16.13**

**180 Volts (280 Tube Free)**


**Latest Model National Velvet-B, Type 3580, in handsome crackle finish black metal casing, for use with sets up to and including six tubes. Input 105-120 volts AC, 50 to 60 cycles. Output, 180 volts maximum at 35 milliamperes. Three variable output intermediate voltages. (Det., RF, AF). Eliminator has excellent filter system to eliminate hum, including 30 henry choke and 18 mfd. Mershon condenser. No motorboating! (Eliminator Licensed under patents of the Radio Corporation of America and associated companies.)**

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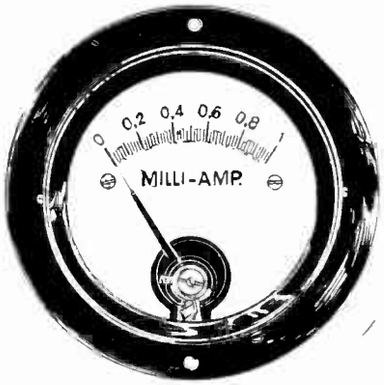
# 0-1 MA, $5.95




*Here is a* 0-1 *milliammeter, accurate to plus or minus* 1% *clearly legible to two-one hundredths of a milliampere at any reading* (20 *microamperes*). *This expertly made precision instrument is offered at the lowest price so far for a* 0-1 *ma. Order Cat. FO-1 at* $5.95. *C. O. D.*

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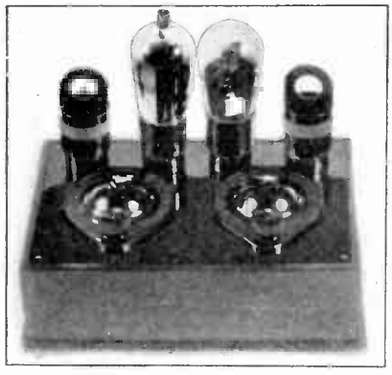

## Order what parts you want.

- ☐ C1, C5—Two short-wave tuning condensers @ $1.50 ..... $ 3.00
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- ☐ Two sets of short-wave plug-in coils, three coils to a set, @ $1.50 a set, total six coils ..... 3.00
- ☐ One AC short-wave adapter cable, 5-prong ..... 1.50
- ☐ Two four-prong sockets ..... .40
- ☐ Two five-prong sockets ..... .40
- ☐ One grid clip ..... .06
- ☐ Two dials @ $.50 ..... 1.00
- ☐ One panel and cabinet ..... 3.00

- ☐ All parts ..... $14.71
- ☐ 227 tube ..... .90

**GUARANTY RADIO GOODS CO.**
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- ☐ Please ship C.O.D. all parts for AC screen grid short wave adapter @ $14.71.
- ☐ If 227 tube is desired also, put check here.
- ☐ Please ship C.O.D. only those parts noted separately.

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**For cigars or cigarettes, with button switch at top. Press switch, and lighter acts instantaneously. $1.00. Model B lighter on tray, $1.50. Radio World, 145 W. 45th St., N. Y. C.**

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Wound with non-insulated wire plated with genuine silver, on grooved forms, these coils afford high efficiency because of the low resistance that silver has to radio frequencies. The grooves in the moulded bakelite forms insure accurate space winding, thus reducing the distributed capacity, and keep the number of turns and separation constant. Hence the secondary reactances are identical and ideal for gang tuning.

The radio frequency transformer may be perpendicularly or horizontally mounted, and has braced holes for that purpose. It has a center-tapped primary, so that it may be used as antenna coil with half or all the primary in circuit, or as interstage coupler, with all the primary on a screen grid plate circuit, or half the primary for any other type tubes, including pentodes.

The three-circuit tuner has a center-tapped primary, also. This tuner is of the single hole panel mount, but may be mounted on a chassis, if preferred, by using the braced holes.

The secondaries are for .0005 mfd. tuning only. There are no models for .00035 mfd.

These coils are excellent indeed for popular circuits like the Diamond of the Air and tuned radio frequency.

Diameters of form, 3 inches.
Two-winding coil, order Cat. GRF @ 99c.
Three-winding coil, order Cat. G-3 CT @ $1.49.

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Please mail me C.O.D. at stated prices, plus few cents extra for postage, the following coils on 5-day money-back guaranty:

☐ GRF at 99c. ☐ G3cT at $1.49

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**Complete details on the theory and construction of the HB Compact were published in a four-part article in Radio World, written by Herman Bernard, designer of the circuit and inventor of the Bernard Dynamic Tuners used in the circuit. Full details on how to wind your own coils. Full-sized pictorial diagram of the wiring. Order the August 24th, 31st, September 7th and 14th issues, 60c—**

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AMPLIFIER KIT
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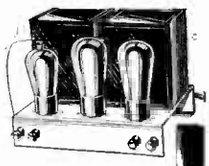

**Includes EVERYTHING (*except tubes*) for building the LOFTIN-WHITE circuit with A.C. Power Supply. Delivers unbelievable volume with one '24, '27, '80 tube. Each part specially selected—thoroughly tested—*approved by the designers.* List Price, $35.00. *Write Dept., RW38 for literature***

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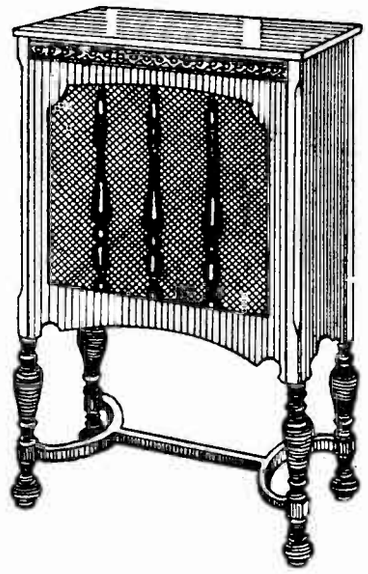
# Aristocrat Floor Speaker

With Molded Wood Horn of 8 ft. tone travel (exponential type) with baffle and horn motor built in. Extraordinary bargain. **$12.00**



The speaker cabinet is walnut finish, 33" high, 24½" wide, 17½" deep, with carved legs. Golden cloth grille covers front opening. Built inside is No. 595 molded wood horn with baffle and No. 203 driving motor unit that stands 250 volts without filtration. Horn and motor removable. Table alone is worth price asked.

Shipped C.O.D. if desired.

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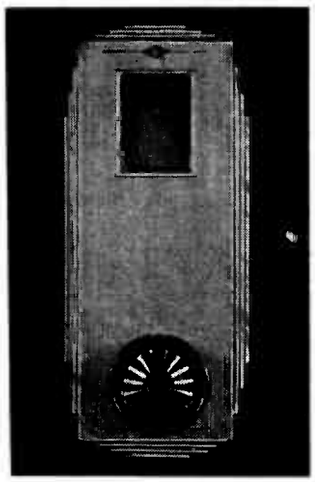
BRILLIANT, NEW

# NATIONAL

MODERNISTIC PROJECTION DIAL WITH RAINBOW FEATURE



Modernize the appearance of your receiver by installing the brilliant new National dial, with color wheel built in, so that as you turn the dial knob one color after another floods the screen on which the dial numbers are read. On this screen the numbers are projected, so that you get the same dial reading from any position of the eye. This is just what DX hunters want—laboratory precision of dial reading.

The escutcheon is of modernistic design. The Velvet Vernier mechanism drives the drum superbly.

Order today. Remit with order and we pay cartage. Shipments day following receipt of order.

GUARANTY RADIO GOODS CO.,
143 W. 45th St., N. Y. City (Just E. of B'way)

Enclosed please find $3.13 for which please send me dial marked below:

☐ Cat. HC6, National modernistic drum dial, with color wheel built in, pilot bracket, 6-volt pilot lamp for storage battery or A eliminator sets; hardware; instructions ..... $3.13

☐ Cat. HC2½, same as above, but with 2½-volt AC pilot lamp ..... 3.13

☐ Order C.O.D. and I pay cartage.

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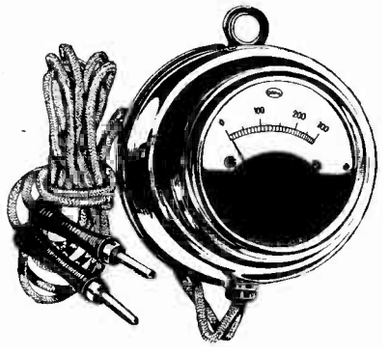
*Portable Type*

# VOLTMETERS

**for Measuring High Voltages, Including Those of B Supplies.**



0-300 volts, at 200 ohms resistance per volt, 5 ma. drain at full-scale deflection. Accuracy, 2%. Case is full nickel finish. Long connecting cords have especially ornamental tip holders. Meter should be read in perpendicular position. Five-day money-back guaranty. Order Cat. F-300 @ $2.59.

0-500 volts, same as above in appearance, but the range is greater and the resistance per volt is 233 ohms., 4½ ma. drain at full-scale deflection. Accuracy, 2%. Five-day money-back guarantee. Order Cat. F-500 @ $3.73.

0-600 volts, AC and DC (same meter reads both types). DC readings accurate to 2%, also AC readings 2% at 50-60 cycles but accuracy is less in AC at substantially different frequencies. Resistance 100 ohms. per volt, 10 ma. drain at full-scale deflection. Same general appearance as illustrated meter. Five-day money-back guarantee. Order Cat. M-600 @ $4.95.

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(Just East of Broadway)

Please ship C.O.D. the following makes, as advertised, on 5-day money-back guaranty:

☐ Cat. F-300 at .....$2.59
☐ Cat. F-500 at ..... 3.73
☐ Cat. M-600 at ..... 4.95

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# Spring Action Diagonal Nipper

A DIAGONAL cutting nipper is the second most useful tool for radio work, next to the soldering iron. Non-friction spring action adds convenience of use, as the handles are sprung back just far enough for a comfortable grip, and the jaws are closed by easy pressure on the handles.

For cutting wire, a constant operation in your work, this tool is most serviceable, as it makes a clean cut, right through fuzzy insulation as well as through metal. The cut is far more incisive than with the common diagonal cutting pliers. With the diagonal nipper you can cut wire not only along its length, but wherever it may be attached, since accessibility is perfect. A cut can be made any place where the diagonal nipper can enter, since the cutting can be done at the tip. Pliers with diagonal cutters can only ply, not cut, at the extremity.

With the diagonal nipper insulation can be bared from wire ends for soldering. Also screws up to 8/32 machine where over-extending. The familiar 6/32 brass machine screw used in radio can be nipped off at any point with one firm application of pressure with one hand.

The device is used extensively in radio set factories and by custom set builders and radio experimenters.

Size 5½" long; weight 1⅝ lbs.; material, drop forged steel; finish, nickel plated. Order Cat. 177 at $1.49, shipped C. O. D. Five-day money-back guaranty.

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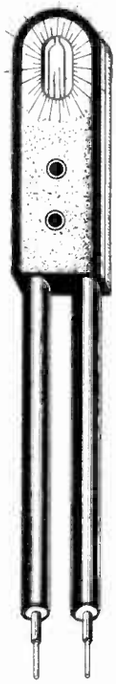
# NEW J-245-X TROUBLE-SHOOTING JIFFY TESTER

## *Illumination Continuity and Polarity Tester FREE with Each Outfit!*

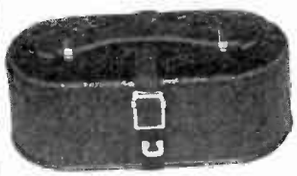

**Your Price**

**$15.82**

**Complete**

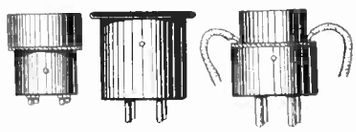


Illumination Tester, Vest Pocket Size, Shows Shorts and Opens Visually, also polarity of DC line. A Neon lamp is built in.



The three-meter assembly, in the crackle-brown finish carrying case, with slip-on cover in place. The handle is genuine leather. The buckled strap holds the cover on.

Illustration above is 2/3 scale.



J-111 Multiplier, upper left, with tip; below it, J-106 Multiplier with tip; plugs, left to right, J-19, conforms UV socket to UX plug; J-20, conforms UX tester socket to UV199 tube; J-24, to test Kellogg and old style Arcturus tubes.

## *Makes All Necessary Tests in a Jiffy and Simplifies Service Work!*

WHEN servicing a radio set, power amplifier, speech amplifier or sound reproduction or recording equipment, the circuits and voltages are almost inaccessible, unless a plug-in tester is used.

The Jiffy 245-X plugs in and does everything you want done. It consists of:

(1)—The encased three-meter assembly, with 4-prong (UX) and 5-prong (UY) sockets built in; changeover switch built in, from 0-20 to 0-100 ma.; ten vari-colored jacks, five of them to receive the vari-colored tipped ends of the plug cable; grid push-button, that when pushed in connects grid direct to the cathode for 224 and 227 tubes, to note change in plate current, and thus shorts the signal input.

(2)—4-prong adapter for 5-prong plug of cable.

(3)—Screen grid cable for testing screen grid tubes.

(4)—Pair of Test Leads for individual use of meters.

(5)—J-106 Multiplier, to make 0-300 DC read 0-600.

(6)—J-111 Multiplier, to make 0-140 AC read 0-560.

(7)—Two jack tips to facilitate connection of multipliers to jacks in tester.

(8), (9), (10)—Three adapters so UV199 and Kellogg tubes may be tested.

(11)—Illumination Tester.

The illumination tester will disclose continuities and opens and also the polarity of DC house mains. It is as handy as a pencil and fits in your vest pocket. It works on voltages from 100 to 400. There are two electrodes in a Neon lamp in the top of the instrument. On AC both electrodes light. On DC only one lights, and that one is negative of the line, the light being on the same side as the lead. Hence the illuminator shows whether tested source is AC or DC, and if DC, which side is negative.

Even the output of the speaker cord will show a light.

Also, the device will test which fuses are blown in fused house lines, AC or DC. Besides it tests ignition of spark plugs of automobiles, boats and airplanes, also faulty or weak spark plugs.

Just flash on the illumination tester momentarily. It will last about 4,000 flashes.

THE new Jiffy Tester, J-245-X, is a complete servicing outfit. It consists of a three-meter assembly in a metal case, with slip-on cover and a cable plug. There are ten adapters. It is vital to have the complete outfit so you can meet any emergency.

With this outfit you plug the cable into a vacated socket of a receiver, putting the removed tube in the tester, and using the receiver's power for making these tests: plate current, up to 100 milliamperes; plate voltage up to 300 volts; filament or heater voltage (AC or DC), up to 10 volts.

Each meter may be used independently. One of the adapters—a pair of test leads, one red, the other black, with tip jack terminals—serves this purpose. Multiplier J-106 extends the range of the DC voltmeter to 600 volts, but this reading must be obtained independently, as must readings on the 0-60 scale of the DC voltmeter. Independent reading of the AC voltmeter for line of voltage is necessary; also to use 0-140 scale while Multiplier J-111 extends the AC scale to 560 volts for reading power transformer secondaries.

The other adapters permit the testing of special receiver tubes, so that tests may be made, in all, of 22 different tubes: 201A, 200A, UX199, UV199, 120, 240, 171, 171A, 112, 112A, 245, 224, 222, 228, 280, 281, 227, 226, 210, 250, Kellogg tubes and old style Arcturus tubes.

GUARANTY RADIO GOODS CO.
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N. Y. City.

☐ Please send me on 5-day money-back guaranty your J-245-X Jiffy Tester, complete, with all 10 adapters, and with illuminated Tester FREE with each order. Also send instruction sheet, tube data sheet and rectifier tube testing information.

☐ Please ship C. O. D. @ $15.82 plus cartage and P.O. fee.

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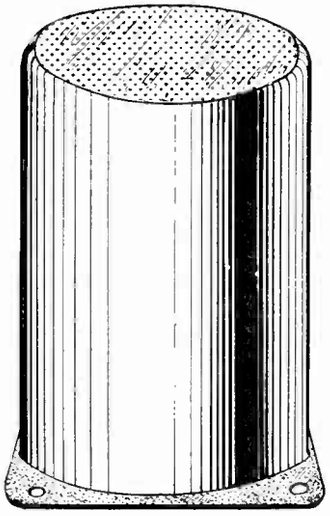
5-DAY MONEY-BACK GUARANTY

# The Latest in Tuning Equipment

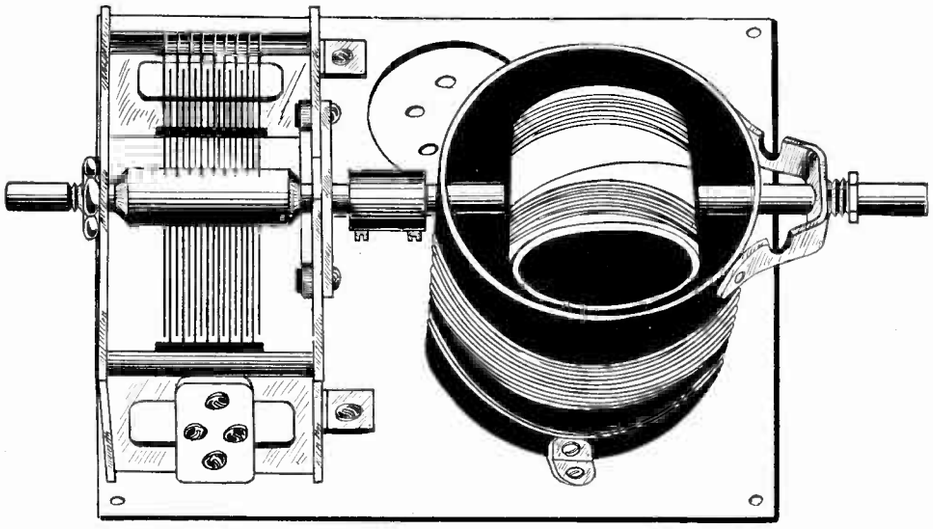
## SHIELDED COIL



RF transformer in aluminum shield 2¾" square at bottom, 3¾" high. If metal sub-panel is used no extra base is needed. Coils have brackets on. You must assemble in shield yourself and solder winding terminals to built-in lugs. For all circuits and stages, including screen grid tubes.

Cat. No. SH3 for .00035 mfd. .....$0.95
Cat. No. SH5 for .0005 mfd. .....$1.00
Cat. SHB (extra base) .....$0.10

## BERNARD TWO-TUBE TUNER ASSEMBLY



For building a tuner consisting of a stage of screen grid radio frequency amplification and a detector. AC or battery-operated, use the Bernard two-tube tuner assembly. Suitable for single control with one drum dial or separately tuned stages with two flat-type dials. The assembly consists of antenna stage (BTL-AC or BTL-DC), having Bernard Tuner BT3A, a .00035 mfd. condenser, socket, link and aluminum base. The detector input stage (BTR-AC or BTR-DC) consists of the same parts, but the coil has a tuned primary with untuned input to detector. Assemblies are unwired but are erected.

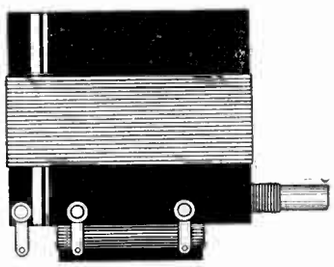
The condenser has shaft protruding at rear, so if two dials are used coil is put at front panel in either instance and condenser at front panel for the other.

For AC operation, 224 RF and 224, 227 or 228 detector, order Cat. No. BTL-AC and BTR-AC at $6.00 for both.

For battery operation of filaments, 222 RF and 222, 240, 201A or 112A detector, order Cat. No. BTL-DC and BTR-DC at $6.00 for both.

[Note: for drum dial single control an 80 mmfd. equalizing condenser is necessary. This is extra at $0.35. Order Cat. EQ-80.]

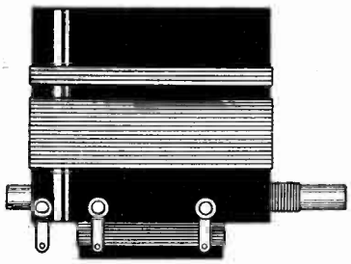
## ANTENNA COUPLER



Cat. No. VA5—$0.85
FOR .0005 MFD. CONDENSER

Moving primary and fixed secondary, for antenna coupling. Serves as volume control.
Cat. No. VA3 for .00035 mfd. .....$0.90

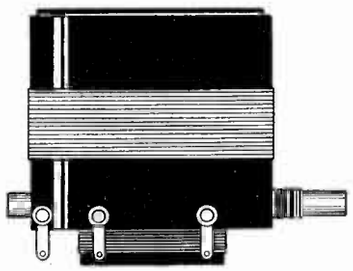
## BERNARD TUNERS



Cat. No. BT5A—$1.35
FOR .0005 MFD. CONDENSERS

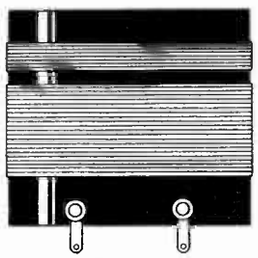
Bernard Tuner BT5A for .0005 mfd. for antenna coupling, the primary being fixed and the secondary tuned. This coil is used as input to the first screen grid radio frequency tube. Secondary has moving coil.
Cat. No. BT3A for .00035 mfd. ..$1.35

Bernard Tuner BT5B for .0005 mfd. for working out of a screen grid tube, tuned primary, untuned secondary. Primary has moving coil.
Cat. BT3B for .00035 mfd. ..$1.35



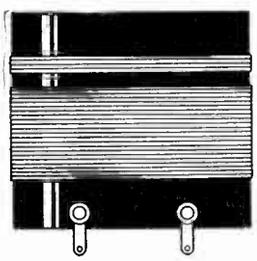
Cat. No. BT5B—$1.35
FOR .0005 MFD. CONDENSER

## SG TRANSFORMER



Cat. No. SGS5—$0.60
FOR .0005 MFD. CONDENSER

Interstage radio frequency transformer, to work out of a screen grid tube, primary untuned.
Cat. No. SGS3 for .00035 mfd. ..... $0.65



Cat. No. RF5—$0.60
FOR .0005 MFD. CONDENSER

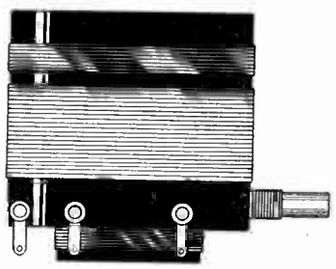
## DIAMOND PAIR

Cat. No. RF5—$0.60
FOR .0005 MFD. CONDENSER

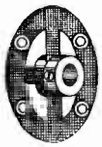
Antenna coil for any standard circuit, and one of the two coils constituting the Diamond Pair.
Cat. No. RF3 for .00035..$0.65

Cat. No. SGT5—$0.85
FOR .0005 MFD. CONDENSER

Interstage 3-circuit coil for any hookup where an untuned primary is in the plate circuit of a screen grid tube.
SGT3 for .00035 mfd...$0.90



Cat. No. SGT5—$0.85
FOR .0005 MFD. CONDENSER



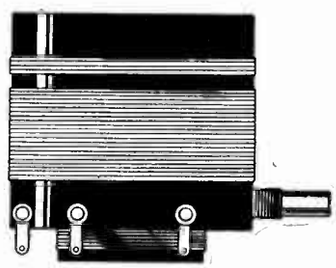
FL4 $0.30
Flexible insulated coupler for uniting coil or condenser shafts
Order Cat. FL4 at .....$0.30
Equalizing condenser, 80 mmfd., for connection across any tuning condenser where ganging is resorted to, or for equalizing independently tuned circuits to make dials track.
Order Cat. EQ80 at .....$0.35

Order the Diamond Pair, Cat. DP5 for .0005 mfd at .....$1.45

Order the Diamond Pair, Cat. DP3 for .00035 mfd. at .....$1.55

[Note: These same coils are for AC or battery circuit.]

## STANDARD TUNER



The standard three-circuit tuner is used with primary in the plate circuit of any RF tube, AC or battery type, excepting only screen grid tube.

For .0005 mfd. order T5 at .....$0.85

For .00035 order Cat. T3 at .....$0.90

All coils have 2½" diameter, except the shielded coil, which is wound on 1¾".

The coils are wound by machine on a bakelite form, and the tuned windings have identical inductance for a given capacity condenser, i. e., .0005 mfd. or .00035 mfd. Full coverage of the wave band is assured.

All coils with a moving coil have single hole panel mounting fixture. All others have base mounting provision. The coils should be used with connection lugs at bottom, to shorten leads.

Only the Bernard Tuners have a shaft extending from rear. This feature is necesary so that physical coupling to tuning condenser shaft may be accomplished by the insulated link.

Screen Grid Coil Company,
143 West 45th Street,
New York, N. Y. (Just East of Broadway.)

Please ship at once C. O. D.:

☐ Cat. No. ..... at $ .....
☐ Cat. No. ..... at $ .....
☐ Cat. No. ..... at $ .....

Name .....

Address .....

City ..... State .....