October 1, 1925
15 Cents a Copy

RADIO PROGRESS

"Always Abreast of the Times"

In This Issue

YCU WILL UNDERSTAND THIS MAGAZINE---AND WILL LIKE IT

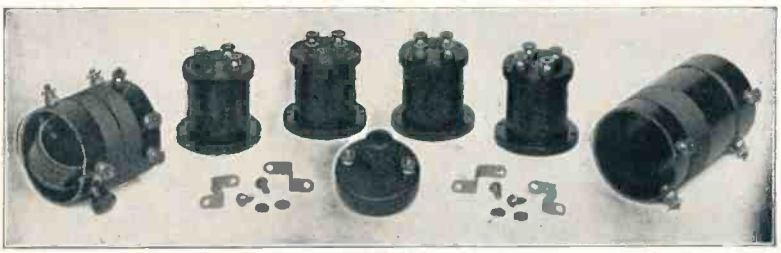
A New England Publication

At Last! At An Unheard of Price!

A SURE FIRE

SUPER-HETERODYNE KIT

A Superadio Product



A Superadio Product

SUPERADIO SUPERHETERODYNE KIT, $17.50

MATCHED TRANSFORMERS—TUNED INPUT

EASY TO BUILD EASY TO OPERATE

UNSURPASSED DISTANCE VOLUME AND SELECTIVITY

WONDERFUL TONE

Kit Consists of:

1 Antenna Coupler
1 Oscillator Coupler
1 Special Variable Condenser
1 Tuned Input Transformer
3 Matched Intermediate Transformers
Hardware for Mounting Couplers

Booklet, With Diagrams and Full Layouts and Information

Manufactured by

DE WITT-LAFRANCE CO., Inc.

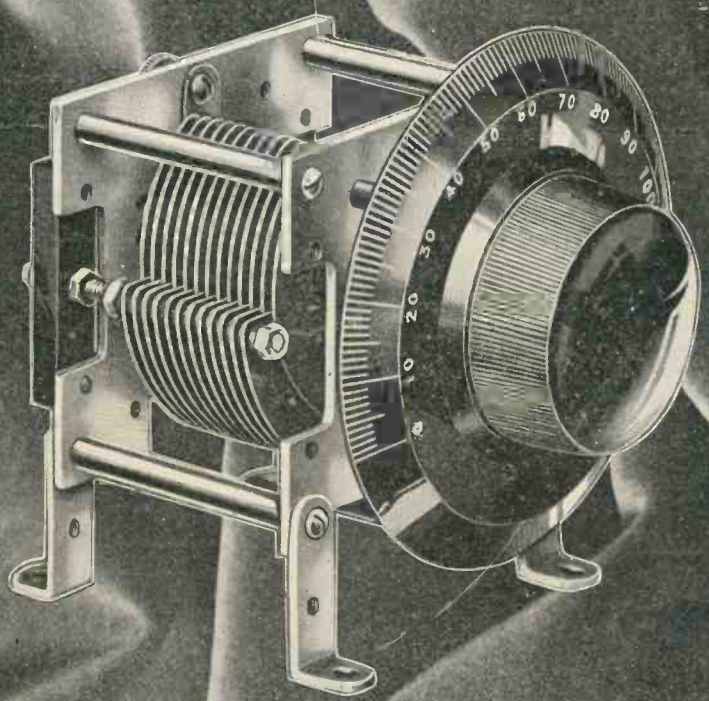
54 Washburn Avenue Cambridge, Mass.

Sales Representatives:

Martin, Hartley and Foss Co. 99 Bedford Street, Boston, Mass.

NATIONAL

VELVET VERNIER CONDENSERS AND DIALS



Made by the NATIONAL COMPANY, INC.
Exclusive Manufacturers of

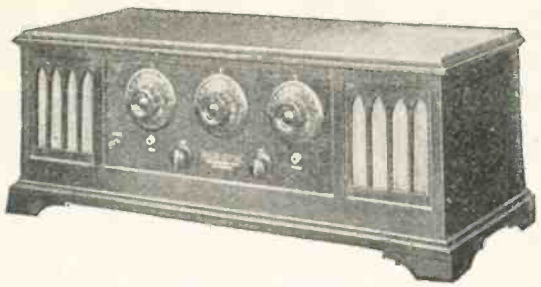
The NATIONAL
Browning-Drake TRANSFORMER

Write for Bulletin 105 R. E.

NATIONAL COMPANY, INC., 110 Brookline St., Cambridge, Mass.

RICO-DYNE DE LUXE SET

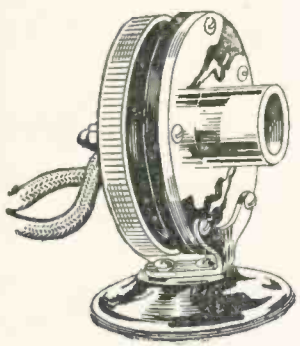
(HAVING NEW STRAIGHT-LINE RADIO FREQUENCY CONDENSER)



Beautiful in appearance and still more beautiful in performance. Mahogany cabinet of classic design. Uses 5 UV201 A tubes with storage battery or UV199 tubes with dry cell batteries. There is room for the dry cell batteries in the cabinet. The De Luxe model contains a loud speaker with the famous MELOTONE Unit, which gives remarkably clear and loud reproduction. Sensitive, selective, non-oscillating. A tuned radio frequency set of the highest order at a remarkably low price.

Type B
De Luxe

$75



ADJUSTABLE

MAKE FULL USE OF YOUR PHONOGRAPH

MELOTONE — "None Better"

Adjustable phonograph unit makes your phonograph a perfect loud-speaker

$7.50

The Melotone Has All the Qualities of the $10 to $12 Units

THE NATION'S FAVORITE HEADSET

RICOPHONES —The Headset of Real Value

There is more quality, real honest-to-goodness quality packed into RICOFONES than you'll find in any headset at twice its price! Compare and see.

$2.75

Manufacturers of the famous "RICO" straight line condensers, at $1.75 each. The "Tropadyne" circuit is supplied free with every tuned "Tropaformer" that we manufacture for all long wave transmission. "Tropaformers" $6.75 each. Dealers—write or wire for wonderful proposition.

RADIO INDUSTRIES CORPORATION,
131 DUANE ST., NEW YORK CITY.

Gentlemen: I am enclosing $..... for the items checked below. Kindly ship at once.

.....RICO-DYNE DE LUXE SET, $75.
.....MELOTONE UNIT, $7.50.
.....RICOFONES, $2.75.

My Dealer is .....

NAME . . ..
ADDRESS . . ..
CITY . . ..

RICO

for all Long Wave Circuits

RICO Products on this Page Will Improve Your Radio 100%

TROPAFORMERS

The sensitivity, selectivity and volume obtained in all types of long-wave circuits depends entirely upon the intermediate frequency transformer. TROPAFORMERS have been specifically designed to meet the new scientific requirements of long-wave circuits. The TROPAFORMER combines transformer and condenser. The condenser is shunted across the secondary winding of the transformer, and by its use the transformer may be tuned to any definite wave length between 3,000 and 9,500 meters. Only in TROPAFORMERS will long-wave circuit users find these advantages, and these advantages are patented for TROPAFORMERS exclusively!

$6.75

Free Hook-up of the Famous Tropadyne Circuit with Each Tropaformer Ordered.

DID YOU EVER BUILD A SET THAT GOT "COAST TO COAST"?

You Can with the RICO-DYNE 5-Tube Auto-Balanced Cellu-Weld Tuned Radio Frequency Kit

$38.75

Complete Knockdown Set as illustrated with full instructions how to build this marvelous set within a few hours.

Greatest Radio Value in History—This is What You Get:

1—Pair Ricofones. 1—Genuine Bakelite Front Panel, completely drilled and engraved. 1—Genuine laminated Bakelite Sub-Panel—with sockets already mounted. All mounting holes properly drilled. 3—Auto Balanced Tuned Radio Frequency Units—perfectly matched and balanced. 3—Beautiful 4-inch Dials. 1—Variable Grid Leak and .00025 M.F. Condenser. 1—4 to 1 Audio Transformer. 1—2 to 1 Audio Transformer. 1—.002 Fixed Mica Condenser. 1—.006 Fixed Mica Condenser. 2—Single Circuit Jacks. 1—Filament Control Switch. 1—30-ohm Rheostat. 1—10-ohm Rheostat.

FOR THOSE WHO WANT TO BUY ONLY THE RICO-DYNE KIT

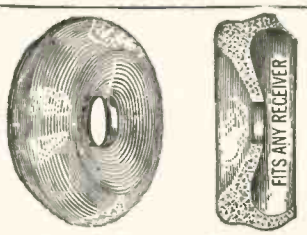
HERE IS JUST WHAT THEY WANT:

It seems unusual that with the tremendous volume, selectivity and distance-range of the Rico Auto Balanced set, it should be so simple to construct. Yet, nevertheless, this is true. We have letters from fans who tell us that they constructed their Rico set within a few hours. The plans which accompany the Rico Kit are so simple that we believe this is so. Any beginner need only to read English in order to construct the Rico set. This Kit contains 3 Auto Balanced Tuned Radio Frequency Condensers, inductance Units, factory matched, book of instructions and drilling template. You can't go wrong!

$16.50

RICO-DYNE HAS SET NEW RECORDS IN RADIO!

for bliss!

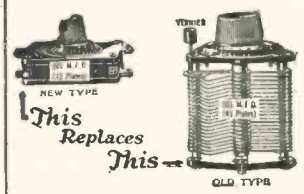


SPONGE RUBBER

RICO FONEKUSHIONS

You'll know what real ear-phone comfort is when you use RICO FONEKUSHIONS. They are made of soft, pure sponge rubber, and fit any make of headphone. They are like soft, downy pillows for your distance-seeking ears..... **50c**

for better tuning



RICO STRAIGHT LINE CONDENSERS

In the old days, folks used horses. Now they can get as much power out of one auto as from 40 horses. It was all right, too, a few years ago, for folks to use the old-time condensers, but now, since Rico brought forth the RICO STRAIGHT LINE CONDENSER, which occupies two-thirds less space than the ordinary mesh plate type, everyone modernizes his set with the RICO STRAIGHT LINE CONDENSER.

No. 411—.00025 mfd. $1.75
No. 423—.0005 mfd. 1.75
No. 450—.001 mfd. 1.75

Inclusive with Dials. Without Dials, $1.50.

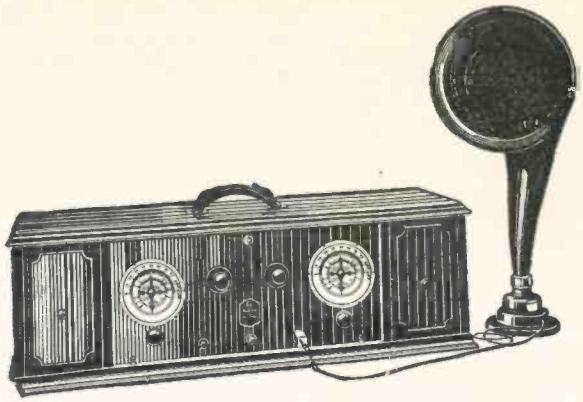
Each of these Rico products means added pleasure and value to your Radio Set.

If Your Dealer Cannot Supply You—Use This Coupon. No Money Down!

RADIO INDUSTRIES CORPORATION
131 Duane Street, New York City

Please send me C. O. D. the following: .....Tropaformers, $6.75 .....Straight Line Condensers, $1.75 .....Ricofones, $2.95 .....Oscillating Coil, $3 .....Fonekushions, 50c .....Melotone Attachment, $7.50.

Name .....Address.....



Which is Better—

A Cheap Set for Cash---or A GOOD Set ON TERMS ?

The Good Set is Cheapest in the End

Bay State specializes on the better grade sets, like Radiola, DeForest, Adler Royal, Magnavox, and sells on **Convenient Terms.**

Write for information. Address Dept. A,

BAY STATE RADIO CO.

The House of Radio Service

116A Washington Street **Boston, Mass.**

Extracts from a Few of the Many

LOVE LETTERS

FROM THE READERS OF "RADIO PROGRESS"

And Not One of Them Solicited

"The style of your magazine and its motto are so good." F. J. PORTER,
U. S. Patent Office, Washington.

"Your Mr. Taylor is the only writer whose work has been so clearly worded that I could get the idea with little effort. 'More power to him.'" B. W. PERCIVAL, Lynn, Mass.

"We like RADIO PROGRESS, but don't see enough of it!" H. S. FRAINE,
of Doubleday, Page & Co., N. Y.

"Your magazine gives so much on the fundamentals of radio that I have decided to subscribe for it. Most people depend on this magazine to keep them instructed on the subject about which the publication deals. Very few buy books. I appreciate it very much and hope it will grow large." DR. J. S. CANTRELL,
Proprietor Snowwhite Eggfarm, Carthage, Mo.

"I like RADIO PROGRESS because its articles are clear and concise, especially those of H. V. S. Taylor." A. A. CONSTEIN,
Ph. G., D. D. S., Upper Sandusky, Ohio.

"RADIO PROGRESS is the most interesting radio magazine I have yet seen, and strikes a happy medium between being too technical and ignoring technical explanation altogether. May 'you live long and prosper.'"
(Dr.) M. S. DELAND,
State Hospital, Topeka, Kan.

"Your magazine has a very pleasing presentation of its subjects without too much technicality, and understandable."
A. J. WERTZEL,
Vice. Pres. United States National Bank, Superior, Wis.

"Enclosed find 50c. for copies Nos. 9, 10 and 11 of RADIO PROGRESS to COMPLETE MY FILE, as I missed them while on my vacation."
FRANK HANUS, Cleveland, Ohio.

"I like your magazine very much and hope you will keep up the good work in publishing such clean cut articles." E. T. LEWIS,
Baltimore, Md.

"Interest in your progressive little magazine as well as the desire to obtain the special hook-up number of Jan. 15th has prompted me to enclose," etc. CORLISS GALLOGLY,
Alden, Minn.

"I like your magazine very much."
JOHN GILLMAN, Long Island City, N. Y.

"While your magazine may not have the bulk of some of your contemporaries the subject matter is excellent. being clearly written and accurate." E. J. WAGNER, Chicago.

You Radio Manufacturers

Who want to advertise where you can make the largest sales for the smallest expense will never do it until you advertise in RADIO PROGRESS

There are more than 20,000 other readers like those above who are awaiting your announcements.

RADIO PROGRESS

8 TEMPLE STREET **PROVIDENCE, R. I.**

RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2 Number 14

Contents for

OCTOBER 1, 1925

New York Representative

SHELDON C. KNIFFIN ..... 503 Fifth Avenue, New York—Phone Murray Hill 3149

Western Representative

W. T. DIEHL ..... 30 North Dearborn Street, Chicago—Phone Central 5410

RADIO PROGRESS is issued on the 1st and 15th of each month by the Oxford Press at 8 Temple Street, Providence, Rhode Island. John F. O'Hara, Publisher. Yearly subscription in U. S. A., $3.00. Outside U. S. A., $3.50. Single copies, 15 cents. Entered as second-class matter, April 4, 1924, at the Post Office at Providence, R. I., under the Act of March 3, 1879. Address all communications to RADIO PROGRESS, 8 Temple Street (P. O. Box 728), Providence. R. I. Title registered at United States Patent Office.

The Two Outstanding Parts In Radio !

Give Low Losses and Amplification Without Distortion to Any Set

QUALITY and distance are what a radio set must give. To insure Quality, amplification without distortion is essential. And to insure Distance, low losses are essential. That is radio in a nutshell.

People in whose sets Acme Transformers are used, are sure of hearing concerts "loud and clear" so a whole roomful of people can enjoy them.

The Acme A-2 Audio Amplifying Transformer is the part that gives quality. It is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, super-heterodyne, regenerative or reflex, the addition of the Acme A-2 will make it better.

Acme A-2 Audio Frequency Amplifying Transformer

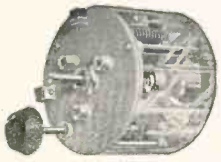
To get the thrill of hearing distant stations loud and clear, your set must have low losses, for it is low losses that give sharp tuning to cut through the locals, and it is low losses that allow the little energy in your antenna to come to the ampifier undiminished. That's what the Acme condenser will do for any set. And it will do it for years, because the ends can't warp, the bearings can't stick and the dust can't get in and drive up the losses several hundred per cent.

The Acme Reflex (trade mark) owes its success and its continued popularity to these two outstanding parts in the radio industry, for low losses and amplification go hand in hand.

Use these two parts in the set you build. Insist on them in the set you buy.

Send 10 cents for 40-page book, "Amplification without Distortion"

WE HAVE prepared a 40-page book called "Amplification without Distortion." It contains 19 valuable wiring diagrams. In clear non-technical language it discusses such subjects as Radio Essentials and Set-building; How to make a loop; Audio frequency amplifying apparatus and circuits; Instructions for constructing and operating Reflex amplifiers; How to operate Reflex receivers; Antenna tuning circuits for Reflex sets; "D" Coil added to Acme four tube reflex; "D" coil tuned R. F. and Reflex diagrams; and several more besides. It will help you build a set or make your present set better. Send us 10 cents with coupon below and we will mail you a copy at once.



Acme Low-Loss Condenser

ACME APPARATUS COMPANY

Transformer and Radio Engineers and Manufacturers

DEPT. (AS), CAMBRIDGE, MASS.

SEND THIS COUPON

ACME APPARATUS COMPANY,
Dept. (AS), Cambridge, Mass.

Gentlemen:—

I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book "Amplification without Distortion."

Name .....

Street .....

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

ACME ~ *for amplification*

Gems from the Program of Our October 15 Issue

"Quality, Quality," is the cry on everyone's lips. One way to make an improvement is to reduce the noises which your phones mix up with the music. These unnecessary sounds come from many different causes. What they are and how to cure them are discussed by the Service Department of one of the large radio manufacturers. Read **"Nine Noises in Radio."**

You keep hearing announcements of "A" and "B" broadcasting stations. Do you know what the difference is between them? An explanation and a discussion of how the government assigns these ratings appears in the article by Vance, **"A and B Broadcasting Stations."**

One of the most popular artists before the microphone once had quite a legal fight as the Sultan of Sulu. This interesting bit, as well as other interesting incidents of his life are well told by Moulan in **"When the Sultan of Sulu Sings."**

You hear a great deal about straight line this and straight line that. What does it all mean and is it really an improvement? This matter is discussed from all angles by Taylor in **"Why the Straight Line Condenser."**

"Radio in the Biggest Cathedral" is a very interesting description by Marx of how broadcasting invaded the interior of St. Peter's at Rome and the surprising results obtained from the innovation.

Romance does not always require a moon to come true. A very romantic story of achievement is told by Goldman in **"From Hospital to Stage."**

Many fans who like to build their own sets have tried a reflex hook-up and not succeeded very well in getting what they wanted. This is largely the fault of going about it wrong. To build a good reflex set is a matter of good parts and knowing how. If you will supply the parts Nickerson will tell you how in **"Reflexing a Loop Set."**

RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. 2. No. 14 OCTOBER 1, 1925 15c PER COPY, $3.00 PER YEAR

Crystal Cures Birdies at KDKA

How to Hold a Wave Which Does Not Vary in Speed

By HORACE V. S. TAYLOR

ALL that chirp are not canaries" might be the way the old proverb is phrased by radio fans. Every dial twister knows that a radio set is full of squeals or birdies, as some people call them.

Perhaps everyone does not know that these squeals may be divided into two big classes. Probably most of them are caused by receiving sets (either yours or your neighbors) in which the tickler coil is turned too high or else a tube is badly

Fig. 1. Two Waves Nearly Alike Fall in and Out of Step

neutralized so that the radio set itself is oscillating.

Two Waves Are Fighting

The other class of whistles is not caused at all by receivers, but starts when two sending stations are transmitting on waves which conflict. When two such waves fight for the same place in the broadcasting band, all listeners-in hear about it is a high pitched, continuous squeal. There is no way such a tone can be cut out on even the most selective receiver, except by tuning to some other station some distance away in wave frequency.

How can you tell whether it is a sending or a receiving set which is messing up the ether? The test is quite a simple one. Turn your main tuning dial about half a degree either up or down. If the pitch of the tone or note changes higher or lower then that proves that it is your own set which is reacting with the sending station to produce the squeal. If, however, the tone is the same note as before, and merely becomes louder or softer, then you may be sure that your receiving set has nothing to do with it and the birdies are coming in from outside.

How to Locate the Squealer

If you find that you are to blame of course the remedy is to reduce your tickler and so cut down on the regeneration. But if the trouble starts outside, the only thing you can do is to wait a while and see if the tone changes. If it does, it proves that some nearby listener is letting his receiver oscillate, and so is disturbing every one within a few blocks. But if after a reasonable time the tone is unchanged, it probably means that two sending stations are affecting each other in this way and the only remedy is to let them know of this condition in the hope that they will be able to adjust their wave to the speed which was decided by the government.

Let us see what it is which causes this condition. In the first place it was mentioned that it was the reaction of two different stations. This is always true—one instrument alone, whether receiver or transmitter, cannot possibly cause a squeal. If a man lives alone on a desert island, then it will mean nothing to him to think about being in step while walking. But if he finds a "Man Friday," then two as they walk along will be in or out of step, depending on how well they keep time together.

Both with Same Step Speed

In Fig. 1, we see a man and a woman walking along the street. They start together each with the left foot and so are in step. If they both take the same length of step (wave length) or expressing it another way, take exactly the same number of steps per minute, (frequency) then they will stay in step as long as they keep on walking.

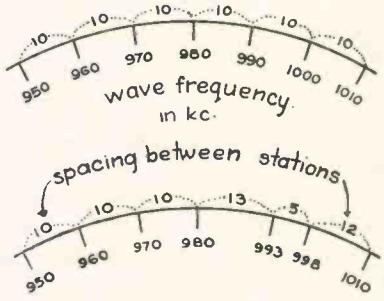


Fig. 2. Upper Cut Shows How Government Assigns the Waves. Lower Waves Cause Trouble

But let us say that the man has longer legs than his companion and so does not make as many movements a minute. Of course, as they keep side by side they are walking along at the same speed, but whereas he covers two feet and a half between foot prints, in her case this distance will be only two and a quarter feet.

As they saunter along the street together, we shall notice that in one minute the woman takes 100 steps, while the man is able to keep walking at the

same speed with only 90 steps per minute. Of course, then they will be in and out of step or "phase" as it is called electrically, every few seconds.

Falling In and Out

The rule for finding the number of times this act occurs is quite simple. Just subtract one speed or frequency from the other and the answer gives the number of times the phase shifts. In this case we have 100 — 90 equals 10. That is every minute will see them fall into step and out again exactly ten times. If the girl stepped 100 times and the man only 80 times a minute, then the changes in phase would be 100 minus 80, or 20 times. And if the man should now speed up his motions to 99, then 100 minus 99 would show that this falling in and out of step would occur only once every minute.

It is just the same way with the radio waves. If two of them have a frequency of 100,000 and 99,000 oscillations per second, then they will be in and out of phase the difference or 1000 times per second. Most waves in the broadcast band go about ten times as fast as this. By the same reasoning a wave of 1,000,000 cycles (300 meters) and 990,000 (303 meters) will have 10,000 changes in phase every second. This is the spacing which is assigned to all the broadcasting stations by the Bureau of Standards.

Spacing the Stations

Instead of talking about 990,000 cycles it is easier to say 990 kilocycles (kc.) This spacing of waves is shown in Fig. 2. At the upper part of the curve appears a line for each frequency which may be used. The dotted lines indicate the difference in kilocycles between each pair of stations. Remember that two adjacent broadcasters are not those which are located close to each other in the same State, but those which have nearly the same wave. The stations themselves may be separated by 1,000 or 3,000 miles.

In each case the spacing in frequency is exactly ten kc. as given out by the Bureau. What happens if the transmitters do not stick to their assignment? The result is displayed in the lower part of Fig. 2. Here the station which should be sending at 990 kc. has slipped up to 993, while the 1,000 kc. broadcaster has allowed his frequency to drop to 998. As a result you will notice that the difference between these two is only five kc. or 5,000 vibrations per second instead of the required 10,000.

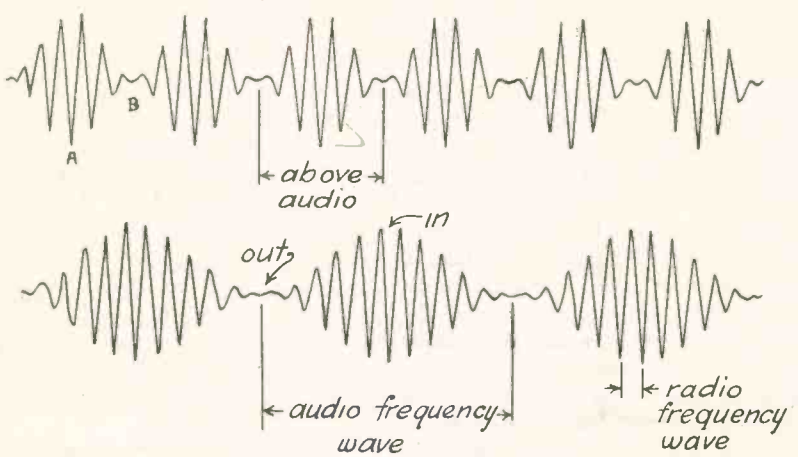


Fig. 3. Upper Curve is for 10 kc. Spacing. No Squeal. Lower, Wrong Spacing Makes Squeal

Radio Waves Like Walkers

This will immediately cause trouble as is better observed from Fig. 3. The upper curve in this figure shows a group of waves which is the combination of the two sending stations. When the two waves are in step they add up their amplitude (loudness) as at A. An instant later they get out of step, B, and now they subtract one from the other. This action is exactly like that of the man and woman which we have already seen in Fig. 1.

We have learned that the number of these groups or shifts in phase corresponds to the *difference* of the frequencies. Since in this case the two waves, when working correctly, are at 1,000 and 990 kc., they will have a difference of 10 kc. or 10,000 groups per second. The detector in your radio set changes these groups into the audio or low frequency vibrations. Your ear, therefore, will receive 10,000 impulses per second from the phones or loud speaker. But it so happens that this figure is so high that the human ear is not able to hear it. There are a few trained musicians who claim to be able to pick up such a very high note, but even if they do, their hearing at that point is so poor that the tones have no volume to speak of. To put it in another way, even though the air waves at that high speed strike our ears we do not know it, and so are not disturbed. That is the reason why the Department of Commerce uses this spacing of 10 kc.

These Groups Are Slow

Now take the case when these two stations have shifted slightly from their assignments as Fig. 2 showed. The difference between 998 and 993 kc. is five kc. or 5,000 vibrations per second. The lower curve of Fig. 3 indicates this condition. Notice that the height of the waves is the same as before and that the spacing of the individual hills and valleys (the radio frequency) is just as above. But it takes longer for the waves to get in and out of step and so the frequency of the groups (audio) is only 5,000 per second or half as big as before.

It is a fact that this speed of vibration is easily heard by everyone's ears as a high pitched, disagreeable squeal. That is why you are able right away to tell when the two stations have got off their assignments. Every time any one of them makes a change it cuts down the separation between its wave and the one just above or below it and that is what causes the squealing or heterodyning, as it is often named. That explains why it is necessary for each station to keep right on its own wave and not wander into its neighbor's pasture.

Such a Small Change

This may seem like an easy thing to do, but just figure out what a small percentage change this is. Take a 300-meter wave, which runs at 1,000 kc. A shift of 2 kc. is only 2/10 of 1 per cent. For the faster waves this proportion is even smaller. Slight changes in electrical apparatus, owing to temperature,

humidity, swaying in the wind, vibrations, and similar causes make quite a difference in the tuning of a set.

As an illustration of this, notice that on your own receiving set it is impossible to tune a distant station in with the filament switch turned off and then by snapping it on find you are at a perfect setting. To be sure most good radios can be logged or recorded for station against dial readings. If you examine closely, though, you will find that there is a shift of as much as half a division of a dial on some stations from time to time. And this is for a receiving set only. When you think of a transmitter with all the extra equipment in the way of oscillators, modulators, generators, microphone and a host of other devices, it is no wonder that the stations find it hard to stay put.

New Kind of a Crystal

A new device for holding this sending frequency constant has been in the development stage for some time, but is now being used at station KDKA with very good results. The basis of this invention is a crystal. It is not the kind which is used as a detector in the more inexpensive sets, but a piece of pure, transparent quartz. This quartz is refined in a special electric furnace (itself a new invention) and comes out in slabs considerably clearer than the purest optical glass. A crystal of this material is seen at the left top of Fig. 4.

This is cut to shape on a grinding wheel something like the way in which diamonds are cut. The cube at the left center of Fig. 4 gives an idea of the way a finished crystal looks. Such a piece, when made to oscillate, will vibrate at the tremendous speed of about a million pulsations per second. If still higher speeds are wanted, then the size of the crystal is reduced, as displayed at the bottom left of this photograph.

A Voltage When Squeezed

There is nothing peculiar in a piece of solid material having the possibility of vibrating when it is hit. A piece of steel will do the same thing. Have you ever seen a pile of rails intended for the railway and hit a projecting end with a stone? The whole rail vibrates and gives out a high pitched tone. However, the peculiarity about the quartz crystal is that when it is squeezed it gives out a voltage. For this reason it is called a "piezo-crystal." Piezo is the Greek word meaning pressure.

The same effect worked backwards makes the crystal faces pull in slightly when a voltage is applied. Of course, no one knows why this action occurs any more than it is clear why water is wet—it is just one of nature's secrets. But after discovering the fact, the engineers at the radio station have put it to a good use.

A Condenser of Quartz

By putting sheets of tin foil on two faces of the crystal a condenser is made since quartz itself is a good insulator, and each sheet of tin foil becomes one of the plates of the condenser. By connecting such a unit into the circuit as illustrated in Fig. 5, we get a hook-up which holds the wave speed absolutely constant.

Here is the way it works. The crystal condenser and tuning coil are adjusted at the start to give the wave frequency which has been assigned to the station by the Government. In the case of KDKA this is 970 kc. or 970,000 complete oscillations per second. This tuner

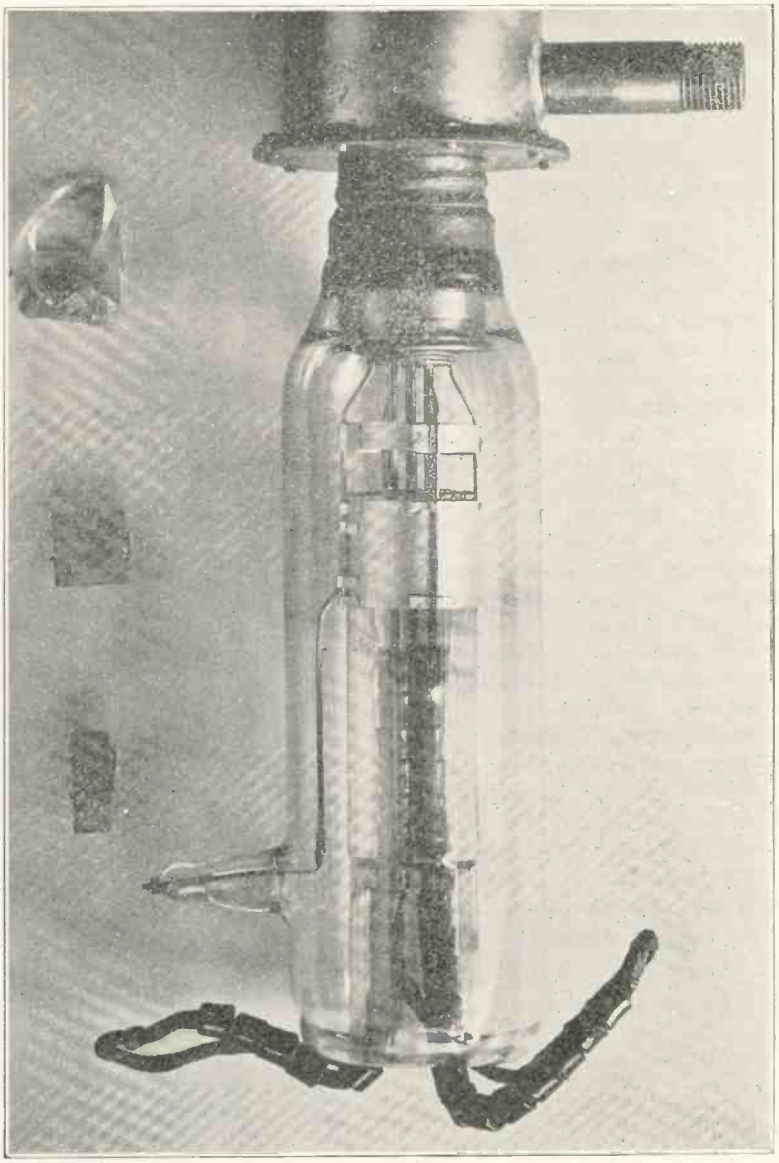


Fig. 4. Here is a 10 kw. Tube, Which Acts as Oscillator for Radio Frequency Waves. Its Speed is Held Constant by Crystal

feeds the grid of a small oscillating tube. A type like the 201-A may be used for this purpose since the amount of power given off by the crystal in its oscillations is very small. The output from the oscillator is run through a radio frequency transformer to the grid of an amplifier tube. This steps up the power by perhaps 10 or 20 times. A second step of amplifier follows this, and if necessary, a third and fourth, until the needed amount has been obtained.

Left, Right, Left, Right

The amplifiers merely make louder or more powerful (since of course you can not *hear* this high frequency) the oscillations which are fed to it from the crystal. If it keeps a true vibration speed, then the power from the last step will be just as true. This is on the same principle as a megaphone at the lips of a soldier who is counting time for his marching men. As long as he sings out left, right, left, right, at the proper speed, the megaphone will certainly neither slow down or speed up the time as he gives it to the marchers.

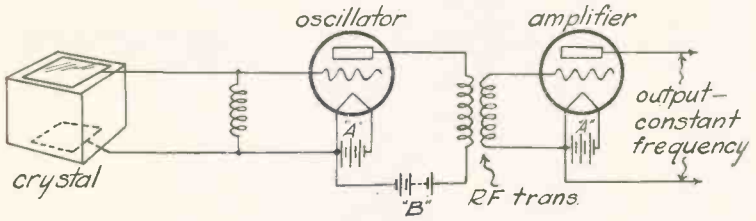


Fig. 5. Hook-up of Crystal and Tubes to Give Constant Wave Frequency

The only way to change the speed of the crystal's vibration is by changing its size or shape. Even the temperature does not have any effect as quartz is very peculiar in that it does not expand to a larger size as it gets heated up. This lack of change with temperature accounts for the fact that a rod or tube of this glass-like material can be heated quite hot in a Bunsen flame and then dropped into ice water without cracking.

Gets All Heated Up

This is a very fortunate property when adjusting to get the correct frequency. A tuning fork is adjusted for pitch by grinding the prongs, but in that case the steel is expanded under the heat of the emery wheel and so the tone when cool is not the one to which the fork was adjusted. In the case of quartz the crystal may be pressed hard against the grinding wheel and tested immediately, as there is no difference when it has cooled down to room temperature again.

The tuning coil which is in parallel with the crystal must be something like correct in order to allow the crystal to vibrate, but it has no effect on the speed of the vibration. That is why the crystal alone acts as timer for the whole system.

In actual use this outfit appears as in Fig. 6. The crystal here is located in the little container mounted on the panel above the operator's right hand. Its vibrations control the oscillating speed of the 201-A tube mounted on the top of panel. The amplifier tubes, which increase the volume of the vibration to the first few steps, are behind the panel and cannot be seen. However, the next tube which appears is a big one and occupies a position near the end of the amplifying series.

A Box with a Loop

At the left of the photograph, near the rear wall, you will notice a box with a loop of wire projecting above it. This is a wave meter which is used in testing to see how constant a wave is held. Underneath the bench are the series of "B" batteries, which go on the plates of the first tubes in the series.

The last tube with the biggest output is shown in Fig. 4. This has the customary filament, which is supplied by the two heavy leads coming out at the bottom of the tube. The grid circuit has a terminal projecting through the glass at the left, an inch up from the bottom. The plate of the tube on which the "B" battery voltage is impressed is made of metal and is part of the wall of the tube itself. It gets so hot that a metal jacket is around it containing cooling water. This is seen at the top of the cut.

A Well Insulated Meter

The mounting of these tubes is quite interesting and is revealed in Fig. 7. Here we see several of the tubes which perform the functions of oscillator, modulator, and amplifiers. After passing the last tube, the radio waves pass out to the aerial overhead. The ammeter, which measures the aerial current, is seen at the top of the board at the right. It must be very well insulated to stand

Continued on Page 34

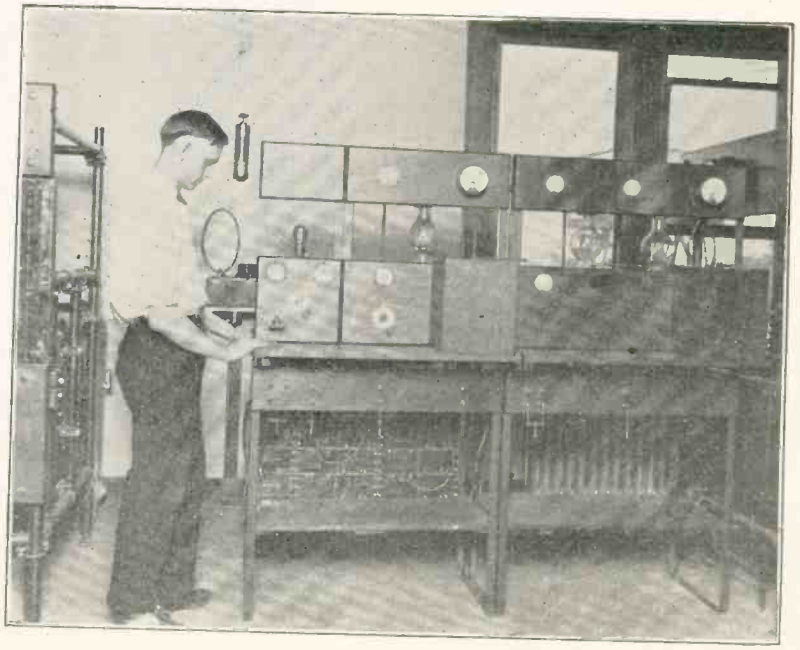


Fig. 6. The Oscillating Crystal is Just Above His Right Hand. Output Tubes are Seen in Rear

Changing Sound to Electric Current

Teaching the Radio Waves How to Talk and Sing

By BERNARD STEINMETZ

A RADIO can talk English, French, Spanish, Russian. How does it happen that it knows so many languages?

Of course, you may say that the man at the mike is speaking the various tongues. To be sure, but how do the radio waves pick up the various sounds? Or to put it in another way, can you explain how the different tones at the sending end are converted into electrical waves?

Electrifying Mouth Sounds

In broadcasting, or any form of radio telephone communication, what is really radiated from the antenna is a form of electricity, that is, electro-magnetic waves. These have been shaped to correspond with the speech or concert which is being sent out. It is the original sounds coming from the instrument or mouth which are converted into electricity so that they may be radiated by means of waves. This subject will be explained here very simply.

In the first place you must get a clear idea as to what sound really consists of

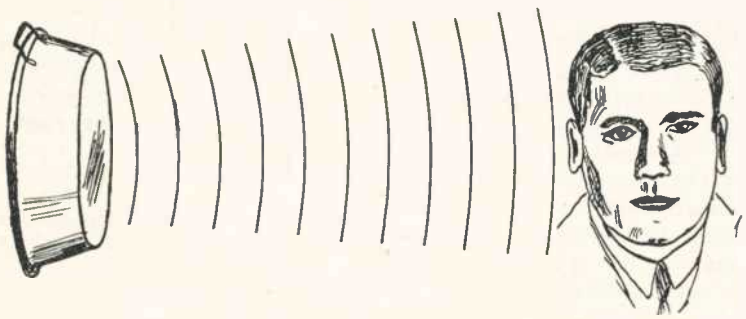


Fig. 1. When a Piece of Metal is Struck, it Sends Sound Waves Through the Air

If you take a tin pan and tap it with your fingers, Fig. 1, you hear the familiar tinny sound. What has actually been done here is that the pan has been made to vibrate by tapping it. The oscillations of the tin pan set the air surrounding it also vibrating; when the pan bottom moves outward it pushes the air out, thus compressing it, and when it moves inward the air rushes back again. This vibration of the air is transmitted to the ear drum which also begins vibrating and a sound is heard. In other words a vibrating body emits sounds.

Sound on Desert Island

Right here the old question may come to your mind—would an explosion make a sound if there were no ear to hear it? The answer to this depends entirely on what you mean by the word "sound." If you mean the vibrations in the air, as most people do, then of course, the presence of a human ear has nothing to do with it. But if you mean by "sound," the actual vibration of an ear drum, naturally there must be one there to vibrate. If you think that the sun makes light and that the rose gives out a sweet odor whether there is anyone around to perceive them or not, then the sound of the explosion exists in the absence of listeners.

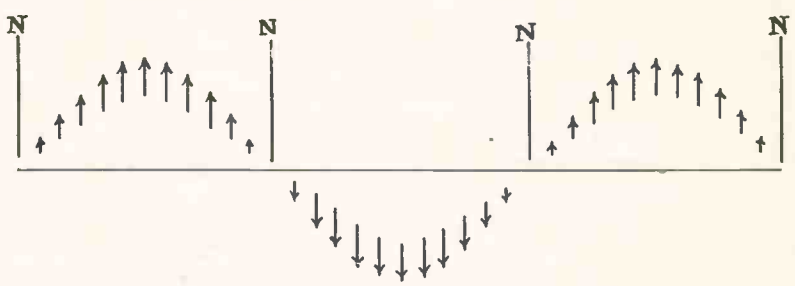


Fig. 2. Water Waves Move to the Right, But Particles of Water Go Only Up and Down

You will also recognize the very familiar case of the tuning fork which gives out a note, say middle G, when struck. As the prongs of the fork oscillate back and forth they set the surrounding air into a similar motion and the ripples of air spread out in circles just as they do in water when a stone is dropped into the lake. There are two big differences though in the case of air and water.

Sound Like Soap Bubble

The first is that the *surface* only of the pond is in motion, and the ripples do not penetrate deep into the lake or go in the upward direction. With air waves of course the motion spreads out in all directions. The wave fronts are in the form of complete spheres or balls. They keep expanding much the same as a soap bubble does when blown from a pipe. Of course, the globe of sound keeps its center always in the same place.

The other difference between air and water waves is that while the latter

vibrate at right angles to the way the waves travel, in the case of air the vibration is back and forth along the direction in which it proceeds. Fig. 2 shows the waves in water. The little particles of the liquid travel up and down as shown by the arrows. When they get the highest or lowest part of their motion they stop for an instant and then reverse their direction. The wave itself moves off into the distance to the right, but the same identical molecules of water are at the same spot in the lake as before.

Fig. 3. Air Waves Are Different. The Molecules Crowd Together and Spread Apart Again

The Air is in Swarms.

Fig. 3 indicates the difference in the case of air. Although the motion is to the right this time as well the air molecules do not bob up and down. They swarm to the right and left. A lot of them have come together at the points marked C, which is called a condensation. At R is a rarefaction where the particles are few and spaced wide apart. An instant later these spots will have moved on to the right as the particles oscillate back and forth. Water does not do this, as to do so requires a fluid which is quite compressible.

In radio telephony and broadcasting, the same means are employed to convert sound into electricity as are used in the ordinary wire telephones. A special type of instrument together with a proper electrical circuit, makes the change. This instrument is called the "Microphone," or "Mike."

The mouthpiece of the ordinary Bell telephone in your home is right in front of the diaphram. A similar device is used for broadcasting which does the same thing that the Bell telephone does.

Your Mouth Starts it

When you talk into the mouthpiece of the ordinary telephone, the tongue starts certain sound waves. These are collected in the mouthpiece and they strike a very thin sheet of metal, called the diaphram. As a result, this metallic disc begins to vibrate also, as we explained above, and its oscillations are in exact unison with the sound waves sent out by your mouth.

We have now changed air waves into a vibration of the diaphram. To see how the latter is still further converted into current pulsations, look at Fig. 4.

Here we have a dry cell in series with a resistance, R, which may be rapidly varied in value, and an ammeter, A, which tells us how much current is flowing in the circuit. When the slider on the resistance, R, is put in a certain definite position, say at the very end at point C, the ammeter reads a certain current. If we decrease the amount of resistance in the circuit by moving the slider towards point D, the current will grow larger which will be shown by the ammeter, A. In other words every variation in resistance of the circuit will be duplicated by a corresponding variation in the current. If we move the slider on the resistance very rapidly up and down the current will vary rapidly also. If we can make the sound waves which strike the diaphram of the microphone vary the resistance of a circuit we will have electrical currents set up which correspond to these sound waves.

If we could make the diaphram work the rheostat back and forth then we should succeed in changing its motion into current fluctuations.

A Queer Thing—Carbon

It is found that the answer to this question lies in the element carbon which is what coal consists of almost entirely (forgetting slate.) Carbon has the peculiar property that when it is compressed its resistance drops way down and when it is released the original value is again restored.

Like a Carbon Sandwich

In the diagram of Fig. 5 we show all the elements of Fig. 4 except that instead of the rheostat we have two sheets of metal, D, D'. Sheet D' is fixed in position so that it cannot move, while D is able to shake back and forth; in other words, it can vibrate. Between these two sheets the space is filled with small granules of carbon. These granules correspond exactly to the rheostat.

We know that carbon is a conductor of electricity which offers a resistance to the flow of electricity. As noted, it is also a variable resistance for this reason. Between the carbon particles there are small air spaces. When the granules are packed together tightly there are fewer and smaller air spaces, and so the carbon particles make better contact with each other and the end metal plates. The resistance of this combination is therefore low. When they are packed loosely, the air spaces increase; the carbon makes poor contact, and the resistance is therefore greater. For every different pressure which is exerted on these granules therefore there will be a different resistance, and in this way a different current will flow through the circuit.

They Are Squeezed Together

Suppose now that you speak in front of the metal sheet, D, which is free to move. The sound waves coming from your mouth set the air in motion and

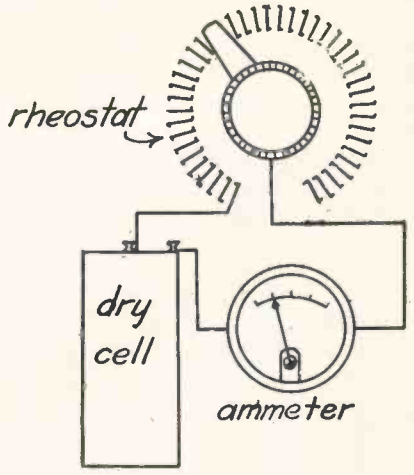


Fig. 4 The Current Through Ammeter Responds to the Rheostat

produce the sound waves. These strike the diaphram, D, and set it into motion in unison with the sound waves coming from the mouth. When the sheet, D, travels backward it compresses the carbon granules, pushing them closer together and this reduces the resistance of the carbon device, which immediately causes an increase in the current. When the sound waves result in the sheet, D,

moving forward again, it reduces the pressure on the carbon, the resistance increases and the current decreases.

In other words the metal sheet, D, vibrates in unison with the speech waves which strike it, and its vibrations alter

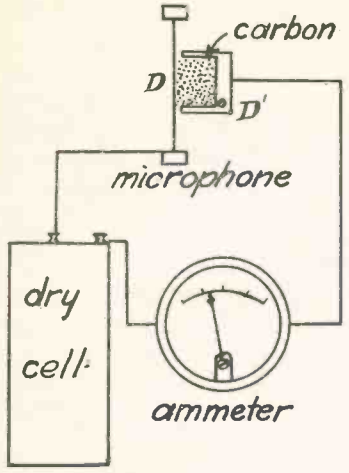


Fig. 5. Here the Carbon Pile Has Replaced the Rheostat

the resistance of the carbon device to which it is attached. But the important point to note is that the resistance changes correspond to the sound wave. Thus if the sound wave is a strong one the resistance is altered a great deal by moving the diaphram, D, in more strongly. Each variation in the sound wave thus produces a proportionate difference in the resistance, and therefore a smooth alteration in the current flowing in the circuit.

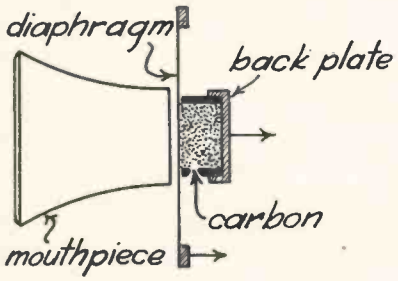


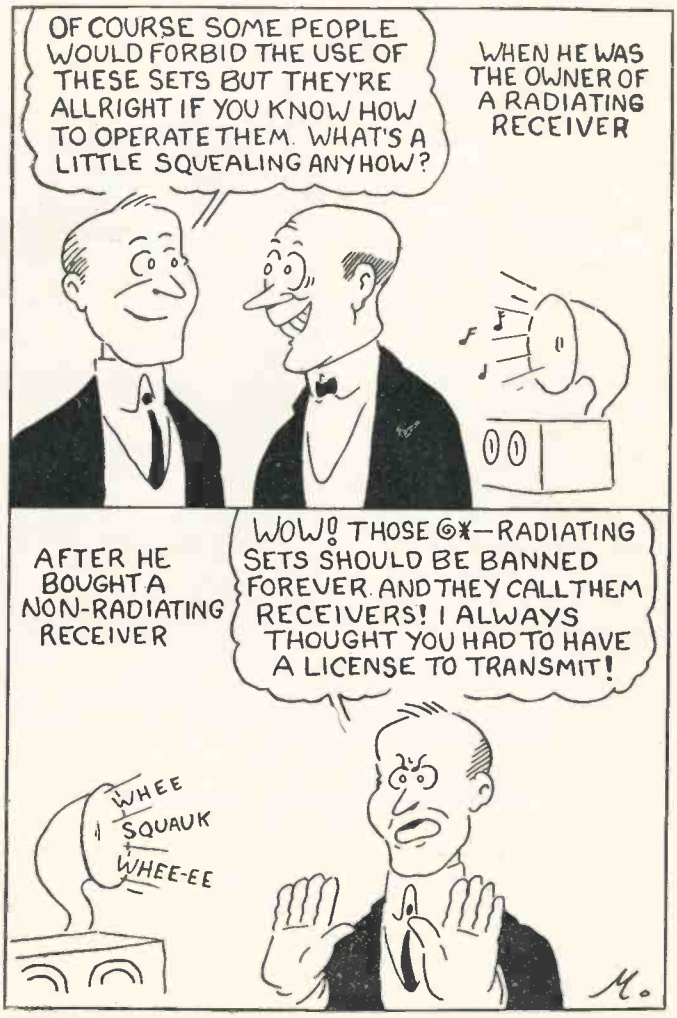
Fig. 6. This is Principle of a Telephone Transmitter

If we place a funnel shaped mouthpiece in front of the diaphram, D, as shown in the drawing of Fig. 6, we shall have a device which collects the sound waves and thus concentrates them on the diaphram, D. This is the usual telephone transmitter. We see therefore that with such a device which consists of a chamber of carbon granules and a moveable diaphram, we can obtain currents which correspond to speech. Of course, you understand that before any sound waves strike the disc there is a current already flowing in the circuit. But this is a direct current of the same strength all the time, and does not have the power to transmit sound. It is only when the current is varied in the circuit that it has the power to transmit speech.

This explains how the ordinary telephone transmitter works. For use in a broadcast studio a Bell transmitter like a desk phone is not satisfactory as the singer would have to keep his mouth within a few inches of it all the time. This would never do for a big gathering or even for a campaign orator who rushes wildly back and forth across the stage. However, the mike used in the studio has the same underlying principle except that it is built to receive sounds from considerably greater distances.

TWINS BY MAIL

A peculiar applause card that expressed the sentiments of the sender without a single written word, was recently received by WEAF, New York. It consisted merely of the pasteboard front cut from a Gold Dust carton and carefully wrapped in paper, symbolizing the fan's appreciation of the entertainment of the Twins, and her approval of the product they represent.



NOW THE SHOE'S ON THE OTHER FOOT—By MORTIMER

Packing a Radio for Shipment

Making Sure That It Will Arrive in One Piece

HAVE you ever seen a man pack a suit case full and then have his wife be able to get about fifty per cent more in without bursting the lid? It seems some people have the knack of packing and others don't.

At this time of the year it happens that many people wish to forward a radio set by express or parcel post. Such a fragile piece of apparatus deserves better treatment than to be thrown into a wooden box with a lot of crumpled paper around it. Such a cave man method of packing is apt to make your set arrive at the other end in a condition which will be a delight to your local repair shop.

They Tell You How

If you know how to go about packing your receiver, tubes or loud speaker, you will be able to deliver it in good condition. The American Railway Express Company issues bulletins on the method of getting the shipment ready. A condensed form of this article appears in Bulletin No. 20.

While the radio industry has created a substantial traffic for the express service, it is still a comparatively new field. Three years have passed since the radio first attracted public attention. During that time much has happened.

Receiving sets, loud speakers, batteries, tubes and all the numerous parts and accessories which go to make up a complete set have become important in express traffic. An enormous distribution of these articles is carried on between manufacturers and distributors or jobbers on the one hand and dealers and ultimate users on the other.

A New Kind of Claims

When you wish to send away your own set, perhaps to a friend or maybe because you are moving, you will be able to take advantage of what has been learned in the experience with these large shipments. The express company, too, has an interest in your sending them off well packed. One of the troubles which they have had in their business is the problem in handling, because of the delicate character of these instruments. This is reflected in the many new and annoying kinds of claims, which have developed of late.

Of course, proper packing is an important consideration at the start. In radio, as in other new industries, this is a matter of experimentation to determine just what is necessary to produce the "perfect package."

Fig. 1. This is the Way a Cushion Box Arrives as Bought

Manufacturers and the company alike have been studying this problem, so that it is now pretty well understood what is necessary to prepare a radio set so that it will carry safely to destination. Likewise, tubes, loud speakers and parts can be so protected in their preparation for shipment that with proper handling practically no damage should occur.

Plaster it with Signs

At the outset it is essential that everyone should realize that *all radio shipments are highly fragile and easily breakable.* Shippers are asked to place on such shipments the caution marks "Fragile" or "Handle With Care," "Glass" or "This Side Up." Where this is done the employes will use extra care in moving such business. Caution marks or labels can advantageously be placed on all sides of a shipment and preferably in *Red.* Of course, "This Side Up" should be placed only on the top side of a shipment.

So many types and sizes of radio sets are in use that it is difficult to give more than general suggestions for the essentials of good packing practice in preparing these delicate instruments for shipment.

The radio fan, especially the one who makes his own set, readily appreciates how delicate all the parts are which go to make it complete. If the smallest wire is broken, the plates of a condenser shorted, or the panel cracked, it may make the set unworkable. Most of the cabinets used are highly polished and in the more elaborate sets are fine specimens of cabinet-making art. An unusually hard fall or a bad breakage of the carton, caused by something being poked through it or an unusually heavy object resting on it may cause very serious damage.

The "Air Cushion" Box

Generally speaking, a radio is best protected in what is known as the "air cushion" box or carton. This carries the set "in suspension," and thus absorbs most of the shocks and jars ordinarily encountered in transportation.

The "cushion," so called, consists of corrugated board, (Fig. 1) made of standard material, scored or bent in such a manner as to provide at least a two-inch open space between the inner wall of the outside carton and the top, sides and bottom of the set. The materials used for the cushions should be of the

same test strength as that of the outside carton.

The shipping unit is thus a box within a box, Fig. 2. The cushions when put on a flat surface around the set prevent the air from escaping and this gives a springlike quality that prevents the shocks which the package may receive

Fig. 2. Assembling the Air Cushion Box

in transit, from reaching the heavy though delicate set inside, and at the same time holds it tight so that it cannot shift.

It Will Not Work Alone

In other words, the close-fitting carton should not be used as a shipping container by itself. This obviously does not protect the set from shocks, as the air cushions and outer container are missing.

The carton itself should be the same style and construction which you often see used by manufacturers in protecting their delicate apparatus. On each box there is a stamp, put there by the box maker, which tells how strong it is. These figures are obtained by the "Mullen" test which is the standard way of finding out how strong a container is. It is not necessary for you to bother with these figures, however, if you buy any box from a regular dealer he will make sure that it is a good one.

The express company does not in its regulations give you any specific rules as to the packing of radio sets. But such cartons must be made and used for a particular size of set to accomplish the best results. Cabinets of two or three different sizes cannot safely be shipped in the same size of air cushion box. Moreover, the cushions defeat their purpose if the corrugations break on the scoring or are weak when used a second time, (Fig. 3.)

Do Not Shake Before Taking

It is apparent that neither loose excelsior nor paper used for cushioning neutralize the jars of ordinary handling, because when crushed down, especially if a wooden box is used, such jars are carried to the set, which must be avoided to prevent damage. (Fig. 4.) Severe shaking does the radio receiver harm and may throw out of position the fine adjustments necessary to have the set work as it should.

It is recommended that to protect the cabinet and panel from scratching, the set be first wrapped in paper. A great many well known manufacturers have adopted this practice.

Of course, breakage may occur due to inherent weaknesses in the materials used by manufacturers. The express company supervisors have been studying this phase of the problem, and manufacturers are gaining experience that will help to eliminate these evils. Two instances will suffice to show what is being done in this field. The supervisors recommend that cabinet manufacturers have the grain of the wood in the end pieces of a cabinet run crosswise and not up and down. The reason for this is that when the end pieces are grooved out where the back panel fits, the wood is weakened and slight shock will cause the ends to split *with* the grain. If cabinets are made of green wood or unseasoned lumber, improperly "dowelled" or grooved, this also causes trouble.

Ponderous Parts Pull Panel

Then there is the question of panel breakage. Some sets have many of the most essential parts, which are really quite heavy hanging from the panel. This is particularly true of condensers some of which are very weighty, and coils. Several of them may put quite a strain on the panel and make it likely to crack. In shipping, such parts should certainly be supported underneath so as to relieve the pull of the weight on the front panel.

Tubes should not be shipped in the sockets of radio sets, because it may result in damage to both. How tubes should be packed is discussed fully in what follows. For the more elaborate type of receiving set, especially those similar to a desk or table in form, the same general type of packing boxes used in the shipping of phonographs is usually employed.

Careless of Home Made Sets

The *occasional* shipper is perhaps the most difficult problem. He is the purchaser of a set who wishes to return it for reasons of his own. Or he may be a fan who has made a radio probably for some one else. In either case, he may not give much thought to the proper packing, because he feels that it is less important than the construction to which he has given so much care and time. He is likely to feel that the hand-

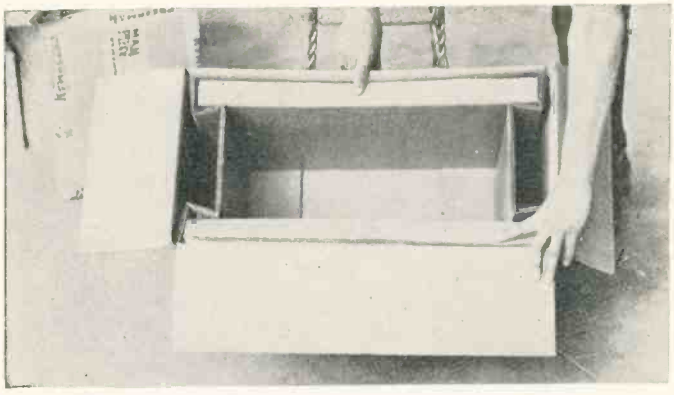


Fig. 3. It is Now Rready to Receive the Radio Set. Notice Air Pockets All Around

ling and not his packing was responsible for breakage, when it occurs.

Radio fans have been known to place a set in a wooden box and use scrap paper for cushioning or to put it in a tight fitting second-hand carton and then expect the express company to deliver it in perfect condition.

How to Pack Tubes

Standard individual tube cartons have been adopted by the leading manufacturers of radio tubes that are proving satisfactory, and any attempt to substitute a cheaper carton for tubes which are intended to be shipped by express should be discouraged. Some of the manufacturers of cheap tubes are placing their products in cheap paper cartons that will not safely protect the tube in transit.

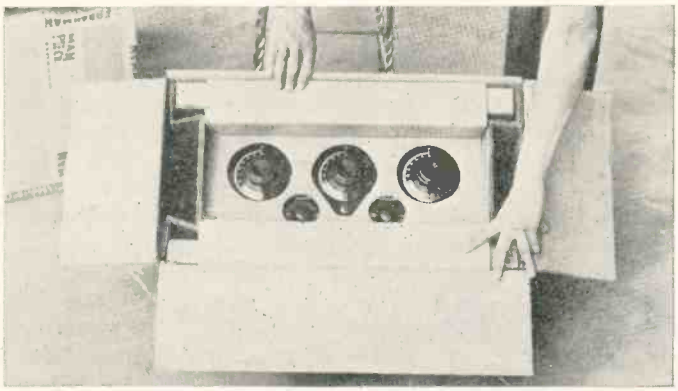


Fig. 4. The Set Must Fit Nicely to Get Benefit of This Kind of a Box

A tube carton is not expected to be strong enough to prevent the tube from being smashed in the event of an accident, but the essential requirements are first to hold the tube firmly so that there will be no play in the package and second to provide a cushion of some sort to protect the tube from shocks and jars.

Four Filaments to a Hair

The outer package container must be strong enough to protect the tube cartons from injury. At the present time no attempt is made by manufacturers or wholesalers, except in the case of broadcasting tubes, to cushion the tubes in any other way than the cushion effect afforded each individual bulb in its individual container. The filament in some tubes is less than one-fourth the diameter of a human hair and a slight jar will break it. A heavier shock will disturb or disarrange other elements inside of the tube causing short circuits in the tube construction.

Too much care cannot be exercised when shipping tubes by express in small lots. The tube carton is not intended to serve as the forwarding container and tubes must not be shipped in this manner. The carton must be placed in another strong container large enough to allow several inches of excelsior on all sides of the containers.

When placing tubes of any description in the tube containers be careful to wrap them evenly in the felt and corrugated wrappers and make sure the ends are well covered.

Don't Leave in Sockets

Tubes *must not* be shipped in the sockets of radio sets. No matter how carefully the radio set itself is packed, there is more filament vibration and this vibration in transit will break the filaments.

Tubes that have been used should not be shipped by express or otherwise. The filament in an old bulb is exceedingly brittle and will not stand handling.

Loud speakers are an important radio accessory, with which some troubles are being encountered, because of faulty packing. One type—the bell loud speaker now in the widest use—comprises a heavy base, containing the unit and a bell shaped horn made of wood or fibre. A new type rapidly growing in popularity is the cabinet loud speaker, which is almost as fragile as the set itself. The Parchment Disk is also new and of growing popularity.

One Inch from Bell

The cartons should be sufficiently large to allow at least one inch on bottom and top of the mouth of the bell. The base should be packed separately, either in another carton or in a separate compartment in the carton holding the bell. A small hole is then cut in the cardboard, which fits into the carton to hold the neck of the horn firm. Corrugated board should be placed between where the base is packed and the horn, provided the base is packed in the same carton.

The elbow should be protected with at least one inch padding to fill out the depth of the box. There should be at least one cushion or filler to protect the mouth of the bell from coming up against the bottom of the carton.

The cover of the box can then be closed and sealed. The marking should be clear and "fragile" labels placed on all sides, with "This Side Up" on the top.

Cabinet loud speakers should have the same care and protection in packing as the radio set itself. The use of air cushions is advised for packing this type of loud speaker.

HIS VOICE AGAIN SOON

The innumerable radio friends of Graham McNamee, the famous WEAF announcer, will be glad to learn that he is well on the road to recovery, following an operation at St. Luke's Hospital, New York City. He has returned to his home, and after a few more weeks of rest, he anticipates returning to his old friend "Mike" at WEAF.

Build a Fast--Short Wave Set

Complete Directions for Constructing a Radio to Pick-up the New Wave

By C. WILLIAM RADOS, Arlington Heights, Mass.

A MAN here who speaks only French misses a lot of what is going on in America. And the radio set which can tune only the ordinary broadcast band of waves is loosing a lot of entertainment, which is constantly on the air.

Although you think you can hear most of the stations on your present radio, you are probably mistaken. Far above your present range, and far below your slowest wave, radio stations are operating every day and night.

Deaf to All These

You are missing them only because you have not the proper wave speed tuner. Some of the most interesting of all the radio stations are outside the regular band at frequencies above 1500 kc. (below 200 meters). Mighty German and Argentine stations on 3750 kilocycles (80 meters), WGY at 3950 kc. (76), KDKA on 4750 kc. (63), Amateur, Navy, Commercial, Army and ship stations on waves from 150,000 down to 2,000 (two meters up to 150) are all going every night and day.

You can hear all these in your own home if you have the right equipment. Some of them are in code, but a great deal of the fast wave material is in the form of music and speeches. Besides getting the enjoyment from the programs themselves you have a good chance of helping advance the art as undoubtedly the fast wave field is the next big development which is coming along in radio.

It Will Open Your Ears

This new set is simple to build, being exactly the same in principle as the more ordinary ones. The condensers and coils are quite a bit smaller, but that is the principal difference. By carefully following the directions, this receiver will cover a range of about 7,500 to 2,500 kc. (40 to 120 meters) thus enabling you experimenters to hear all of the fast wave broadcasters as well as the amateurs and others.

Look over the list of parts and see what new ones you will need. The panel may be a piece of wood or rubber, the condensers cut down as shown in the photograph, and in other ways economy may be effected so that the whole set is to be made out of odds and ends of your present radio "junk." The condensers are of standard low loss construction, but if the experimenter wishes to reach the fastest waves to get the special code, he should use a 5-plate tuning condenser and an 11-plate volume condenser.

Fig. 2 shows how a high capacity condenser was cut down for use on the fast waves. The insulation was cut away so that the leakage paths from the supporting pillars were longer.

Why Wood Will Work

As already mentioned many of the parts you will probably already have in stock. The panel is a 7x8 size, as shown in Fig. 1. As this is not in contact with any parts which are alive, the highest grade of insulation is not needed. Even a wooden panel, which has been thoroughly dried and then varnished, will be quite satisfactory. Of course, if you have a suitable piece of bakelite or hard rubber, then use it instead. All the plates above six in number were removed so as to reduce the maximum capacity.

By removing the plates the minimum capacity is not lowered very much as most of the leakage capacity occurs from the rotor shaft to the stator. For this reason the range of the completed set will not be extended very far into the high speed vibrations by removing plates. However, there is an advantage not to have too many as the greater the number of plates the closer will be the dial setting for any station. This does

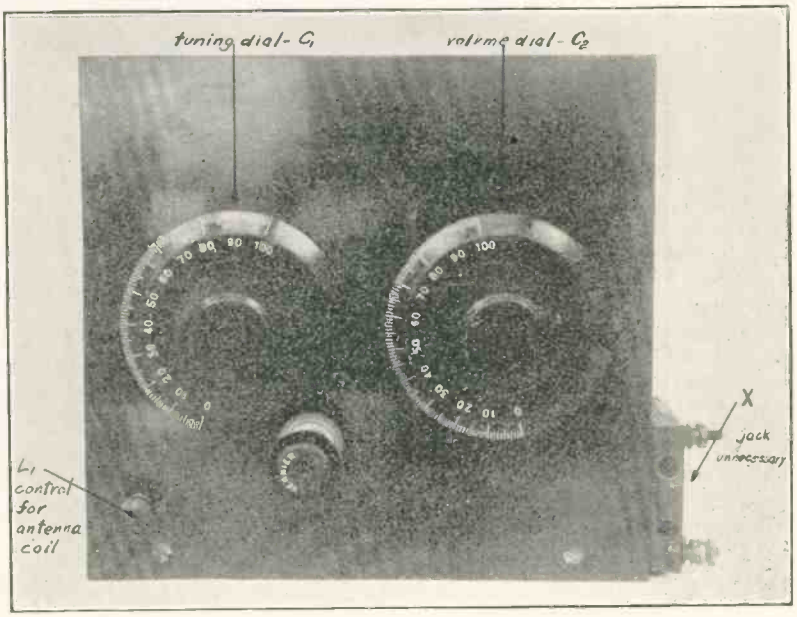


Fig. 1. This Panel Holds All the Controls for This High Frequency Set. The Jack May Be Omitted.

not mean that the tuning of the set is any sharper, but merely that the adjustment is more critical.

Round Plate Causes Crowding

The plates of the rotor were also cut away to give something like straight line frequency tuning. Fig. 3 shows the difference. At A is a semi-circular plate such as is used in the ordinary condenser. This gives equal increases of capacity as the dial is moved one degree at different parts of the scale. It has the disadvantage of crowding the fast (short) wave stations together and leaving the slower waves spaced far apart.

By cutting off the rotor plate to a shape roughly like that of B, the increase in capacity at the lower end is much slower than at the upper end of the condenser and in this way the crowding is avoided and the stations are spread out pretty evenly along the dial. If you are buying a condenser it is well to get one with this idea built into it.

Large Sizes No Better

In winding the coil No. 16 dcc. (double cotton covered) is specified as this is about the best all around wire to use. At the very high frequencies to be brought in the skin effect which makes the current travel only on the surface of the wire is so marked, that the gain from using larger sizes of wire is quite small.

The primary circuit may also use the same wire although No. 18 is large enough to carry the much smaller current which flows in the primary coil.

The tube is a UV199, or the new UX199 if you can get it. This bulb is especially suitable for high frequency waves as the internal capacity is considerably lower than with the 201A, 11 or 12. Be sure that you get a good tube as the bootleg variety are apt to be poor. A good bakelite socket should be used so as not to allow any extra leakage at the grid. The grid condenser should have a value of .00025 mfd. The grid leak will run between two and five megohms. This value should be found from trial.

Two Turns for Primary

L1 is the primary of two turns of No.

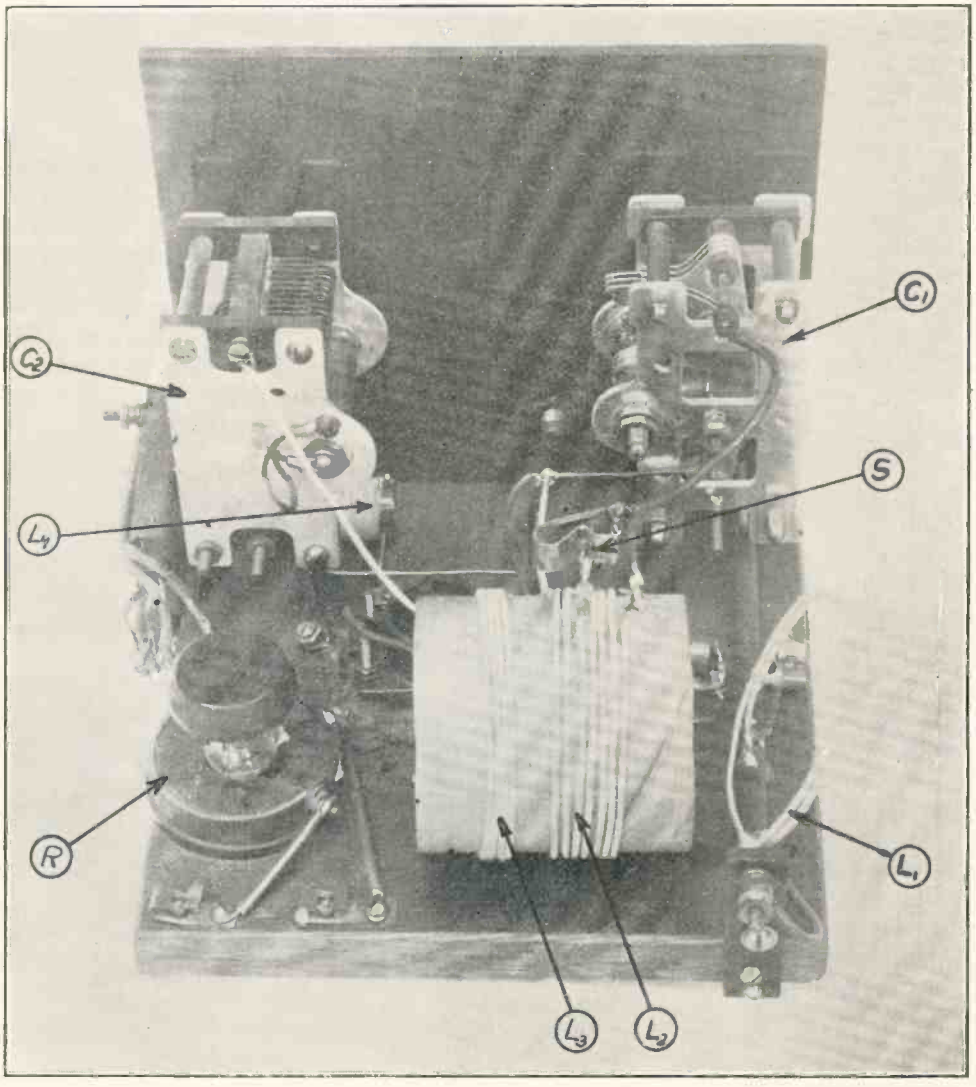


Fig. 2. This View Behind the Panel Gives a Good Idea of the Layout of Parts. The Rheostat is Seldom Touched, so is Mounted in Rear

16 or No. 18 dcc. It is wound on a form three inches in diameter, and then withdrawn. Light thread is used to tie the two turns together at several points around the circle. The ends are fastened to flexible leads, which are brought out to binding posts. The coil is fastened to a hard rubber or wooden rod, ¼-inch diameter which projects through the panel.

The photograph, Fig. 1, shows this knob in the lower left hand corner, while in Fig. 2 it appears at the right. When the knob is turned so that the primary L2 swings close to the secondary, it increases the coupling and so the loudness, while a movement in the opposite direction increases the selectivity.

Space Winding a Coil

The coils L2 and L3 are wound on a three-inch diameter hard rubber or Radion tube 3 inches long. L2 is "space wound" seven turns with a tap at the fourth turn. This method of winding disposes the wire so that the space between each turn is equal to the diameter of the wire. This is easily done by winding on at the same time a piece of twine the same size as the wire. Then when the latter is completely on, the twine can be removed thus leaving a space winding.

L3 is the tickler coil or plate winding. It consists of four to eight turns depending on your tube. The one in the actual model had four turns, but a very good tube was used. The harder it is to make the bulb oscillate the more turns will be needed in this coil. If you find that the tube will not oscillate with eight turns when the control condenser C2 is fully in mesh, then it means either there is something wrong in the wiring of your set, or else the tube you are using is a poor one. The smaller the number of turns in L3, the better the tube which must go with it.

Up in the Air

The distance between the plate winding and the secondary winding is ¾-inch. The radion tube on which these coils are wound is mounted up in the air by means of two small screws and four nuts. This gets the tuner away from the wood base.

For the benefit of the radio experimenter, we may mention that the plate circuit has a *parallel* feed. This means that the radio frequency current and the "B" battery current are kept separate in parallel. This necessitates a choke coil to keep the radio frequency out of the phones. This winding L4, is 100 turns of No. 24 dcc. on a tube ¾-inch diameter and 2½ inches long.

This coil is seen in Fig. 2, lying underneath the control condenser, at the left. It is directly in series with the plate and phones.

Putting the Set Together

After drilling and mounting the panel, we are ready to assemble. First fasten the socket, the radio choke L4, the grid condenser and leak, the rheostat, and the large tube with L2 and L3. Also put on the different binding posts.

After this part of the wiring is finished, the two condensers may be put on. The primary mounting is left until later. In this way the parts on the panel will not be in the way when the base wiring is done.

We are now ready to start making the hook-up. The secondary is the best to begin with. Lead 5 is soldered to the clip, S, and also to wire 7, which runs down to the A minus binding post. This clip is clearly seen marked S in Fig. 2. It will be hooked on either the end tap

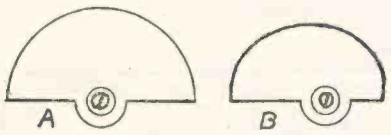


Fig. 3. A is a Plate From an Ordinary Condenser, While B is a "Straight" Line" Plate

6 or the middle tap 61, depending on whether a slower or faster wave is being brought in.

Use Lamp Cord Here

The other lead from 5, is a flexible piece of lamp cord to R, which is the terminal for the rotor plates on the tuning condenser. This connects the latter to the "A" and "B" batteries. It will be noticed also that the rotor plates of the other condenser are also hooked up to the batteries. Connect 8, the other end of the secondary to 9, one side of the grid condenser and leak. From 9 connect to 10, the stator plates of the tuning condenser. Then 11, the other side of the grid leak and condenser, is connected to the G terminal (grid) of the tube socket.

In hooking up the tickler coil, L3, it is necessary that the proper polarity is observed. The plate connection is at 6, at the end of the coil and the condenser terminal at 13, towards the center. The correct direction of winding of the coils is also important. Coil, L3, is wound like a *right* hand thread on a screw starting down at 6 and up at 13. Coil, L2, on the contrary, is like a *left* hand thread as shown. If this direction of winding *both* coils is reversed then the set will work just as well, but if one only should be changed, then the tickler instead of causing an increase in the loudness would give a decrease. The direction and polarity of the primary coil, L1, makes no difference.

Plate Circuit is Divided

Connect 16 to 17, the plate terminal of the socket. Notice that from 17 there are two leads, one to 18, the plate terminal of the socket, and the other to 19, the radio choke. The circuit continues through the choke to 20, to 21 which is one terminal for the telephones or a jack. The other telephone terminal 22, runs to B plus, 23, while B minus, 24, goes to "A" minus as before.

From "A" plus, 25, we follow the arrow to 26, one terminal of the rheostat. The current goes through the resistance wire and out at 27. Run a lead from 27 to 28, one filament terminal on the socket. The current through the filament comes out at 29, the other terminal of the socket. From here the leads run to 15 and back to 7, the other connection of the "A" battery. Notice that 15 is connected to the rotor plates of the volume condenser, R.

Primary Coil Must Swing

The primary coil, L1, is mounted on a shaft which may be turned through 90 degrees, thus giving various amounts of coupling with the secondary. Two short pieces of flexible lamp cord are used to connect this coil to the A and G binding posts. The photo, Fig. 2, shows the details of mounting the coil, and Fig. 1, the panel, show the control knob.

The way this set works can be seen best from Fig. 5. The incoming waves from the aerial flow in through terminal 2, primary coil, L1, and out again at 3. The wire connecting the A minus terminal to the ground, shown dotted in

Fig. 5, is not really necessary, as it carries none of the operating current, but it is useful when preventing body capacity as the operator approaches the batteries or wiring of the set. For that reason, it is well to include this lead.

Selective or Loud

The amount of power which is transferred from the primary across to the secondary coil, S, depends on the position of the control knob. When the two turn primary is swung up close and into line with the other coils, naturally it will have the most effect on them. When the knob is turned in the other direction so that the coils are separated and at right angles, then the transfer from one to the other is at a minimum. This latter position gives the greatest selectivity to the set, but the loudness may be increased by coupling the coils closer together.

The magnetic field, which changes its direction back and forth millions of times per second, depending on the wave frequency which is being picked up, induces a voltage in the secondary coil. The higher speed vibrations are obtained when clip 5, is connected to 61, so that there are only four turns in the secondary. This coil is tuned in the ordinary way by tuning condenser, C1. One side of this combination feeds the signal to the grid through leak and condenser 11, and the other side reaches the filament through leads 7 and 15. This completes the action of tuner and input to the coil.

The output from the plate, 18, divides at connection 17. The audio frequency contains the message or music and is the result of the regular detector action. It can not go down through coil, L3, as its further passage is blocked by condenser, C2. Audio frequency, you recall, owing to its slowness of vibration, will not pass to any extent through a small condenser. The only way out for the audio frequency is through choke

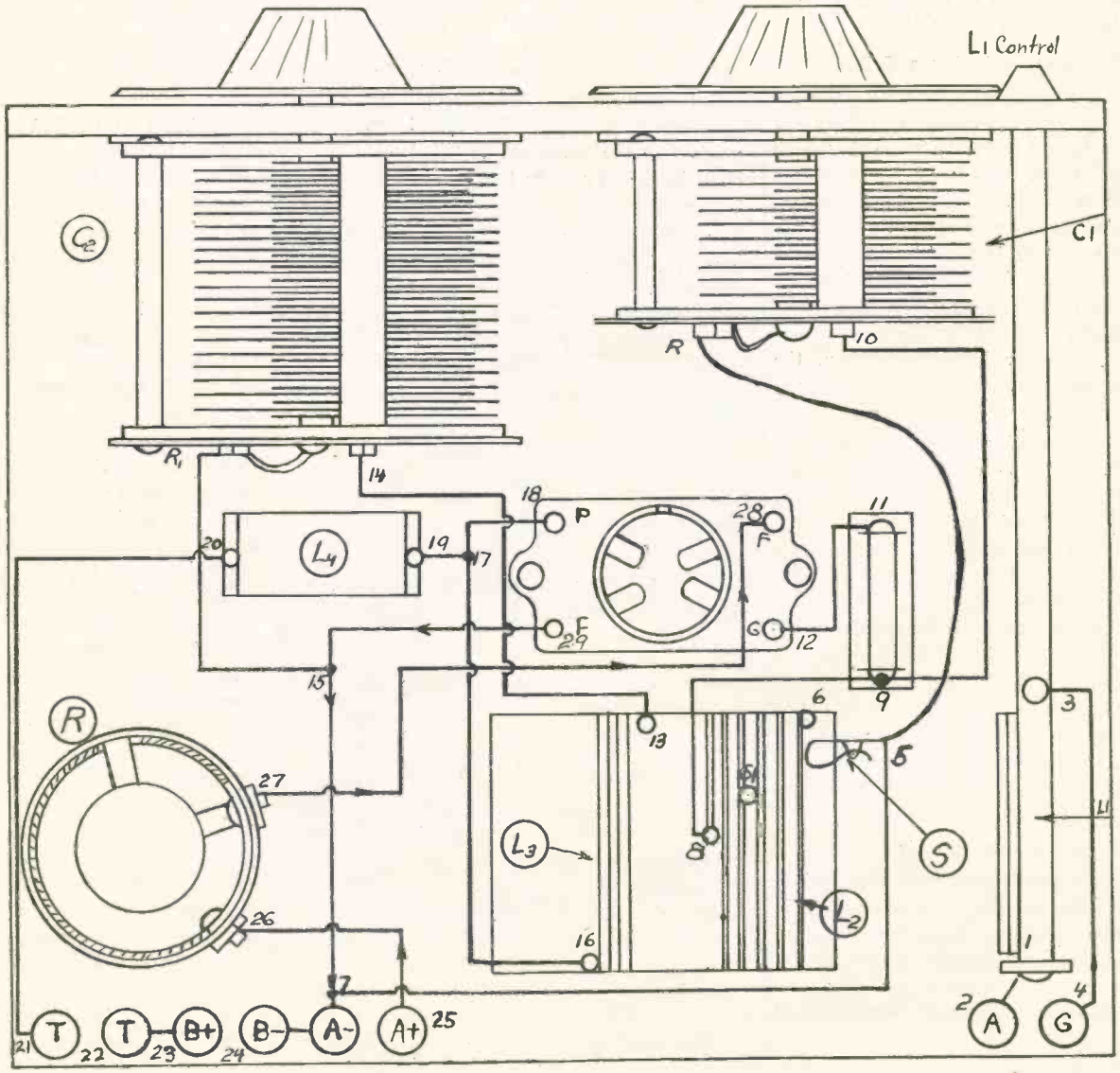


Fig. 4. Here is the Layout for the Base. The Coil, L1, in Lower Right, is Adjusted to Give the Proper Coupling for Volume and Selectivity

coil, L4, which does not retard it, owing again to the low vibration speed. From there the signal goes through the phones and "B" battery and so back to the filament.

The radio frequency, which has also left the plate with its brother, the audio, finds that the high frequency choke, L4, is too much for it, and so it cannot pass that way. Instead it flows down to tickler coil, L3, and from there on through the volume condenser, C2, and back to the filament. When this volume condenser is set at 0, the capacity will be so low that only a small amount of current can get through. By increasing the reading of C2 more and more, high frequency is allowed to thread the tickler coil, L3, and so the amount of regeneration is easily controlled. This completes the action of the set.

Connect antenna and ground, the batteries and the phones. Put a good UV or UX199 tube in the socket. When the phones are connected a click should be heard signifying that all connections are correct.

A Plop Tells the Story

Put the clip, S, on 6 so that the whole 7 secondary turns are in use. Leave the tuning dial at 0 and light the tube. Then turn over the plate or volume condenser slowly until you hear a faint "plop" or thud which shows that your tube is oscillating. When the secondary is at zero the tube should oscillate easily. If the tube will not oscillate, reverse the "A" battery. If this does not make the tube oscillate, it shows that there is not enough tickler winding. You can then add some more tickler or you can shove the coil, L3, nearer to the secondary coil.

Try increase of "B" battery. Although this may sound as if a great deal of trouble were expected, that is not the case. Usually when the tube does not oscillate at once the trouble is rectified within five minutes.

The Thrill of a Lifetime

Getting long distance is where the thrill comes in. If you are a broadcast listener and do not know the code you will still be able to hear all over the U. S. A., and a few (very few) European stations. However, if you are lucky enough to know the code the world is yours. You can hear the important international news coming from Germany, Holland, Russia, and other important countries.

As you listen at your set some night about twelve o'clock, you will be tuning around 7500 kc (40 meters) and catch a faint voice. Getting the station in louder you will hear him say "radio station 6BCP, San Francisco." An amateur station from 2600 miles away. Next you will turn up to 3,000 kc. (100 meters) and hear British, 2GD, in the drawl of the British Isles.

One Tube All Over Room

Turn your dial just a trifle, and in will pop KDKA, only a few hundred miles away. Some nights, this station comes in strong enough to be heard all over the room on this one tube set.

To get these stations you will have your tube just oscillating. Then turn the tuning dial until you hear the squeal of a radio telephone station. Now turn back your volume dial until the squeal just ceases and then you will hear the voice. With this set the turning of one dial will not affect the other.

If you want to hear Australia, you must know the code. But this will not take long if you really want to learn. Remember Australia is just half way around the world, just a matter of some twelve thousand miles. This set has copied Australian stations night after night on a fifty-foot antenna.

In conclusion the author wishes to state that he will be glad to hear from fans if a stamped addressed envelope is enclosed care of RADIO PROGRESS.

List of Parts:

1 7x8x¼ radion panel.

1 8x10x¼ base board.

C1 11-plate (or smaller) low-loss condenser.

C2 23-plate low-loss condenser.

L1 2 turns No. 18 wire, 3 inches in diameter.

L2 7 turns No. 16, 3 inches in diameter.

L3 4 to 10 turns No. 16, 3 inches in diameter.

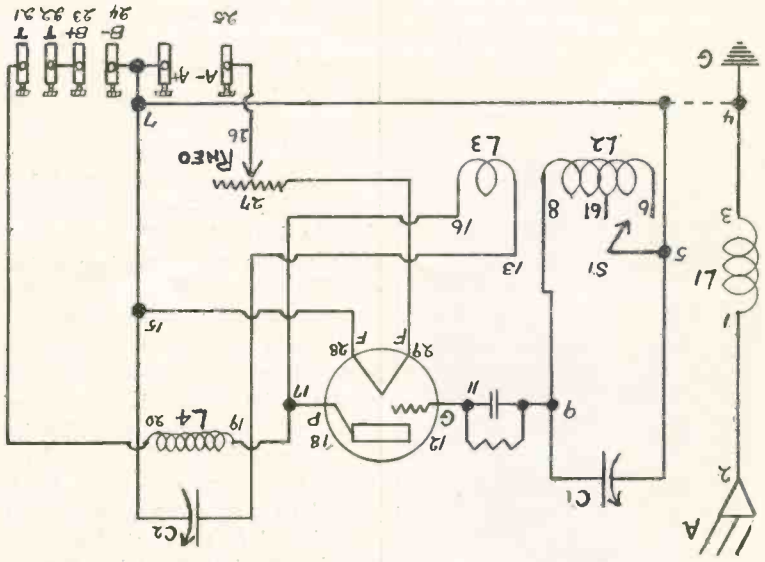


Fig. 5. Here is the Hook-up. Notice That it is Not a Trick Circuit, But Reliable and Easily Made.

L4 100 turns No. 24 (or smaller) ¼ inch diameter.

R 30-ohm rheostat.

S Fahnestock clip (used for switch.)

1 199 tube socket.

1 Grid condenser .00025 mfd.

1 2-megohm leak.

1 3-inch tube, 3 inches long.

1 ¼-inch tube, 2½ inches long.

1 Rod, ¼-inch diameter, 9 inches long.

8 Binding posts

2 Machine screws for coil mount.

4 Feet bus bar.

1 Foot flexible lamp cord.

2 3-inch dials (vernier desired.)

1 Pad, felt for tube socket.

DeForest Develops Some Novel Devices

Radiation Preventor Designed to Remove the Squeals From the Air

By OLIVER D. ARNOLD

DON'T think that anyone has invented a squeal strainer. No, unfortunately if some of your nearby friends are broadcasting squeals on the same wave frequency as the station you wish to hear, there is no device which will strain them out and let the wanted signal through.

The radiation preventor, which has been put on the market by the DeForest Company, is designed to prevent the squeals from being shot into the air and

Fig. 1. This Simple Looking Device is What Strains the Squeals

not to kill them when they are once on the ether. For this reason it is necessary to persuade owners of regenerative sets to use the preventor themselves in order that you may not hear their attempts at tuning.

Here is Something to Offer

Of course, this is a disadvantage of the system. Indeed it is the weak point of every scheme which has been proposed to deal with the problem of regeneration But there are a good many people who would prefer not to disturb their neighbors, and it is certainly much better to have something to offer them if they are willing to do their part in keeping the air clear.

Of course, regenerative sets are not the only ones which offend in this way. Some of the radio frequency sets are bad howlers. A properly adjusted neutrodyne will not radiate, but many of the home-made sets of this model are not neutralized correctly by their builders, and so send out their chirps with the best of them. This question of the interference from radiating sets has been discussed a great deal recently.

So the Law Was Repealed

Sometime ago England took the bull by the horns by forbidding absolutely that anyone use a receiver which was capable of sending out radiation when improperly adjusted. However, after trial for a good many months this law was withdrawn. It was found that only the more intelligent class knew and understood about the ruling and abided by it. They were just the ones who would know enough not to make their sets squeal anyway. The ignorant and less experienced fans either did not know of the law against radiating receivers or else disregarded it, and as a result the air around the large cities was just as full of merry warblings as was the case in America.

Just prior to the plans of the De Forest Radio Company in placing their preventor on the market, the engineers of the company concluded a very elaborate series of tests concerning interference. These tests, which took over seven months of hard work to complete, showed that the range of disturbance of a powerful radiating receiver is so great that a small fraction of the number of these sets already sold, if properly placed could blanket the entire United States with sufficient radiated energy to interfere seriously with the reception of signals from any direction.

Half of Them Can Squeal

That the condition is even more serious than this fact would intimate at first glance, can be made apparent when it is stated on good authority that in New York City alone more than one half of the many hundred thousand receivers in use are capable of radiating. This includes besides regenerative sets many improperly balanced radio frequency

Fig. 2. Inventor of Many Radio Devices—Lee de Forest

receivers as well as that type known as the "internally balanced" set.

The radiation preventor is designed for the use of owners of either ready-made or home-built receivers. It consists of a small enclosed bakelite case about the same dimensions as an ordinary tube socket. (Fig. 1). It adds no expense to the running of the receiver, as it requires no additional current or tubes. Further than that, its use also

sharpens the tuning of the set as well as making its sensitivity to weak signals fully 50 per cent greater than before.

Make a Silent Squeal

If you run an oscillating receiver which includes a radiation preventor, then while you are hunting for and finding stations by the "squeal" method it is causing no interference even to your nearest neighbor, through only a thin apartment wall. Turn your tickler way up and sweep the air with wild turns of the condenser—Jones, the man upstairs, will enjoy his program to the fullest, unbothered by interference. Perhaps many of the others of the great radio audience will be willing to purchase one for the nearby owner's sake when they realize the freedom from horrible squawks that it gives to them.

The device is small and very inexpensive and is applicable to all types of oscillating receivers whether regenerative "bloopers" or multi-tube receivers which depend upon the oscillations of tubes for their efficiency. Many engineers of the radio world regard this new device as one of the most important steps toward perfect reception that has been made since the crystal detector was surplanted by the "audion," another very important one of Dr. De Forest's (Fig. 2) many inventions.

Hook-up of Preventor

The attached drawing Fig. 3, illustrates the necessary connections for attaching a De Forest preventor to an ordinary single circuit regenerative set having one stage of audio frequency amplification.

It consists of a choke coil, L3, in series with the telephones and plate circuit of the audio frequency amplifier, and a small condenser, C4, which connects the plate of audio frequency tube to the grid of the regenerative tube.

The antenna connection, instead of going to the usual place (shown dotted in hook-up) for this type of circuit is connected to the grid of the audio frequency tube.

If desired a loading coil, L4, is cut into the antenna line before it reaches the grid. By making this adjustable you will be able to tune the aerial to the incoming wave and so get somewhat more selectivity. This is a refinement, which many people do not use, however, as it means one more adjustment to make. It may be pointed out that even if you use such a coil and neglect to make the adjustment, you are no worse off than if you omit the coil entirely. Any circuit with low resistance is tuned to *some* wave speed and it does not help matters to ignore this fact.

Uses the Ordinary Parts

The rest of the circuit uses the ordinary parts, which are contained in most radio sets. L1 is the stator and L2 the rotor of a variocoupler. C1 represents the tuning condenser by which the various waves are selected. C2 is the grid leak. C3 by-passes the phones or audio frequency transformer, T.

It is very rare with this combination that you will plug in at the first jack and so do without the step of radio amplification. However, if you wish to do so use a four spring model for jack II. The two center springs are to be connected together. This allows "B" battery current to reach the plate of tube 2, even when the plug is withdrawn from this right hand jack.

The way the set is operated is like this. The signal wave is impressed upon the grid of the audio frequency tube II, which then acts as a radio amplifier, resulting in high frequency variations in the plate current of the second tube.

Forward, but Not Back

Due to the fact that this condenser is very small, a negligible amount of RF oscillation gets through to the plate of the right hand tube even when the detector tube, I, is oscillating violently. And since the aerial is connected not to the plate, but to the grid, it means that whatever vibrations reach the plate must jump across the vacuum from plate to grid before they can reach antenna. Of course, any pulsations sent to the grid are magnified in the plate, but this is like a turn stile, and will not work backwards. The small oscillations which the plate has picked up through condenser, C4, cannot get backwards through the tube to the aerial.

The overall result on the received signal is a material increase in selectivity and in efficiency. When storage battery tubes are used, this noticeable increase is often as high as 50 per cent. In the dry cell type, the grid to plate capacity being higher, the general increase in efficiency may be about 20 per cent.

Good for Two Tubes Up

From this diagram and description of the manner in which this may be attached to any regenerative circuit, you will see that it will apply to any set which contains two or more tubes, provided that one of them is in the audio frequency side of the circuit.

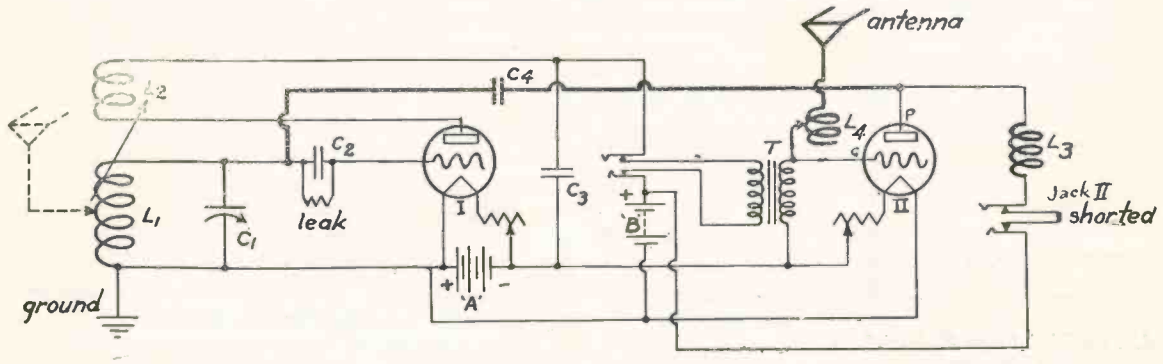


Fig. 3. Here is the Hook-up as Used on a Two-Tube Set. On Larger Receivers the Principle is Just the Same.

Referring once more to Fig. 1, you see that there are three terminals marked G, P, and T. This round case contains the condenser, C4, and the choke coil, L3, illustrated in our hook-up. These two devices are in series and one terminal goes to the grid of the detector tube, one to the plate of the amplifier, and the third to the telephone. The hook-up shows the grid terminal connected to the outside of the grid condenser, C2. If preferred it may be attached directly to the wire between the grid condenser and the grid of the tube.

How They Do it in England

Speaking of the inventor of this system, Lee DeForest, it may be interesting to quote a few words which he recently sent in regard to broadcasting in England. He wrote as follows:

"The British Broadcasting Company, as most of you know, is a non-commis-

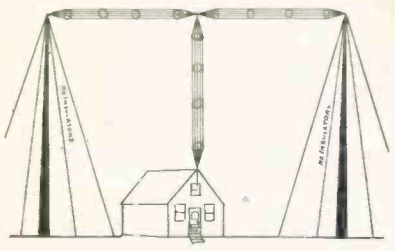


Fig. 4. The Bird Cage T Aerial Is Quite Efficient

sioned organization made up of seven or eight of the principal British manufacturers of radio apparatus. It is in partnership with the British Government through the General Post Office under an act of Parliament whereby the Government levies a tax of ten shillings (24 cents each) on every receiving set sold or installed in Great Britain. This arrangement was entered into at the beginning of popular radio, when the governmental ban was first taken off. As the British people are instinctively a law abiding nation, this plan of levying and collecting a tax on each receiving set has worked out admirably.

They Have Too Much Money

"There are of course a certain number of 'bootleg' stations, but they are comparatively small. I found that there was a very distinct sentiment among radio users in Great Britain to consider it not good sportsmanship or square-dealing to avoid this tax. An owner of a radio set who does not pay the government tax is actually held in bad repute by his neighbors. As a result of this situation the British Broadcasting Company, which receives two-thirds of the tax the government raises from radio sets, is now in possession of a very large annual income from this source—more income, as it was expressed to me, than they know what to do with. The purpose of this fund is to pay for high-class talent for broadcasting, but judging from the quality of some of the entertainment to which I listened, the British Broadcasting Co. (B. B. C.) could well afford to spend more money than they have been doing in this direction.

"Th stations of the B. B. C. were all built from this common government fund, and now number twenty-one—nine being main stations, ten for relaying only, and one high-power station. All of these have been opened in lesss than three years, as follows:

5IT	Birmingham	November 1922
2ZY	Manchester	November 1922
5NO	Newcastle	December 1922
5WA	Cardiff	February 1923
5SC	Glasgow	March 1923
6BM	Bournemouth	October 1923
2BE	Belfast	October 1924
6FL	Sheffield	November 1923
5PY	Plymouth	March 1924
5EH	Edinburgh	May 1924
6LV	Liverpool	June 1924
2LS	Leeds & Bradford	July 1924
6KH	Hull	August 1924
5NG	Nottingham	September 1924
5ST	Stoke-on-Trent	October 1924
2DE	Dundee	November 1924
5SX	Swansea	December 1924
5XX	Experimental High Power Station	July 1925

"The High Power Station, Daventry, 5XX, was opened July 27th, 1925, and it was my good fortune to be one of the invited guests on that occasion.

Tea and a Special Train

"The B. B. C. chartered a special train to take the Postmaster General and his party, Government Officials and the leading Radio Engineers of Great Britain, out to the scene, which is situated about seventy-five miles from London. Tea was served in the most approved British fashion on the way up, and the time passed very rapidly in the society of so many of the leading radio lights of Great Britain.

"We arrived at Daventry at 6:20 where we were met on the station platform by an impressive array of local officials, including the Lord-Mayor of Daventry in wool sack, with the highly polished brass mace of his office carried in magnificence by a uniformed lackey. After the proper amount of decorum had been reeled off, the train-load was crowded into large motor coaches which took us up to the top of Burrough Hill. There the party was conducted through a tour of the buildings, and the "gear" and machinery carefully explained.

Bird Cage T Antenna

"The Daventry station, I found, was indeed worth all the formalities bestowed on its opening. Extensive and substantial one-story buildings were centered midway between two splendid steel towers, the construction of Mr. C. F. Elwell of London. These towers are five hundred feet high, of triangular construction and located eight hundred feet apart. They are grounded, and even the guys are not insulated. The bird-cage antenna of T form (Fig. 4) extends between the two towers and comes down into the center of the roof of the transmitter building.

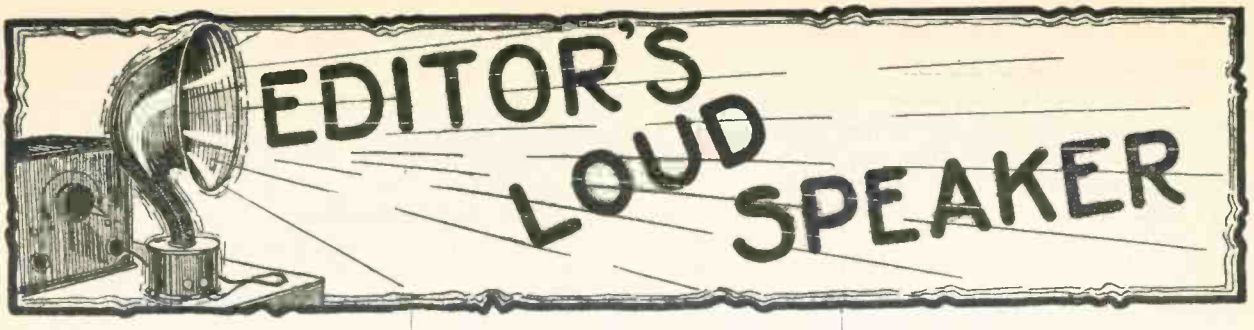
"I was particularly interested in the grounding arrangement. This consists of thirty-six heavy zinc plates driven edgewise into the earth. Each one projects four inches above the surface, and is connected by a substantial copper cable which extends vertically to the top of a ten-foot stake, where it turns and runs inward to a point close to the antenna insulator, where all 36 cables are joined. It appeared at first like a counterpoise, but it forms a highly efficient earth.

Gate Cuts Off Power

"The actual transmitting apparatus is contained in a polished aluminum framework. These frameworks are neatly spaced and the whole is surrounded by a polished steel rail. Access to the apparatus is obtained through a safety gate, which when opened, makes it impossible to switch on the power.

"The control of the whole apparatus, including operation of the running machinery, is effected at a control table in a corner of the transmitting room. If the engineer on duty notices anything

Continued on Next Page



IS RADIO DANGEROUS?

Two or three times recently the newspapers have carried stories which seem to show that radio may be regarded as dangerous. If this is really the case we must be more careful when we fool around with it.

When all the accounts were read it turned out that in every case of a death the conditions were about the same. An aerial wire was installed which crossed over or under a high-voltage power line. Later on one of the wires got loose or broke and when the two touched of course it put full voltage on the aerial. The first person who happened to touch this line at the set naturally got the same jolt which would have been felt by touching the power line itself.

It is one of the rules of the Fire Underwriters that no aerial shall be installed so that it can in any way come near a high-tension line. Cross-overs are absolutely forbidden. The rules of the various cities and towns usually repeat this caution against putting up an aerial which may be crossed with a high pressure wire.

In spite of this, there are a good many antennas which some day may pick up a deadly charge of electricity if it happens that the wires break or swing in the right way. Now is a good time to glance out of the window at your own equipment and see whether there is any possibility of its swinging down.

Not only that, but you must be just as sure that no other wire may fall on it, as you must remember it is just as much forbidden that your wire may pass under another as over it. To be sure, the electric light wires are pretty ruggedly put up, but they have been known to break, and it is too risky to take such chances with death.

Getting back to our first question, does this condition justify us in saying that radio is dangerous? We might ask the same thing about ladders. There have been many cases reported where children have used a ladder to climb up an electric light pole and touch the wires with the result o a funeral in the family. However, we should hardly blame the ladder for such cases.

In the same way it is not fair to mention radio as the cause of the electric shocks received from crossed aerial wires. As far as it is known, radio itself has never caused so much as a slight injury to anyone.

PITY THE AUTHORS

When an author rushes into print and signs his name we all feel that we have a sort of right to discuss his subject with him and perhaps ask him to reply to our letters.

The articles which we publish in RADIO PROGRESS have been written by persons who as far as we know have all been very willing to answer correspondence.

Continued on Next Page

DeFOREST DEVELOPS

Continued from Previous Page

wrong, he can switch off everything by pushing one button.

"In the radio room are arranged in the general shape of a 'T,' the various units comprising the 25-kilowatt outfit. There is a master-oscillator which is set very exactly to control the radiated wave, 187 kc. (1600 meters.) The high-frequency current from this master-oscillator drives the main high-frequency generator, which consists of three water-cooled tubes, each of a 10 KW rating.

Water Spray is Insulator

"I was particularly interested in the very ingenious way in which the water-cooling problem of these many powerful tubes has been handled. Water is delivered from above into large pans by means of fine spray nozzles. Captain Round informed me that four inches of this spray is effective insulation for 20,000 volts. A similar pan is placed underneath the tube rack, and the water having circulated through the cooling jacket surrounding the metal plate of the tube passes through similar fine sprays into this lower tank and thence to earth. The simplicity and effectiveness of this spray installation system was in marked contrast with the many difficulties which radio engineers in this country have encountered in attempting to insulate their water supply by means of long coils of rubber tubing.

"Each group of this powerful radiophone transmitters at Daventry is beautifully arranged, the insulation being throughout of heavy glazed porcelain, especially designed and moulded for the particular task in hand. The conductors connecting the units are of large copper bus-bar type, burnished and lacquered. The other metal trimmings are all nickel finished, including the safety rails. The entire floor is matted in rubber and the general appearance of the equipment was by far the finest I have ever seen. Truly no expense whatever was spared to make Daventry the last word in engineering excellence and good taste.

"It is early yet to say what results will be obtained at Daventry station as compared with the station at Chelmsford, but the indications are that during the coming winter it will be perfectly feasible for countless American stations, which are equipped to pick up this slow wave to receive the London concerts through Daventry."

EDITOR'S LOUD SPEAKER

Continued from Previous Page

Some of the write-ups have interested our readers to such an extent that many fans have taken their pens (or typewriters) in hand and have written to the author with suggestions and often times with questions.

This is all right and most of the recipients of such correspondence have felt pleased and even flattered at this attention. However, when receiving a large amount of fan correspondence and answering it, there are a few points which would help very greatly in saving time and nerves.

Here is a set of rules which was drawn up by one of our authors with the request that we publish it in the interests of all who are asked such questions.

(1) Use ordinary business letter size paper, which is 8½x11. This allows the various letters to be filed in a pile or in a letter cabinet.

(2) Use only one side of the paper. It is a great disadvantage when handling a lot of mail to be required to turn every sheet over to read the other side.

(3) If you have a typewriter, it saves the reader's eyes and disposition to use it. Otherwise, take out your trusty fountain pen. A pencil is very unsatisfactory for such work.

(4) Number your questions 1, 2, 3, etc. This is not only an advantage to the author, but makes it more certain that you will get a reply to every question.

In this connection we might remark that these rules are so good that we hope our own correspondents will also follow them.

CREAM OF PROGRAMS

Once upon a time when a man bought an automobile he was concerned principally with how fast it would go and whether it would get him back home again.

Now, however, *any* machine will travel a good deal faster than the average person cares to go and unless you play tag with a tree or the like, you are certain to get back again after a trip. That is to say the point of interest has shifted from the mechanical details and is now laid on the enjoyment you get from motoring.

In the same way when radio first started and for the next year or two loudness and distance were asked about. These questions are not so much in evidence now as any good make of receiving set will pick up 1,000 or more miles and will give music plenty loud enough for the average room.

As a result of this, popular fancy again has shifted to quality and entertainment. The matter of quality is largely built into the radio set itself, but the entertainment feature depends on what the broadcasters give us. Radio is now so natural that when a singer flats a little we are sure to have our teeth set on edge, and we do not blame static for it either.

So it is particularly pleasing to learn that this winter we are to have a season of music which will be the best ever. Station WEAF, New York, and probably the eleven other sending stations with which it is accustomed to hook up, will broadcast each Sunday night a concert of the highest type. The list of artists is an imposing one.

To mention a few we see such names as Anna Case of the Metropolitan, Freda Hempel, Louise Homer, and Mabel Garrison. The men are represented by Edward Johnson, Reinald Werrenrath, Albert Spalding, the violinist, and a number of others equally well known.

Besides the list already announced definitely, there are several who will sing and play if they can get permission from the musical organizations with whom they are associated. Many of the phonograph companies have exclusive contracts with their performers, which forbids them to display their talents to the public except by permission of the company.

Mr. Kent, of the Atwater Kent Company, has taken the leading part in arranging this series of programs. All radio fans will feel a sense of gratitude to him and also to Station WEAF for being able to obtain such an array of talent.

The concerts, which will be given once a week through the fall and winter season, start at 9:15 every Sunday evening and last for an hour. The first one begins October 4. The programs will contain not only high classical music, but also many of the popular numbers. Be sure you tune in on Sunday evenings for these wonderful events.

LEARN NURSING IN CLUB

All women within hearing distance of WGY may consider themselves non-resident members of the Schenectady Woman's Club, as this organization is offering weekly talks and musical entertainments, during the fall and winter months.

The program is especially noteworthy for the variety of the subjects discussed, which include Club Work, Women in Politics, Conservation, Home Hygiene, Psychology in Child Discipline, Home Economics, Philanthropy, Law, the Drama of To-day, etc. The entertainments will include music, drama, reading and programs by the Club Chorus.

A feature will be a series of six lessons in home hygiene and the care of the sick by Miss Anna McGee. These lessons are built up from "Red Cross Classes in the Home Care of the Sick," and they are given with the consent of the American Red Cross for the first time by radio. The information given by Miss McGee should enable the woman in the home to cope with sickness when no nurse is available. Questions written to Miss McGee on the subject of home hygiene will be answered by her.

HEARING A PIE

A resident of Woodhaven, Long Island, reporting reception of WGY's 50-kilowatt super-power signals, stated that he used a pie plate as an aerial. This was placed under a telephone receiver and the plate was connected to a two-tube set by a wire.

Hoover's Department Favors Super-Power

Looks as if Sending Stations Would Increase Their Loudness

An Interview from Commerce Department

WHEN travelling on the train, how do you talk to your friend? Undoubtedly you raise your voice and if it is particularly noisy you are apt to shout.

The same thing occurs in transmitting from a broadcasting station. If there is a great deal of noise in the air (static) then the logical thing to do is for the sender to shout—use more power in his aerial. In this way he will drown out the racket and will be heard in your receiver.

The past summer has witnessed a 10-fold increase of power used in many of the broadcasting stations, as well as experiments on still higher powers, running up to 50 kilowatts. Measurements on the actual signals delivered by these stations have been made by the Bureau of Standards, Department of Commerce, and co-operating laboratories. These measurements culminated in special observations on the alternation 50 and 2½ kilowatt transmission of WGY, Schenectady. Some surprising conclusions can be announced.

The results are remarkable for some things that did not happen as well as for some that did. First and foremost, high power has *not* resulted in signals of overwhelming intensity. Even the 50-kilowatt transmissions reached many listeners with an intensity which was not noticeably greater than that of many other stations on moderate power. Excessive interference or blanketing of lower power stations is another element of the popular picture of "super-power" which has failed to materialize. These results, from the viewpoint of scientific investigation, are regarded as important check on the calculations of radio engineers. They have been predicting right along that no bad effects of jamming the air, throwing the receivers out of adjustment and the like would be noticed.

The U. S. a Laboratory

Thousands of radio listeners have complied with the request of Secretary Herbert Hoover of the Department of Commerce and have reported on the 50-kilowatt transmission tests made by WGY, August 22, 24 and 25. From the great transmitter laboratory of the General Electric Company, super-power signals were broadcast for three nights, and the entire country, for the purpose of the Department of Commerce, was on those nights, a great laboratory with every listener invited to become an investigator.

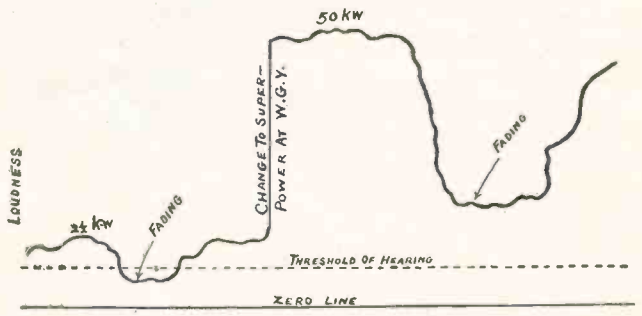


Fig. 1. This Explains Why WGY Did Not Cure Fading by Superpower

According to Martin P. Rice, manager of broadcasting for the General Electric Company, no attempt has been made to survey all the letters thus far received, but the reports of those already tabulated indicate the following:

Tuned Out Four Miles Away

In practically all cases the super-power signals of WGY could be tuned out and other stations brought in. Even in Schenectady, within three or four miles of the 50-kw. transmitter, outside stations were brought in on selective receiving sets.

Listeners reported that static was less troublesome when super-power was used. A majority wrote that fading, where any fading existed, was less on super-power, that in cases where the 2½-kw. signal entirely disappeared, the 50-kw signal faded but was always audible.

The reason for this fading effect is probably that of the "Threshold of Hearing." A certain strength of radio waves must strike your aerial before you are able to get any sound at all. This is partly because the receiving set will not work below a certain minimum and partly because our ears are not sensitive enough to pick up very small sounds.

When the Ball Game Fades

As you walk away from a ball field where a game is going on, you hear the cries of the spectators growing fainter and fainter. Some distance away you can just catch them and beyond this point they have disappeared. But of course, you realize that the sound vibrations are still in the air—it is only because they are below the threshold of your ears that makes you no longer pick them up. The dog at your feet is still able to hear these noises quite plainly as his threshold is considerably lower.

This effect can be appreciated from Fig. 1. The curve shows the loudness of the signals from WGY at the time they changed from 2½ to 50 kilowatts. This does not represent the volume as our ears pick it up from the set, but the actual amount of vibrations going on the air. A certain quantity which is represented by a height of the dotted line is needed to reach the threshold of our hearing.

Notice that the curve shows a fairly loud signal coming in until at the point marked "fading" it drops to about 1/3. As this new value is below the threshold of course the signal entirely disappears. Then the sending station increases its power 20 times up to 50 kw. (50,000 watts). This shows on the curve about four or five times as loud. Now when fading reduces this volume to 1/3, it is still well above the threshold and so does not disappear as before.

The most startling conclusions are in reference to fading, or signal fluctuation. At all distances greater than about 50 miles from a station, actual tests show that the received wave intensity is continually fluctuating, the variation from maximum to minimum being sometimes as great as 100 to 1, instead of 3 to 1, as illustrated in our cut. The ear is notoriously insensitive to intensity changes, otherwise the reception of distant broadcast programs would be quite unacceptable. Increasing the power was found to effect no improvement in the *degree of fluctuation*. It can therefore be definitely stated that high power is not the solution of the fading problem.

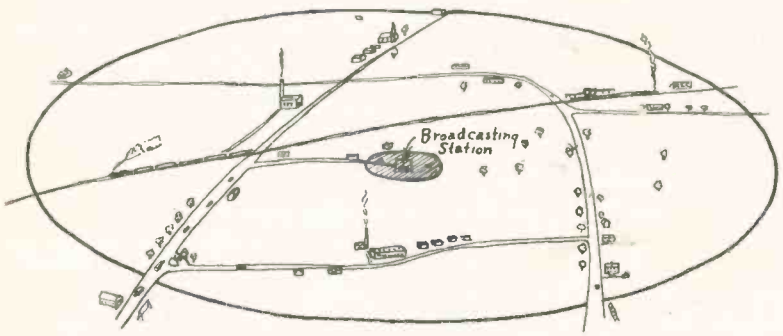


Fig. 2. One of the Surprises of Test. Although Loudness Increased Only Slowly the Radius of Action Varied Directly as the Power

Harder to Catch the Words

Many of the letters reported the quality on low power was considerably better than that on high. The words although much fainter could be easily understood at the 2½ kw. rating. When the power was stepped up it was something like the effect of a man shouting—although the tone was considerably louder, the voice was much harder to understand because the words were rather blurred. Now that the engineers know of this defect they are working to overcome it and will unquestionably be able to make the powerful voice as clear as the weaker one.

Along these lines there was an experiment on the three days on the amount of modulation. This is the proportion of the carrier wave changed by the audio frequency. A certain proportion of the letters after each night's test stated that the signals were exceptionally strong. When the modulation was 25 per cent on the first night, 14 per cent of the letters reported these exceptionally strong waves. The second night when the modulation was raised to 50, there were 39 per cent of the writers who commented on the strength. And on the third evening when 75 per cent of the carrier wave was modulated, 43 writers out of every hundred told of the unusual loudness of the signal.

Seemed Four Times As Loud

It appears that the super-power signals received locally in Schenectady showed little increase in signal strength. Correspondents in New York, Brooklyn, places on Long Island, and Philadelphia report that the high power seemed from two to three times normal volume. Several listeners in Georgia, North Carolina, and South Carolina report that the volume of super-power was about four times as great as the 2½ kw. transmission.

Two or three crystal set owners in Schenectady reported inability to hear the super-power transmission. The high power was audible, but music and speech were indistinguishable. This was doubtless due to faulty receivers.

The first test of super-power was interrupted for an hour by an SOS call from a vessel at sea. The test was continued when coast stations signalled that the air was clear again. Many correspondents reported an exceptionally brilliant Aurora Borealis during the latter part of the evening. An enterprising and imaginative feature editor wired the General Electric Company to inquire if the use of super-power was the cause of the "strange light in the northern sky."

Did It Help Other Stations?

An unusual and as yet unexplained condition was reported by three Schenectady listeners, working independently. They reported that in tuning in an outside station during the time WGY was using 2½ kw., they observed, after WGY changed over to 50 kw., that there was a marked increase in the signal strength of the outside station. These men were not receiving the same station and the observations were made on different nights.

It appears that the distance over which a broadcast station gives highly satisfactory, dependable service is quite limited. There is the omnipresent background of static and all sorts of electrical disturbance, which require that the radio wave have more than a certain minimum intensity in order to assure reception free from interference.

The Daylight Radio Zone

There is an area around every broadcast station within which such perfect reception is assured and beyond which it is not possible to rely on night-time reception free from disturbance. Daytime reception is in general not possible at all beyond this area. This zone of really dependable radio service around each broadcasting station is surprisingly small, but its area is approximately proportional to the station's power.

This idea is shown better in Fig. 2. Here we have the broadcasting station on 2½ kw. covering an area of service which is heard easily and clearly even in the day time. Beyond the limit of the shaded area, the signals are too weak to be called entirely satisfactory. When the power is raised to 20 times this amount of 50 kw., the radius of good reception is extended 20 times, which gives us 400 times the aerial. In our sketch owing to limits of space, we have shown the outside circle with only ten times the radius. If drawn to scale, this would have to be doubled.

The Department of Commerce authorized the General Electric Company to conduct further high power tests at their broadcasting station, WGY, on September 21, 22 and 23; these tests

Continued on Next Page

Broadcasters Hold Lively Meeting

Annual Convention in New York Clears Up Many Matters

PROBABLY you think of broadcasters as talking one at a time and always carrying around with them a pet microphone. However, they can get together in a convention and can accomplish a lot of business when they are able to tear themselves away from their sending stations.

The annual meeting of the National Association of Broadcasters was held September 16 and 17 in New York City. Judging from the large and enthusiastic audience, there is no danger for a long time that we shall have to worry about having to pay sending stations to keep us entertained. It looks more as if measures would have to be passed to discourage the number of those who are anxious to spread their voices on the air.

A Fine Set of Men

The election of officers was an important event. Station WOC, Davenport, Iowa, drew the first prize in the person of Frank W. Elliott, who was elected president. The vice-presidency is ably supported by two well-known men, Powel Crosley, Jr., of WLW, Cincinnati, and William H. Heinz of WHO, Des Moines, Iowa. A. F. Kales of KFI, Los Angeles, is secretary. Station WNAC, Boston collects the money through the treasurer, John Shepard. The executive chairman is Paul B. Knegh of New York.

It was decided to divide up the country into five parts for purposes of meetings. These divisions include New England, Atlantic, Great Lakes, Central and Pacific States. Each group is to have a regional chairman who will have the duty of calling their regional meetings whenever necessary. This will save time, as each division can act immediately on matters of importance as they arrive without having to wait for the annual national meeting.

This racing greyhound enjoys listening to radio music. Sitting upon the running-board of his mistress's automobile, he is intently listening-in while she tunes-in.

Five Directors of Sections

The election of these directors resulted as follows:

New England, WTIC—W. C. Cowles, Hartford Conn.

Atlantic, WAHG—Alfred H. Grebe, New York City.

Great Lakes, WJR—E. H. Jewett, Pontiac, Mich.

Central, WHO—George Kurne, Des Moines, Iowa.

Pacific, KFI—Earle C. Anthony, Los Angeles, Cal.

One of the interesting reports which was given was that of the Membership Committee. This showed a large number of applications of the different stations who wanted to come into membership. At the head of the list was WEAF, New York. As the association is intended to be of service to the whole radio community, it was felt that all stations in good standing should be admitted. That is why all the applicants were unanimously elected.

How Broad is Copyright?

Among the important matters discussed was the troublesome copyright matter. Ever since broadcasting was started there has been a conflict between the publishers of music and broadcasting stations over the public performance of music. At first broadcasters took the position that the copyright law did not contemplate, and therefore did not cover broadcasting of music, for the reason that such broadcasting is in the nature of a public service, and is without any means of having direct pecuniary return from the listeners.

However, recently there has been a change of feeling in this regard. The composers of songs have pointed out that while broadcasting their creations

Continued on Next Page

HOOVER'S BUREAU

Continued from Previous Page

covered a period of two hours each, beginning at midnight, Eastern Standard Time, using 50 k. w. power throughout.

On September 24, 25 and 26, they used alternatingly 2½ and 50 k. w. power. This test differed from the previous ones in that the same antenna system was employed for both powers.

Authority has also been granted for the use of 50 k. w. power for regular broadcasting on Saturday and Sunday evenings, beginning October 3.

Still Working on Fading

More specific conclusions cannot yet be stated by the Department of Commerce on the special 50-kilowatt tests of September 21 to 26. Further experimentation with high power can be expected. Particular attention is being given to fading in further studies by the Bureau of Standards and co-operating laboratories. More data on the effects of atmospheric conditions which give rise to fading are seen as the only hope of extending satisfactory radio reception to great distances.

BROADCASTERS MEET

Continued from Previous Page

oftentimes gets people interested and so hastens the time of buying by the public, still the constant broadcasting over and over again of the popular pieces makes the listeners get tired of a new song much quicker than used to be the case. The net result is that oftentimes fewer copies are sold than would have been disposed of before the days of radio.

Then Congress Took a Hand

From this it seems fair that the composers and publishers of broadcast music receive some pay from the sending stations. This same problem came up years ago in the matter of phonograph records and player piano rolls. At that time Congress made a ruling on the matter which treated all competitors with fairness.

The Broadcasting Association after much discussion finally adopted at this convention the idea of extending to radio broadcasting the present paragraph of the copyright law which relates to mechanical reproduction of music by phonograph and piano.

With this scheme in mind they resolved that this idea should be presented to all the broadcasting stations for their approval and if the verdict were favorable that the association endeavor to get this extension of the copyright law put on the statute books.

How About a Censor?

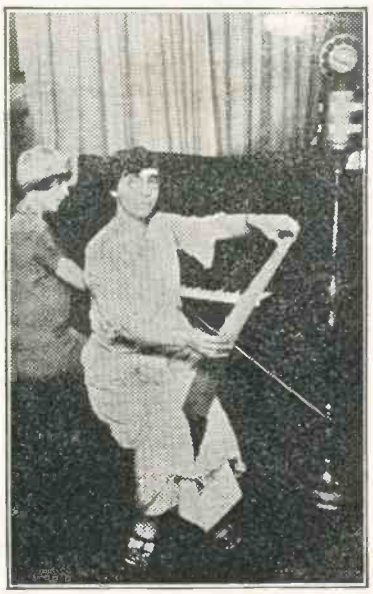
Another matter of importance was the question of censorship. There have been rumors of bills to be introduced in Congress which will require a broadcasting station to label, through announcement, whether a program is an advertisement or not. Discussion on this subject covered much data on the present state of broadcasting for profit.

It was brought out that the ordinary form of indirect advertising used at most of the stations, consists of an entertainment program entirely. The advertisers name is mentioned once at the beginning of the period and again every now and then as announcements are made during the hour or half hour while the number is in progress. The whole idea is to create good will towards the advertiser in the mind of the broadcast listener. If the announcements are not skillfully made the radio fan not only will not feel well disposed to the manufacturers whose product is being mentioned, but he may even get a grudge against him and become prejudiced against his goods.

Like Gilding the Goldenrod

Since it costs the advertiser anywhere from $5.00 to $10.00 *a minute* or more, to get his name mentioned occasionally in connection with the program, it is pretty certain that he will be mighty careful that the announcement is suitably made. In view of these facts it seemed to the Broadcasters Association that any ruling as to the announcement of advertising would be superfluous and entirely unnecessary.

Censoring the programs was another subject which was talked over at length.



Taking the wood-saw from the shed to the music room via radio broadcasting, has been one of the achievements of the Crosley WLW superpower station. Mrs. Harry H. Nagle is the first woman to play upon the wood-saw for radio audiences.

None of the broadcasters could see any advantage in this at all. It was pointed out that the success of radio broadcasting is founded upon the maintainence of public good will, and that no broadcasting station can operate successfully without an appreciative audience.

You and I Are the Censors

Furthermore it is found that the public is quick to express its approval and even quicker to display its dislike of special programs. So it was unanimously resolved by the meeting that any agency of program censorship other than public opinion is not necessary and would be bad for the art.

No agreement could be reached upon the matter of superpower. All the larger stations definitely favored it, while the smaller ones were afraid that they might be blanketed and so lose their listeners. It was agreed that any increases in power must be based upon avoiding signs of jamming other stations.

Unravelling the Waves

The matter of untangling the wave frequencies was a very difficult one. All the B allotments are more than full, many stations dividing up the time two and even three ways. The A wave frequencies are swamped with applications. This matter was referred to a committee which was instructed to report at the next meeting.

All of the resolutions adopted were constantly mentioned as recommendations only to the Secretary of Commerce, to aid him if possible, in the many problems with which he is confronted. It was the opinion of members, frequently expressed, that any new legislation which had for its purpose the giving of full power to the Secretary of Commerce to regulate and control radio in all of its phases would be satisfactory, if radio could always be assured of a Secretary of Commerce as competent and as sympathetic toward radio as Secretary Hoover. Fear was expressed, however, that some Secretary in the future might not be competent to handle the problems of radio, and it was therefore the opinion of those present that any legislation intended to regulate and control radio should be solely in the interests of the public, and that such authority should therefore not be put in the hands of one man.

Gather in the Small Ones

A new Constitution and By-Laws were submitted, which simplify the method of association procedure, and are designed to make the association more attractive to small stations. Mr. Harkness speaking for the American Telephone and Telegraph Company, in addressing the convention, dwelt upon the necessity of having all small stations members, and that the association should pay particular attention to their problems.

The meeting finally adjourned with the feeling of everyone that considerable good had been accomplished and the association was much stronger than before.

American Radio Relay League

AMATEURS AID ARMY

An agreement authorized by the War Department has just been concluded between the Signal Corps and the transmitting radio amateurs. Complete radio communication for every National Guard and Organized Reserve Unit in the United States Army, the establishment of a corps of civilian radio operators trained in the methods of the Army, and the organization of a complete network of Army-amateur radio stations throughout the country are some of its aims. The American Radio Relay League, with headquarters in Hartford, is being asked to represent the transmitting amateurs of the country in organizing the plan.

A Vast Radio Net

The first move in this far-reaching plan will come when the League commences the enrollment of its member stations in the various radio nets which will comprise the organization. These amateurs, when enrolled, will be asked to act as communicating stations for battalions, regiments, brigades, divisions and corps area headquarters. When the organization of radio men is completed there will be within each corps area the necessary radio net work to link up the corps headquarters with each subordinate unit in the area.

It is the hope of the Signal Corps that this plan will build up a strong defense unit of civilian radio stations that will be able to operate when land lines are down because of storm, civil commotion or actual warfare. At the same time it is hoped to secure a large reserve of radio operators, trained in army methods of procedure and in the basic principles of using radio in the field.

Another consideration behind the army acceptance of the plan is the desire to add the large facilities of American Radio Relay League member stations to the radio experimental section of the Signal Corps.

The direction and control of the various nets in corps headquarters will be carried out by a Liaison Agent at the Signal School, Camp Alfred Vail, New Jersey, where the control station of the entire system will be located.

In order to furnish the necessary amount of traffic work to initiate properly the radio amateurs into the methods of handling army material, routine reports of National Guard and Organized Reserve units are to be transmitted by radio in addition to dispatching, as formerly, the confirmation copies by mail. It is also planned to send as much official correspondence as possible through these amateur stations.

It Will Take a Whole Year

In transmitting the plan to the American Radio Relay League, Major General C. McK. Saltzman, Chief Signal Officer of the Army, said:

"The Signal Corps fully appreciates the magnitude of this undertaking. It cannot be accomplished in a few weeks or months. By careful, considerate cooperation on the part of the Signal Corps and the amateurs this plan should in a year or so provide the United States with a vast number of radio operators of potential value to their communities and the nation in an emergency.

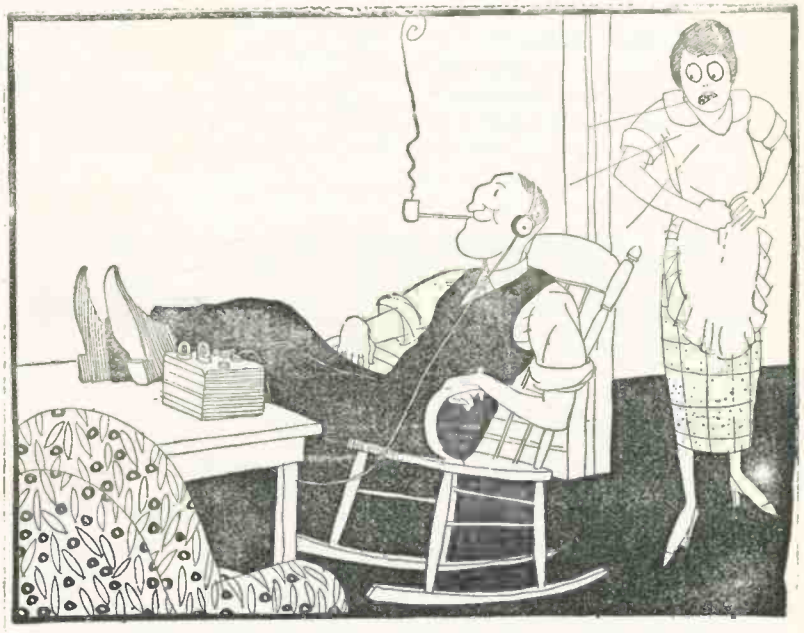
"It is confidently believed that this plan is beneficial to both the Signal Corps and the transmitting radio amateur. The latter's participation in it will be a positive answer to those who question his right to continue to exist."

Preliminary organization work is already being carried on with the amateurs by officials of the Traffic Department of the American Radio Relay League and at the same time Signal Corps officers are at work revising the specifications for the various radio nets which the completed plan will require.

HERE'S QUICK WORK FOR FAIR

To supply the need of a broadcasting station for the Saskatoon Fair, at which such celebrities as Field Marshal Earl Haig and the Honorable Charles Stewart are to be guests of honor, the Saskatoon Radio Club, with the co-operation of local radio merchants plans to go on the air with a 250-meter broadcasting station that will carry speeches, music and fair news to the three prairie provinces and perhaps beyond.

Each operator of the station is a member of the American Radio Relay League and has spent many weeks in perfecting himself in radio science. The station has already been on the air several times and it has established remote controls and a city studio. During the Saskatoon Fair week, apparatus will be moved to the fair grounds to provide full coverage of all events.



PHONES OR LOUD SPEAKER?

Fone Fun For Fans

Bill's a Fan Now

Burglar's Wife—"Bill, you ain't tend'n' to business nights since you stole that three-tube set."—Judge.

Merely Doing His Bit

She—"It's very good of you to ask me to dance."

He—"Don't mention it, it's a charity ball."—Jack o' Lantern.

Accomplished

Fond Mother—"Yes, Genevieve is studying French and Algebra. Say 'Good morning' to the lady in algebra, Genevieve."—Ohio State Sun Dial.

No Such Animal

A prospective buyer walked into a garage and said to the proprietor: "I would like to see a first-class second-hand car."

The proprietor looked at him and smiled as he replied: "So would I, brother."—The Automobile Journal.

Broadcasting a Signal

"Wonder why so many men sing while they are taking a bath?"

"I know why I do—the bathroom door won't lock."

The Old Reliable Nuisance

"Have you any alarm clocks?" inquired the customer. "What I want is one that will arouse father without waking the whole family."

"I don't know of any such alarm clock as that, madam," said the man behind the counter. "We keep just the ordinary kind that will wake the whole family without disturbing father."—Wheeler's Magazine.

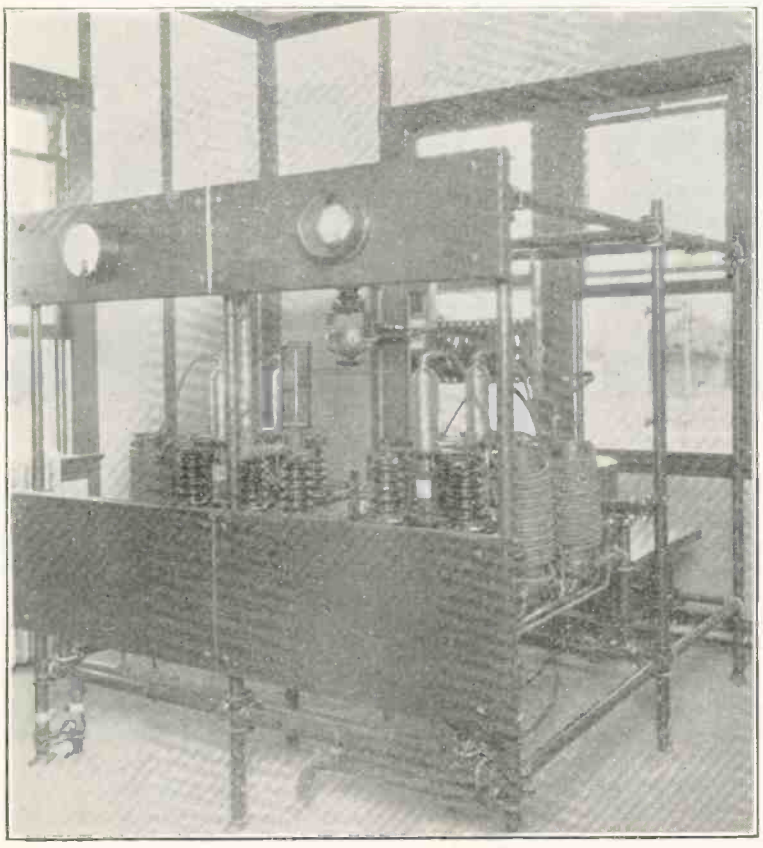


Fig. 7. These Tubes, Which Put the Power in the Aerial, Vibrate Exactly in Time

CRYSTAL CURES BIRDIES

Continued from Page 12

the tremendous voltage at which the waves are radiated.

This piezo crystal has been used by KDKA for several months and has proved to be a wonderful advance over previous ways of controlling the frequency.

The Springfield Station, WBZ, has also been experimenting with this control and thinks very favorably of it. For this reason the other Westinghouse stations, KYW, Chicago, and KFKX, Hastings, are planning to install crystals. When all stations have done so, you will hear no more birdies except from squealing receivers.

A DOZEN FOR WOMEN

On Monday morning, September 21, a new type of chain broadcasting was introduced to radio listeners, on a scale more extensive than anything yet tried in commercial broadcasting, when twelve of the principal broadcasting stations of United States, from the Atlantic to the Pacific Coast, started tthe simultaneous broadcasting of the Betty Crocker Home Service Talks.

Three times a week, on Mondays, Wednesdays and Fridays, at 11:00 A. M., Eastern Daylight Saving Time, Betty Crocker is talking to the nation's housewives from the following stations: WEAF, New York, N. Y.; WEEI, Boston, Mass.; WFI, Philadelphia, Pa.; WCAE, Pittsburgh, Pa.; WGR, Buffalo, N. Y.; WEAR, Cleveland, O.; WWJ, Detroit, Mich.; WHT, Chicago, Ill.; KSD, St. Louis, Mo.; WDAF, Kansas City, Mo.; KFI, Los Angeles, Calif., and WCCO, St. Paul-Minneapolis, Mo.

This hook-up of these larger broadcasting stations are the first in history exclusively for women. The talks deal with preparation of food for the table, model menus, party suggestions, proper diet for children, and in addition, three complete cooking schools. The series, with brief interruptions at Christmas and Easter, will continue for 29 weeks.

GOOD GROUND ON FARM

Remove the paper covering from an old dry cell, fasten the ground wire to the negative and positive terminals, and bury it in the ground. As it remains moist it will make a good ground for a year.

Rx DR RADIO PRESCRIBES.

NOTE: In this section the Technical Editor will answer questions of general interest on any radio matter. Any of our readers may ask not more than two questions, and if the subjects are of importance to most radio fans they will be answered free of charge in the magazine. If they are of special interest to the questioner alone, or if a personal answer is desired, a charge of fifty cents will be made for each answer. This will entitle the questioner to a personal answer by letter. However, if the question requires considerable experimental work, higher rates will be charged.

Question. Will the new Radiotron bulbs give better results than the old ones?

Answer. Those which merely replace the old line (the UX-201A for the UV-201A) are just like the superseded styles in their electrical parts. The only difference is the style of base. The new ones will give no better results than the old. However, there are several tubes like the UX-120, UX-112, and UX-210, which are brand new and are considerably louder than any of the older line.

Question. Are the aerials which fold up or roll into a curtain as good as the outside style?

Answer. No, there is no chance of their picking up as much energy as they do not cover enough area. If you had a curtain as big as your outside aerial it would work just as well; but when you try to collapse it into a space 4 x 6, or smaller, then the volume will suffer very greatly. Of course, the larger amount of wire in one of these special antennas tunes better to the waves which lie in the broadcast range, and so are an improvement over a short, say ten-foot wire. However, they cannot equal the old reliable outside aerial.

Question. In by-pass condensers for reflexing, how accurate should the capacity be held?

Answer. The value of it is not at all critical. Some experimenters recommend .002 micafarad, while others hold that .001 mfd. is enough. This shows that the range may be at least 100 per cent. without any trouble.

Question. In the new radiolas, why are the dials set edgewise?

Answer. In this position it is found that they are easy to turn and also space is left to write in the call letters of the stations heard. In this way a complete log is easy to keep. Also the letters are always rightside up and read straight across instead of sticking out fan shape, as is usual where an ordinary dial is employed.

Question. Why is it that three resistance amplifiers are usually used for audio, whereas only two steps of transformer coupled units are common?

Answer. If the same tubes are used for both styles of hook-up, then the gain in loudness through them is identical in the two cases. In addition to the step up through the tube the transformers themselves have a factor of three to six, while in the resistance coupling there is no such gain—if anything a slight loss, owing to the audio frequency loss in the resistances themselves. The three tubes are therefore needed with this style to equal the two of the transformer coupled set. To overcome this objection some companies are making a special tube with a much higher gain in volume. Two of these units are intended to take the place of two ordinary tubes with their transformer.

Question. What is the difference between a "B" battery hydrometer and the ordinary model?

Answer. An ordinary hydrometer works in the same way, but requires considerable more electrolyte than its cousin the "B" battery tester. Owing to its smaller size, the latter will give a reading with only a couple of thimblefuls of liquid. The small size of the "B" battery cells prevents much of the solution from being used in testing. But a "B" battery hydrometer can be used just as well for testing "A" batteries.

Question. In the Cockaday circuit, why is one coil built at right angles to the others?

Answer. This particular coil is used for loading the primary or reducing the wave speed (frequency). It is not intended that it shall have any other effect and so it is located as you describe. If it were in line with the other coils, then the magnetism which results from the flow of current through it would pass along the axis of the other coils and so would induce a voltage in them. As this action is not wanted, the position at right angles sends the magnetic flux *across* the windings and this has no effect in generating a voltage in their wires.

CURRENT-BEARING TREES

The use of trees as substitutes for radio aerials, advocated by some operators, is unsafe in places where electric light wires are strung through foliage says W. H. Ude, public relations director of the Washington Water Power Company of Spokane.

"Radio users," he added, "should make sure that there are no such wires passing through or near the trees which they intend to use as aerials, for if the wires do pass through the trees and the latter are used as aerials, there is a danger of the high voltage completing a circuit through the aerial lead-in wire, bringing the current directly to the radio set, with the possibility of injuring the set and the operator."

A HARP THAT SWINGS

A novel and ingenious instrument made its appearance before WJZ's microphone recently. Captain Charles Longbottom was the performer on this unusual creation which is probably the most unique sound instrument in the world.

The main part of the device is a rectangular hollow box with outside dimensions of approximately 14 by 6 by 3 inches. The box is constructed of light wood and an opening of about three inches in diameter is left in the "face" of the instrument. Then four harp strings are run lengthwise with the box, crossing the 3-inch opening, and these are tightened to tune to four pitches.

The instrument is played by grasping it firmly in both hands, with the "face" uppermost and plucking the strings with the thumbs of both hands, and at the same time the harp is swung from a position near the floor to a position above the head, and again returned to the floor. The effect is most unusual, sounding somewhat like a harp and somewhat like a banjo and at the same time employing the rising and falling wail found in Hawaiian instruments. The Swinging Harp is a purely home-made product, Captain Longbottom stating that he has never seen one of the instruments on sale, and knows of only one or two others in existence.

RADIO GOOD FOR SQUATTERS

Definite health gains are beginning to be measured as a result of the morning exercises broadcast daily through WEAF, WCAP and WEEI from the Metropolitan Tower, New York City, for the past few months. Many letters describing actual improvements in health resulting from the exercises are being received.

One amusing result is the fact that several amateur gardeners, both men and women, found that they are now better able to bend over the rows for seeding or weeding the garden, and remain for longer periods in a squatting position without tiring. "Other years after seeding I was all exhausted," writes one, while a man states that he used to get pains in his back that he no longer has. These are members of the largest health class ever organized, made up of thousands who, rain or shine, hot or cold, do their "daily dozen" under the guidance of Arthur Bagley.

Your Friend Will Thank You

When you finish reading this magazine, don't throw it away. Just hand it to your friend. Any intelligent person can understand it, and your friend will thank you.

RADIO PROGRESS
8 Temple St. (P. O. Box 728)
Providence, R. I.

Date.....

You may enter my subscription to RADIO PROGRESS

for.....year { 1 year $3.00 / 2 years $5.50

Signature.....

Send it to this address

Paid by (PRINT) .....

Check ☐.....

Cash ☐.....

Money order ☐.....

WE SAY—

The
Brooklyn Radio Exposition

WILL BRING—

RECOGNITION
STABILIZED BUYING
NEW BUSINESS

WHY DID—

Western Electric Corporation
David Grimes, Inc.
Marwol Radio Corporation
Tower Mfg. Company
Valley Electric Co.
C. J. Boissonnault Company, Inc.
Herzog Radio Corporation
Powerola Radio Corporation
Wildermuth & Co. (Atwater-Kent)
20th Century Radio Corp. (Garod)
G. J. Seedman & Co. (Grebe)
Victory Electric Supply Co. (Fada)
J. W. Weber, Jr., Inc. (Eagle)
McPhilben Radio Co. (De Forest)
Pyramid Motor Equipment Co. (Thermiodyne)
Marko Storage Battery
Willard Storage Battery Co.
and others

ELECT TO EXHIBIT AT THE BROOKLYN SHOW?

ASK THEM!

TIME: OCTOBER 17th to 24th, 1925

PLACE: 23rd REGIMENT ARMORY, BEDFORD AND ATLANTIC AVES., BROOKLYN, N. Y.

EXECUTIVE OFFICES

1-7 DeKalb Ave., Brooklyn, N. Y.

PHONE: TRIANGLE 4126

S. T. ROGERS, Managing Director

UNITED STATES BROADCASTING STATIONS ARRANGED ALPHABETICALLY BY CALL LETTERS

Abbreviations: W.L., wave length in meters; K.C., frequencies in kilocycles; W.P., wattpower of station.

	K.C.	W.L.	W.P.
KDKA—Westinghouse Elec. & Mfg. Co., E. Pittsburg, Pa.	970	309	1000
KDPM—Westinghouse Elec. & Mfg. Co., Cleveland, O.	1200	250	500
KDZB—Frank E. Siefert, Bakersfield, Cal.	1430	210	500
KFAB—Nebraska Buick Auto Co., Lincoln, Neb.	880	341	500
KFAD—McArthur Bros. Mercantile Co., Phoenix, Ariz.	1100	273	100
KFAE—State College of Washington	860	349	500
KFAF—Western Radio Corp., Denver, Colo.	1080	278	500
KFAJ—University of Colorado, Boulder, Colo.	1150	261	100
KFAU—Boise High School, Boise, Idaho	1080	278	500
KFBK—Kimball Upson Co., Sacramento, Cal.	1210	248	100
KFCF—Frank A. Moore, Walla Walla, Wash.	1170	256	100
KFDM—Magnolia Petroleum Co., Beaumont, Tex.	950	316	500
KFDX—First Baptist Church, Shreveport, La.	1200	250	100
KFDY—S. Dak. Ste. Col. Ag. & Mech. Arts, Br'kngs., S. D.	1100	273	100
KFEQ—Scroggin, & Co. Bank, Oak, Nebr.	1120	268	500
KFFV—Graceland College, Lamoni, Iowa	1200	250	100
KFGC—Louisiana State Univ., Baton Rouge, La.	1120	268	100
KFGD—Oklahoma College for Women, Chickasha, Okla.	1190	252	200
KFGH—Leland Stanford Junior Univ., Stanford Univ., Cal.	1110	270	500
KFGX—First Presbyterian Church, Orange, Texas	1200	250	500
KFI—Earl C. Anthony, Los Angeles, Cal.	640	469	3000
KFIF—Benson Polytechnic Institute, Portland, Ore.	1210	248	100
KFIO—North Central High School, Spokane, Wash.	1130	266	100
KFIQ—First Methodist Church, Yakima, Wash.	1170	256	100
KFIZ—Daily Com'lth & Wis. R. S'les, Inc., Fondulac, Wis.	1100	273	100
KFJF—National Radio Mfg. Co., Oklahoma, Okla.	1150	261	225
KFJM—University of No. Dak., Grand Forks, No. Dak.	1080	278	100
KFKQ—Conway Radio Laboratories, Conway. Ark.	1200	250	100
KFKU—University of Kansas, Lawrence, Kas.	1090	275	100
KFKX—Westinghouse Elec. & Mfg. Co., Hastings, Neb.	1040	288	2000
KFLR—University of New Mexico, Albuquerque, N. Mex.	1180	254	200
KFLV—Swedish Evangalical Mission Church, Rockford, Ill.	1310	229	100
KFLZ—Atlantic Automobile Co., Atlantic, Iowa	1100	273	100
KFMQ—University of Arkansas, Fayetteville, Ark.	1000	300	500
KFMR—Morningside College, Sioux City, Iowa	1150	261	100
KFMX—Carleton College, Northfield, Minn.	890	337	750
KFNF—Henry Field Seed Co., Shenandoah, Iowa	1130	266	500
KFOA—Rhodes Dept. Store, Seattle, Wash.	660	454	500
KFON—Echophone Radio Shop, Long Beach, Cal.	1290	233	100
KFOO—Latter Day Saints Univ., Salt Lake City, Utah	1270	236	250
KFOR—David City Tire & Electric Co., David City, Neb.	1330	226	100
KFOX—Technical High School, Omaha, Nebr.	1210	248	100
KFPG—Oliver S. Garretson, Los Angeles, Cal.	1260	238	100
KFPR—Los Angeles County Forestry, Los Angeles, Cal.	1300	231	500
KFPY—Symons Investment Co., Spokane, Wash.	1130	266	100
KFQA—The Principa, St. Louis, Mo.	1150	261	100
KFQB—Searchlight Publishing Co., Fort Worth, Texas.	1140	263	150
KFQC—Kidd Brothers Radio Shop, Taft, Cal.	1300	231	100
KFQU—W. E. Riker, Holy City, Calif.	1350	222	100
KFQZ—Taft Products Co., Hollywood, Calif.	1330	226	250
KFRB—Hall Bros., Beeville, Texas	1210	248	250
KFRU—Etherical Radio Co., Bristow, Okla.	760	395	500
KFSG—Echo Park Evangelistic Asso., Los Angeles, Cal.	1090	275	500
KFUM—W. D. Pyle, Colorado Springs, Colo.	1240	242	100
KFUO—Concordia Seminary, St. Louis, Mo.	550	545	500
KFUT—University of Utah, Salt Lake City, Utah	1150	261	100
KFVE—Film Corporation of America, St. Louis, Mo.	1250	240	500
*KFVF—Clarence B. Juneau, Hollywood, Cal.	1440	208	250
KFVW—Airfan Radio Corporation, San Diego, Cal.	1220	246	500
KFWA—Browning Bros. Co., Ogden, Utah	1150	261	500
KFWB—Warner Bros. Pictures, Inc., Hollywood, Cal.	1190	252	500
KFWD—Arkansas Light & Power Co., Arkadelphia, Ark.	1130	266	500
KFWH—F. Wellington Morse, Jr., Chico, Cal.	1180	254	100
KFWI—Radio Entertainments, Inc., So. San Fran., Cal.	1360	220	500
KFWM—Oakland Educational Society, Oakland, Cal.	1430	207	500
KFWO—Lawrence Mott, Avalon, California	1420	211	250
*KFWM—Oakland Education Society, Oakland, Cal.	1430	207	500
KFWU—Louisiana College, Pineville, La.	1260	238	100
*KFXC—Santa Maria Val. R. R. Co., Santa Maria, Cal.	1430	210	100
KGO—General Electric Co., Oakland, Cal.	830	361	3000
KGU—Marion A. Mulrony, Honolulu, Hawaii	1110	270	500
KGW—Portland Morning Oregonian, Portland, Ore.	610	491	500
KHJ—Times-Mirror Co., Los Angeles, Cal.	740	405	500
*KHQ—Louis Wasmer, Seattle, Wash.	1100	273	100
KLS—Warner Bros. Radio Supplies Co., Oakland, Cal.	1240	242	250
KLX—Tribune Publishing Co., Oakland, Cal.	590	509	500
KLZ—Reynolds Radio Co., Denver, Colo.	1130	266	250
*KMA—May Seed & Nursery Co., Shenandoah, Iowa	1190	252	500
KMO—Love Electric Co., Tacoma, Wash.	1200	250	100
KNX—Los Angeles Express, Los Angeles, Cal.	890	337	500
KOA—General Electric Co., Denver, Colo.	930	322	2000
KOB—New Mexico Col. of Agriculture, State Col., N. Mex.	860	349	750
KOIL—Monarch Manufacturing Co., Council Bluffs, Ia.	1080	278	500
KOP—Detroit Police Dept., Detroit, Mich.	1080	278	500
KPO—Hale Bros., San Francisco, Cal.	700	428	500
KPRC—Houston Printing Co., Houston, Texas	1010	297	500
*KPSN—Pasadena Star-News, Pasadena, Cal.	950	316	1000
KQP—Apple City Radio Club, Hood River, Ore.	1110	270	100
KQV—Double-Hill Electric Co., Pittsburg, Pa.	1090	275	500
KSAC—Kansas State Agric. College	880	341	500
KSD—Post-Dispatch, St. Louis, Mo.	550	545	750
KSL—The Radio Service Corp., Salt Lake City, Utah	1000	300	1000
KTAB—Tenth Ave. Baptist Church, Oakland, Cal.	1390	216	500
*KTBI—Bible Institute of Los Angeles, Los Angeles, Cal.	1020	294	750
KTCL—American Radio Tel. Co., Inc., Seattle, Wash.	980	310	1000
KTHS—New Arlington Hotel Co., Hot Springs, Ark.	800	375	500
KTW—First Presbyterian Church, Seattle, Wash.	660	454	1000
KUO—Examiner Printing Co., San Francisco, Cal.	1220	246	150
KUOM—State Univ. of Montana, Missoula, Mont.	1230	244	250
KWKC—Wilson Duncan Studios, Kansas City, Mo.	1270	236	100
KWWG—City of Brownsville, Brownsville, Texas	1080	278	500
KWKH—W. G. Paterson, Shreveport, La.	1110	273	250
KYW—Westinghouse Elec. & Mfg. Co., Chicago, Ill.	560	535	1500
KZKZ—Electrical Supply Co., Manila, P. I.	1110	270	100
KZM—Preston D. Allen, Oakland, Cal.	1240	242	100
KZRQ—Far Eastern Radio, Manila, P. I.	1350	222	500
WAAB—Valdemar Jensen, New Orleans, La.	1120	268	100
WAAC—Tulane University, New Orleans, La.	1090	275	100
WAAF—Chicago Daily Drovers Journal, Chicago, Ill.	1080	278	200
WAAM—I. R. Nelson Co., Neark, N. J.	1140	263	500
WAAW—Omaha Grain Exchange, Omaha, Neb.	1080	278	500
WABA—Lake Forest University, Lake Forest, Ill.	1320	227	200
WABI—Bangor Hydro-Electric Co., Bangor, Me.	1250	240	100
WABO—Lake Avenue Baptist Church, Rochester, N. Y.	1080	278	100
WABX—Henry B. Joy, Mount Clemens, Mich.	1220	246	150
WADC—Allen Theatre, Akron, O.	1160	258	100
WAFD—Albert B. Parfet Co., Port Huron, Mich.	1170	256	500
WAHG—A. H. Grebe Co., Richmond Hill, N. Y.	950	316	500
WAMD—Hubbard & Co., Minneapolis, Minn.	1230	244	500
*WAPI—Alabama Polytechnic Institute, Augurn, Ala.	1210	248	500
WARC—Am. Rad. & Research Corp., Medf'd H'lsde, Mass.	1150	261	100
WBAA—Purdue University, West Lafayette, Ind.	1100	273	250
WBAK—Pennsylvania State Police, Harrisburg, Pa.	1090	275	500
WBAO—James Millikin University, Decatur, Ill.	1110	270	100
WBAP—Wortham-Carter Publishing Co., Fort Worth, Tex.	630	476	1000
WBAX—John H. Stenger, Jr., Wilkes-Barre, Pa.	1170	256	100
WBAY—Erner & Hopkins Co., Columbus, Ohio.	1020	293	500
WBBG—Irving Vermilya, Mattapoisett, Mass.	1210	248	100
WBBL—Grace Covenant Church, Richmond, Va.	1310	220	100
WBBM—Atlas Investment Co., Chicago, Ill.	1330	226	1500
WBBP—Petoskey High School, Petoskey, Mich.	1260	238	200
WBBR—People's Pulpit Assoc., Rossville, N. Y.	1100	273	500
WBES—Bliss Electrical School, Takoma Park, Md.	1350	222	100
WBOQ—A. H. Grebe Co., Richmond Hill, N. Y.	1270	236	100
WBT—Southern Radio Corp., Charlotte, N. C.	1090	275	250
WBZ—Westinghouse Elec. & Mfg. Co., Springfield, Mass.	900	331	2000
*WBZA—Westinghouse Electric & Mfg. Co., Boston, Mass.	1240	242	250
WCAC—Connecticut Agric. College, Mansfield, Conn.	1090	275	500
WCAD—St. Lawrence University, Canton, N. Y.	1140	263	250
WCAE—Kaufmann & Baer Co., Pittsburg, Pa.	650	461	500
WCAH—Entrekin Electric Co., Columbus, O.	1130	266	500
WCAJ—Nebraska Wesleyan University, Univ. Place, Nebr.	1180	275	100
WCAL—St. Olaf College, Northfield, Minn.	890	337	500
WCAO—A. A. & A. S. Brager, Baltimore, Md.	1090	275	100
WCAP—Cheaspeake & Potomac Tel. Co., Wash., D. C.	640	469	500
WCAR—Southern Radio Corp. of Texas, San Antonio, Tex.	1140	263	100
WCAU—Durham & Co., Philadelphia, Pa.	1080	278	500
WCAX—University of Vermont, Burlington, Vt.	1200	250	100
WCBC—University of Michigan, Ann Arbor, Mich.	1310	229	200
WCBD—Wilbur G. Voliva, Zion, Ill.	870	345	2000
WCBN—Foster & McDonnell, Chicago, Ill.	1130	266	500
WCBQ—First Baptist Church, Nashville, Tenn.	1270	236	100
WCCO—Washburn Crosby Co., Minneapolis, Minn.	720	416	5000
WCEE—Charles E. Erbstein, Elgin, Ill.	1090	275	1000
WCLS—H. M. Couch, Joliet, Ill.	1400	214	100
WCM—Texas Markets & Warehouse Dept., Austin, Tex.	1120	268	250
WCN—Foster & McDonnell, Chicago, Ill.	1130	266	500
*WCSH—Congress Square Hotel Co., Portland, Me.	1170	256	500
WCTS—C. T. Sherer Co., Worcester, Mass.	1120	268	500
WCUW—Clark University, Worcester, Mass.	1260	238	250
*WCX and WJR—The Detroit Free Press and Jewett Radio and Phonograph Co., Pontiac, Mich., (operating jointly).	580	517	1500
WDAE—Tampa Daily News, Tampa, Fla.	1100	273	250
WDAG—J. Laurence Martin, Amarillo, Tex.	1140	263	100
WDBE—Gilham-Schoen Electric Co., Atlanta, Ga.	1080	278	100
WDBK—M. F. Broz Radio Store, Cleveland, O.	1320	227	100
WDBO—Rollins College, Winter Park, Fla.	1250	240	100
WDBR—Tremont Temple Baptist Church, Boston, Mass.	1150	261	100
WDBY—North Shore Congregational Church, Chicago, Ill.	1160	258	500
WDWF—Dutee W. Flint, Cranston, R. I.	680	441	500
WDZ—James L. Bush, Tuscola, Ill.	1080	278	100
*WEAF—American Tel. & Tel. Co., New York, N. Y.	610	492	5000
WEAH—Hotel Lassen (Rigby-Gray H. Co.), Wichita, Kas.	1120	268	100
WEAI—Cornell University, Ithaca, N. Y.	1180	254	500
WEAJ—University of So. Dakota, Vermilion, So. Dak.	1080	278	100
WEAM—Borough of North Plainfield, N. Plainfield, N. J.	1150	261	250
WEAN—Shepard Co., Providence, R. I.	1110	270	250
WEAO—Ohio State University, Columbia, Ohio.	1020	294	500
WEAR—Goodyear Tire & Rubber Co., Cleveland, Ohio.	770	389	1000
WEAU—Davidson Bros. Co., Sioux City, Iowa	1090	275	100
WEAL—Iris Theater, Houston, Tex.	1110	270	500
WEBC—Walter C. Bridges, Superior, Wis.	1240	242	100
WEBH—Edgewater Beach Hotel Co., Chicago, Ill.	810	370	1000
WEBJ—Third Avenue Railway Co., New York, N. Y.	1100	273	500

The Heart of Your Radio Set

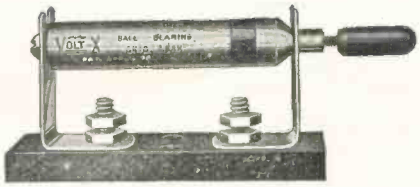
A Grid Leak is essential on every set. There are few sets made which wouldn't be improved by the use of a Variable Grid Leak.

Even the set makers admit that.

But those makers say—"Show us a good Variable Grid Leak,"—because they know that most of the variables on the market have been a failure.

Right now -- we're showing them

Buy It



Try It

Volt-X Ball-Bearing
Variable Grid Leak

If you are not satisfied, return it and get your money back

This GRID LEAK is made by an organization which has been handling delicate electrical instruments for years. We know what it means to build accurately and substantially. We KNOW that this GRID LEAK is as nearly perfect as human hands and precise machinery can make it —we're glad to have you try it with the knowledge that if it doesn't do what we claim for it, your money will be refunded.

Clip the coupon, and send it in with $1.00—a grid leak will be mailed at once.

BURTON & ROGERS MFG. CO.

755 Boylston St. Boston, Mass.

Please send me one of your VOLT-X VARIABLE GRID LEAKS.
I enclose $1.00 with the understanding that this merchandise is guaranteed to give satisfaction, or may be returned.

NAME. . . . . .

ADDRESS. . . . . .

	K.C.	W.L.	W.P.
WEBL—Radio Corp. of America, United States (portable)	1330	226	100
WEBM—Radio Corp. of America, United States (portable)	1330	226	100
WEBW—Beloit College, Beloit, Wis.	1120	268	500
WEEI—Edison Electric Illuminating Co., Boston, Mass.	630	476	500
WEMC—Emmanuel Missionary Col., Berrien Springs, Mich.	1050	286	500
WENR—All-American Radio Corporation, Chicago, Ill.	1130	266	100
WEW—St. Louis University, St. Louis, Mo.	1210	248	100
WFAA—Dallas News & Dallas Journal, Dallas, Tex.	630	476	500
WFAV—University of Nebraska, Lincoln, Neb.	1090	275	500
WFBG—William F. Gable Co., Altoona, Pa.	1080	278	100
WFBH—Concourse Radio Corp., New York, N. Y.	1100	273	500
WFBI—Galvin Radio Supply Co., Camden, N. J.	1270	236	250
WFBL—Onondoga Hotel, Syracuse, N. Y.	1190	252	100
WFBM—Merchant Heat & Light Co., Indianapolis, Ind.	1120	268	250
WFBR—Fifth Infantry, Maryland N. G., Baltimore, Md.	1180	254	100
WFDF—Frank D. Fallain, Flint, Mich.	1280	234	100
WFI—Strawbridge & Clothier, Philadelphia, Pa.	760	395	500
WFKB—Francis K. Bridgman, Chicago, Ill.	1380	217	100
WGAQ—W. G. Paterson, Shreveport, La.	1110	273	250
WGAZ—South Bend Tribune, South Bend, Ind.	1090	275	250
WGBA—Jones Electric & Radio Mfg. Co., Baltimore, Md.	1180	254	100
WGBB—Harry H. Carman, Freeport, N. Y.	1240	244	100
WGBF—Finke Furniture Co., Evansville, Ill.	1270	236	100
WGBQ—Stout Institute, Menomonie, Wis.	1280	234	100
WGBS—Gimbel Bros., New York	950	316	500
*WGBU—Florida Cities Fin. Co., Fulford By-The-Sea, Fla.	1080	278	500
WGBX—University of Maine, Orono, Me.	1190	252	100
WGCP—D. W. May, Newark, N. J.	1190	252	500
WGES—Coyne Electrical School, Oak Park, Ill.	1200	250	500
WGHP—Geo. H. Phelps, Detroit, Mich.	1110	270	500
WGMU—A.H.Grebe&Co.,Inc.(portable),Richmond Hill,N.Y.	1270	236	100
WGPH—George Harrison Phelphs, Inc., Detroit, Mich.	1110	270	500
WGN—The Tribune, Chicago, Ill.	810	370	1000
WGR—Federal Telephone Mfg. Corp., Buffalo, N. Y.	940	319	750
WGS—Georgia School of Technology, Atlanta, Ga.	1110	270	500
WGY—General Electric Co., Schenectady, N. Y.	790	380	2000
WHA—University of Wisconsin, Madison, Wis.	560	535	750
WHAD—Marquette Univ. and Mil. Jour., Mil., Wis.	1000	275	500
WHAG—University of Cincinnati, Cincinnati, O.	1290	233	100
WHAM—University of Rochester, Rochester, N. Y.	1080	278	100
WHAP—William H. Taylor Finance Corp., Brooklyn, N. Y.	1250	250	100
WHAR—Seaside Hotel, Atlantic City, N. J.	1090	275	500
WHAS—Courier Journal & Louisville Times	750	400	500
WHAT—George W. Young, Minneapolis, Minn.	1140	263	500
WHAV—Wilmington Electric Specity Co., Wilmington, Del.	1130	266	100
WHAZ—Rensselaer Polytechnic Institute, Troy, N. Y.	790	380	500
WHB—Sweeney School Co., Kansas City, Mo.	820	366	500
WHBF—Beardsley Specialty Co., Rock Island, Ill.	1350	222	100
WHBH—Culver Military Academy, Culver, Ind.	1350	222	100
WHBP—Johnstown Automobile Co., Johnstown, Pa.	1170	256	100
WHBW—D. R. Kienzle, Philadelphia, Pa.	1390	216	100
WHDI—Wm. Hood Dunwoody I. Inst., Minneapolis, Minn.	1080	278	500
WHEC—Hickson Electric Co., Inc., Rochester, N. Y.	1160	258	100
WHK—Radiovox Co., Cleveland, O.	1100	273	250
WHN—George Schubel, New York, N. Y.	830	361	500
WHO—Bankers Life Co., Des Moines, Iowa	570	526	500
WHT—Radiophone Broadcasting Corporation, Deerfield, Ill.	1260	238	1500
WIAD—Howard R. Miller, Philadelphia, Pa.	1200	250	100
WIAS—Home Electric Co., Burlington, Iowa	1180	254	100
WIBA—The Capital Times Studio, Madison, Wisc.	1270	236	100
WIBC—L. M. Tate Post No. 39, V.F.W. St.Petersburg, Fla.	1350	222	100
WIBK—University of the City of Toledo, Toledo, O.	1460	205	100
*WIBO—Nelson Brothers, Chicago, Ill.	1330	226	1000
WIBT—O. E. Miller, New York, N. Y.	1420	211	100
WIBW—L. L. Dill, Logansport, Ind.	1360	220	100
WIL—St. Louis Star, Benson Radio Co., St. Louis, Mo.	1100	273	250
WIP—Gimbel Bros., Philadelphia, Pa.	590	508	500
WJAD—Jackson's Radio Eng. Laboratories, Waco, Texas.	850	353	500
WJAG—Norfolk Daily News, Norfolk, Nebr.	1110	270	250
WJAK—Clifford L. White, Greentown, Ind.	1180	254	100
WJAM—D. M. Perham, Cedar Rapids, Ia.	1120	268	100
WJAR—The Outlet Co., Providence, R. I.	980	306	500
WJAS—Pittsburgh Radio Supply House, Pittsburgh, Pa.	1090	275	500
WJAZ—Zenith Radio Corp., Chicago, Ill. (portable)	1120	268	100
WJBC—Hummer Furniture Co., La Salle, Ill.	1280	234	100
WJBD—Ashland Broadcasting Committee, Ashland, Wisc.	1290	233	100
*WJBI—Robert S. Johnson, Red Bank, N. J.	1370	219	250
WJJ—Supreme Lodge L. O. Moose, Mooseheart, Ill.	990	303	500
*WJR and WCX—Jewett Radio and Phonograph Co., and The Detroit Free Press. Pontiac, Mich., (operating jointly)	580	517	1500
WJY—Radio Corporation of America, New York, N. Y.	740	405	1000
WJZ—Radio Corporation of America, New York, N. J.	660	454	1000
*WKAA—H. F. Paar, Cedar Rapids, Iowa	1080	278	500
WKAF—WKAF Broadcasting Co., Milwaukee, Wis.	1150	261	250
WKAQ—Radio Corporation of Porto Rico, San Juan, P. R.	880	341	500
WKAR—Michigan Agric. Col., E. Lansing, Mich.	1050	286	1000
*WKBE—K. and B. Electric Co., Webster, Mass.	1300	231	100
WKBG—C. L. Carrell (portable), Chicago, Ill.	1390	216	100
*WKBK—Shirley Katz, New York, N. Y.	1430	210	500
WKRC—Kodel Radio Corp., Cincinnati, O.	710	422	1000
WKY—E. C. Hull and H. S. Richards, Oklahoma. Okla.	1090	275	100
WLAL—First Christian Church, Tulsa, Okla.	1200	250	150
WLB—University of Minnesota, Minneapolis, Minn.	1080	278	500
WLBL—Wisconsin Dept. of Markets, Stevens Point, Wis.	1080	278	500

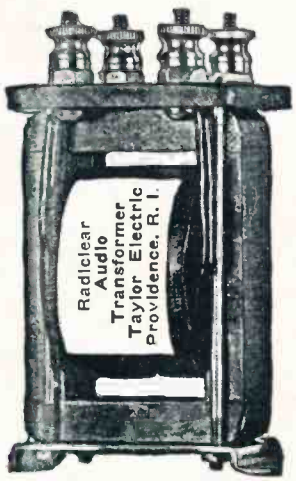
*Additions and corrections.

	K.C.	W.L.	W.P.
WLIT—Lit Bros., Philadelphia, Pa.	760	395	500
WLS—Sears, Roebuck Co., Chicago, Ill.	870	345	500
WLTS—Lane Technical High School, Chicago, Ill.	1160	258	100
WLW—Crosley Radio Corp., Harrison, O.	710	422	5000 / 500
WLWL—Mis. Soc. of St. Paul the Apostle, New York	1040	288	1000
WMAC—Clive B. Meredith, Cazenovia, N. Y.	1090	275	100
WMAF—Round Hills Radio Corp., Dartmouth, Mass.	680	441	1000
WMAF—Round Hills Radio Corp., Dartmouth, Mass.	833	360	100
WMAK—Norton Laboratories, Lockport, N. Y.	1130	466	500
WMAQ—Chicago Daily News, Chicago, Ill.	670	448	500
WMAY—Kingshighway Presbyterian Church, St. Louis, Mo.	1210	248	100
WMAZ—Mercer University, Macon, Ga.	1150	261	500
WMBB—American Bond & Mortgage Co., Chicago, Ill.	1200	250	500
WMBF—Fleetwood Hotel, Miami Beach, Fla.	780	384	500
WMC—Commercial Appeal, Memphis, Tenn.	600	500	500
WMCA—Greeley Square Hotel Co., New York, N. Y.	880	341	500
WNAB—Shepard Stores, Boston, Mass.	1200	250	100
WNAC—Shepard Stores, Boston, Mass.	1070	280	500
WNAD—University of Oklahoma, Norman, Okla.	1180	254	250
WNAP—Wittenberg College, Springfield, Ohio	1210	248	100
WNAT—Lennig Bros. Co., Philadephia, Pa.	1200	250	100
WNAV—People's Tel. & Tel. Co., Knoxville, Tenn.	1290	233	500
WNAX—Dakota Radio Apparatus Co., Yankton, S. Dak.	1230	244	100
*WNOX—People's Tel. & Tel. Co., Knoxville, Tenn.	1120	268	500
WNJ—Radio Shop of Newark, Newark, N. J.	1290	233	100
WNYC—City of New York, New York, N. Y.	570	526	1000
WOAI—Southern Equipment Co., San Antonio, Texas.	760	395	1500
WOAN—James D. Vaughn, Lawrenceburg, Tenn.	1060	283	500
WOAW—Woodmen of the World, Omaha, Nebr.	570	526	1000
WOC—Palmer School of Chiropractic, Davenport, Iowa.	620	484	5000
*WOI—Iowa State College, Ames, Iowa	1110	270	750
*WOK—Neutrowound Radio Mfg. Co., Homewood, Ill.	1380	217	500
WOO—John Wanamaker, Philadelphia, Pa.	590	508	500
WOQ—Unity School of Christianity, Kansas City, Mo.	1080	278	500
WOR—L. Bamberger & Co., Newark, N. J.	740	405	500
WORD—People's Pulpit Association, Batavia, Ill.	1090	275	2000
WOS—Missouri State Marketing Bureau, Jefferson City, Mo.	680	441	500
WOWL—Owl Battery Co., New Orleans, La.	1110	270	100
WOWO—Main Auto Supply Co., Fort Wayne, Ind.	1320	227	500
WPAJ—Doolittle Radio Corporation, New Haven, Conn.	1120	268	100
WPG—Municipality of Atlantic City, Atlantic City, N. J.	1000	300	500
WPSC—Pennsylvania State College, State College, Pa.	1150	261	500
WQAA—Horace A. Beale, Jr., Parkesburg, Pa.	1360	220	500
WQAC—Gish Radio Service, Amarillo, Tex.	1280	234	100
WQAM—Electrical Equipment Co., Miami, Fla.	1120	268	100
WQAN—Scranton Times, Scranton, Pa.	1200	250	100
WQAO—Calvary Baptist Church, New York, N. Y.	833	360	100
WQJ—Calumet Rainbow Broadcasting Co., Chicago, Ill.	670	448	500
WRAF—The Radio Club, Laporte, Ind.	1340	224	100
WRAK—Economy Light Co., Escanaba, Mich.	1170	256	100
WRAM—Lombard College, Galesburg, Ill.	1230	244	100
WRAV—Antioch College, Yellow Springs, Ohio	1140	263	100
WRAX—Flexon's Garage, Gloucester City, N. J.	1120	268	250
WRBC—Immanuel Lutheran Church, Valparaiso, Ind.	1080	278	500
WRC—Radio Corporation of America, Washington, D. C.	640	469	1000
WREO—Reo Motor Car Co., Lansing, Mich.	1050	286	500
WRK—Doron Bros. Electrical Co., Hamilton, O.	1110	270	200
WRM—University of Illinois, Urbana, Ill.	1100	273	500
WRMU—A. H. Grebe & Co., Richmond Hill, N. Y.	1270	236	100
WRNY—Experimenter Publishing Co., New York, N. Y.	1160	258	500
WRR—Dallas Police & Fire Dept., Dallas, Tex.	1150	261	350
WRW—Tarrytown Radio Research Labs., Tarrytown, N. Y.	1100	273	500
WSAC—Clemson Agric. Col., Clemson College, S. C.	890	337	500
WSAI—United States Playing Card Co., Mason, O.	920	326	500
WSAJ—Grove City College, Grove City, Pa.	1310	229	250
WSAN—Allentown Call Publishing Co., Allentown, Pa.	1310	229	100
WSAR—Doughty & Welch Electric Co., Fall River, Mass.	1180	254	100
WSAV—Clifford W. Vick Radio Const. Co., Houston, Tex.	1210	248	100
WSB—Atlanta Journal, Atlanta, Ga.	700	428	500
WSBC—World Battery Co., Chicago, Ill.	1430	210	200
WSBF—Stix, Baer & Fuller, St. Louis, Mo.	1100	273	250
WSDA—The City Temple, New York, N. Y.	1140	263	250
WSKC—World's Star Knitting Co., Bay City Mich.	1150	261	100
WSMB—Saenger A'm'h Co., & Maison Blanche N. O. La.	940	319	500
WSMK—S. M. K. Radio Corp., Dayton, Ohio	1090	275	500
WSOE—School of Eng'rng of Milwaukee, Milwaukee, Wis.	1220	246	500
WSRO—Radio Co., Hamilton, Ohio	620	483	100
WSUI—State University of Iowa, Iowa City, Iowa	620	484	500
WSY—Alabama Polytechnic Institute, Auburn, Ala.	1200	250	500
WTAB—Fall River Daily Herald Pub. Co., Fall R'vr, Mass.	1130	266	100
WTAC—Penn. Traffic Co., Johnstown, Pa.	1430	210	100
WTAM—Willard Storage Battery Co., Cleveland O.	770	389	2500
WTAQ—S. H. Van Gorden & Son, Osseo, Wis.	1180	254	100
WTAR—Reliance Electric Co.. Norfolk, Va.	1150	261	100
WTAS—Charles E. Erbstein, Elgin Ill.	990	302	1500
WTAT—Edison Illum'ting Co., Boston, Mass. (portable).	1230	302	100
WTAW—Agric. & Mech. Col. of Texas, Col. Station, Tex.	1110	270	250
WTHS—Flint Senior High School, Flint, Mich.	1370	219	250
WTIC—Travelers Insurance Co., Hartford, Conn.	860	349	500
WWAD—Wright & Wright, Philadelphia, Pa.	1200	250	100
WWAE—Lawrence J. Crowley, Plainfield, Ill.	1240	242	500
WWAO—Michigan College of Mines, Houghton, Mich.	1140	263	250
*WWGL—Radio Engineering Corp., Richmond Hill, N. Y.	1410	213	500
WWI—Ford Motor Co., Dearborn, Mich.	1130	266	500
WWJ—Detroit News, Detroit, Mich.	850	353	1000
WWL—Loyala University, New Orleans, La.	1090	275	100

Frozen Water Pipes Now

What, you say it is too soon for water pipes to freeze? Although the weather is coming off a lot cooler it does seem a little early for such trouble.

But in your radio set you have something which is similar. The trouble with a frozen pipe is that it does not let the water through. And if you have a poor transformer in your hook-up while it will not prevent the program from reaching your loud speaker, still it will block sweet and natural tones just as if it were frozen.



Perhaps you have no transformer at all and use a single tube set with phone. In that case you have no idea how much more pleasure you will get by adding at least one step of good audio amplification.

Aside from the tube the transformer is practically the whole thing in each step. If you want to get one of these units which gives out music as it was played in the studio, then you need a transformer like the Radiclear. This unit has been designed with one thing in mind—smooth, sweet tones.

It will pay you to send for a RADICLEAR transformer. The price is $3.95. The kit, which sells for $6.00, contains a RADICLEAR transformer, socket, four spring jack, rheostat, amplifier binding post, and the necessary wiring. Use the coupon for ordering.

For a crystal set do not forget that the Audion Crystal in competition with others selling up to $1.00 has showed louder and clearer tones than most of the others in the field.

If you find any crystal at any price giving better results than ours, we are glad to refund you the price,—25c each.

The Taylor Electric Company,
1206 Broad Street,
Providence, R. I.

Please send me the following by parcel post. (Mark which one you want.)

Radiclear Audio Transformer @ $3.95
Amplifier set complete @.....$6.00
(Socket to fit.....tube)
Audion Crystal @ 25c.
Gold Plated Cat Whisker @ 25c.

☐ I enclose $.... to pay for these.
(These above prices include the postage.)

☐ Send them to me C. O. D. I will pay the above price plus postage.
(Indicate which way you wish to pay.)

Name.....

Address.....

TAYLOR ELECTRIC CO.

1206 Broad Street

Providence, R. I.