May 15, 1925
15 Cents a Copy

RADIO PROGRESS

"Always Abreast of the Times"

In This Issue

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

PUBLISHED TWICE A MONTH

RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2 Number 5

Contents for

MAY 15, 1925

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.

Don't Miss the June 1st Issue

Batteries seem to be taboo these days. There are many ways of charging them in place but what seems to be wanted is a method of plugging these sets into your electric light socket. This is discussed in our next issue by Rados, who shows how to build such a set for either direct or alternating current.

When you feel so terribly hot this coming summer you will naturally think of the coolness of the North Pole. And if you want to be able to hear the messages sent up there to MacMillan, you will need a radio which will work on the high-speed 20-meter wave. MacDonald tells how to construct one in **"Build a 20-Meter Wave Receiver."**

Loop sets are going to be popular this summer. There are some precautions which you must take in setting them up. Some queer cases when they would not work and why are explained by Taylor in **"Loops Disturbed by Metal Masses."**

Many people realize that it is expensive to run a radio station. Just what does it cost to equip and operate a studio? Some interesting figures appear in **"What it Costs to Broadcast."**

Probably the best known Impresario in radio is Roxy, and one of the most popular of his gang is Margery Harcom. Gordon has given a description of the career of this songbird, which explains how it was a stroke of chance which started her to fame and fortune.

There are so many different styles of coils on the market that it is hard to choose between them. The place where the good and bad qualities of coil construction are best tested is in the Superhet. Marx gives a construction article showing a particularly efficient form of winding for such a hook-up in **"Double D Coil for Transformers."**

When you close one eye you loose the ability to see how far away objects are from you. Two eyes give the sense of distance. In the same way it is found that natural sounds effect both ears so that you get the sense of direction. This is lacking with phones or loud speaker. Why this is and how it can be overcome is described at length in **"Using Both Ears for Receivers,"** by Arnold.

Biltmore Master Reflex

We wish to announce our

Model V1 Master Reflex Receiver

which we are about to place on the market.

It has taken more than a year of constant improvement on one of the most popular reflex circuits which has ever been designed to develop this receiver.

And we have been well repaid for our efforts. We have completed this six tube machine, a set extreme in sensitiveness and excellent in selectivity.

But most important of all, the receiver is perfect in tone! We will compare it with any standard receiver, and guarantee that it wins the opinion of all who hear, that it has the finest tone of any receiver manufactured.

If your dealer is not yet supplied, we shall gladly fill your order direct, and if you are within a reasonable distance of Boston, we shall be pleased to have the receiver installed and demonstrated in your own home, and to your own satisfaction.

MODEL V1 $115

DEALERS ARE REQUESTED TO WRITE

Please mention RADIO PROGRESS

THE BILTMORE RADIO COMPANY

BOSTON 30 MASS.

The Heart of Your Radio Set

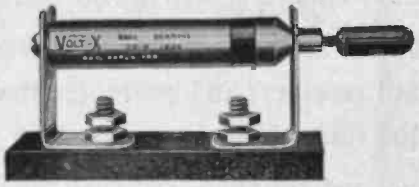
A Grid Leak is essential on every set. There are few sets made which wouldn't be improved by the use of a Variable Grid Leak.

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



Volt-X Ball-Bearing
Variable Grid Leak

Try It

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.

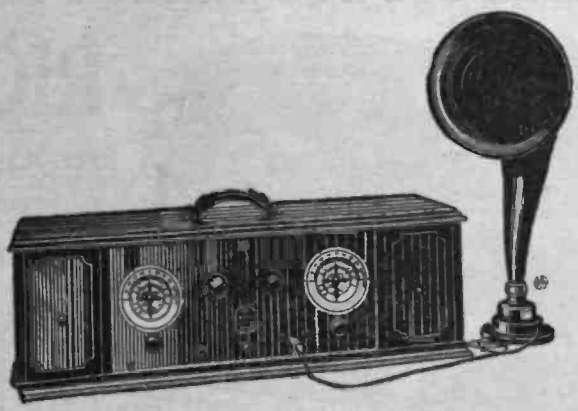
Clip the coupon, and send it in with $1.00—a grid leak will be mailed at once.

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. . . . . .



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.**

The Marvelous 5-Tube Radio Frequency Set

AUTO BALANCED 5-TUBE RADIO FREQUENCY

The combination of "RICO" CELLUWELD Low Loss Coils and Variable Condensers is made mechanically perfect. The Coils are welded firmly to the support of the rotor plates, our own patented principle.

Selective and non-oscillating, the "RICO" "AUTO-BALANCED" TUNED RADIO FREQUENCY SET accomplished by carefully setting the neutralizing angle of the Coils at the factory; remains permanent due to the CELLUWELD process.

The Complete Ricodyne Kit contains everything. The set you can build in 3 hours. Price Complete.....$38.75

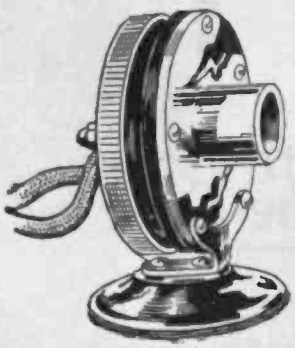
RICO-DYNE

An assurance of perfect performance, faithful tone production and $100 radio receiver value, all for

$60.

Mahogany Cabinet

The Set with a Punch



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.

$2.95

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 SET, $60.
.....MELOTONE UNIT, $7.50.
.....RICOFONES, $2.95.

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:

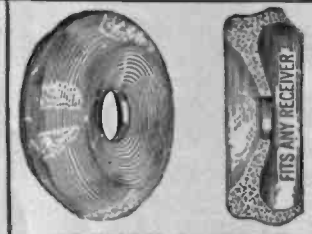
It seems unusual that with the tremendous volume, selectivity and distance-range of the Rico Auto Balanced set, it should be so simple to construct. Yet, nevertheless, this is true. We have letters from fans who tell us that they constructed their Rico set within a few hours. The plans which accompany 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!



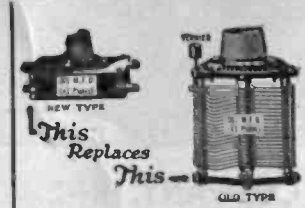
SPONGE RUBBER

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.....

RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. 2, No. 5 MAY 15, 1925 15c PER COPY, $3.00 PER YEAR

Low Loss Wiring in a Set

Some Apparently Good Tests Are Really Very Misleading

By HORACE V. S. TAYLOR

HAVE you a friend with a house like this? The front door is strongly fastened each night with a Yale lock, and in addition a stout bolt. No one could break in short of using a battering ram. But the back door is fastened by an ordinary cheap lock, which almost any five and ten-cent store key will open. The fact that a burglar would naturally be more inclined to work at the back, where he could not be seen from the street, does not seem to worry the householders.

In the same way, many a set builder pays a good deal of perfectly good money for low loss condensers, non-distorting transformers, anti-capacity coils, and the like. Yet when he comes to hook up those very good parts he uses wiring methods which are all wrong. As a result, all the energy which he saved by his extra fine parts is wasted in the wires and a lot more besides.

When Even Engineers Go Wrong

This point of correct wiring is not always as easy as it seems. Many people are apt to make mistakes in laying out a set. And when it comes to testing the circuits, even experienced radio engineers sometimes go wrong. For instance, in a recent number of a popular radio magazine, there appeared an article on "Low Loss," by an eminent radio man, which was incorrect in several important details. And you will remember the old adage, "When doctors disagree, what can poor laymen do?"

The circuit which was used to run the tests is illustrated in Fig. 1. This shows the condenser and wiring being tested. A meter at the left shows the input, while one at the right measures the output. The idea is that the ratio between the reading of the right hand meter and that of the left can be taken as a measure of the efficiency of the condenser.

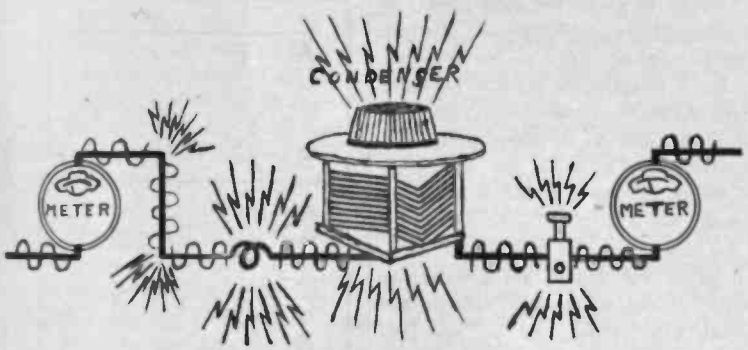


Fig. 1. There is a Mistake in This Hook-up for Westing Wiring

Checking Your Water Meter

This is a mistake at the very first. The two meters are in series, and so will both carry exactly the same current, except for leakage which may occur from the wire between them to the return wire of the circuit, which does not appear in the diagram. No such scheme will measure the efficiency of a condenser. Many amateurs attempt to use this kind of hook-up and are disappointed. Suppose you had a water meter in your cellar, which you suspect is not accurate. To test it out you get the company to install a second meter five feet away and connect it to the same pipe line, so that the water passing through one also operates the other.

What would you say in such a case if one meter read more than the other? If the second read higher than the first, you would know that it was due to a mistake in registration in one or the other unit. If it were the first, however, which had the higher reading, there would be a possibility that some water was leaking out of the pipe which connected the two units. In the absence of such a leak, you know that the same quantity must pass through both and any discrepancy between the two shows that one or both meters must be cheating. Returning to Fig. 1, the same conditions apply. If meter No. 1 shows a higher reading than No. 2, it is due to trouble in one or the other, or else the difference is caused by leakage or capacity current, leaving the wire somewhere between the meters. In either case it is not the fault of the condenser or other unit which it is hoped to test.

Where Neon Comes from

In order to tell whether the wire itself is satisfactory, it is sometimes advocated that you use a neon tube for testing. Such a tube consists of a small sealed glass chamber, about the size of a dance program lead pencil. Inside this tube (which has had all the air removed) is a small amount of neon. This last is one of the rare gases which is mixed in very small proportion with the oxygen and nitrogen of the air. When the latter two gases are removed from the air, then neon and a few other —even rarer gases—remain.

Neon has the peculiar property that it will glow with an orange reddish hue when the tube is brought near to a strongly electrified body. Of course, the glass, which contains the neon, is a good insulator, and indeed no contact has to be made to obtain this glow. The way it works is this. One end of the tube must be in a high voltage part of the electric field surrounding a wire and the other end of the tube in a low voltage part. It is the *difference* in the electrical effect at the two ends of the tube which makes the gas give out light.

Such a tube is the active part of many spark testers for automobile use. The Westinghouse "Spark-C" is one of these devices. It is very useful to tell whether a spark plug in your engine is operating or not. If you suspect that it may be missing, all you have to do is to bring the Spark-C up close to the wire, and if it is getting the proper voltage the glow will be seen through a little window in the handle.

A Test That Will Not Work

Many radio fans believe that such a device will assist them in finding leakages of energy along their wiring. To make such a test, they recommend that voltage be applied to the wiring and condenser, and the neon tube touched at one part or another. The intensity of the glow is supposed to be a measure of the amount of leakage occuring at that point. Unfortunately, such a test is of no value at all.

In the first place, it requires considerable voltage to make the tube glow. It is designated as explained, to operate for testing spark plugs on an automobile. Such plugs work with a pressure of from 5,000 to 10,000 volts, and the Spark-C is built to fit these pressures. Remember that a radio set works on ether waves having a pressure of a few millionths of a volt. To be sure, the "B" battery may run up to 90 volts, but it gives out *direct*, not alternating current. Radio waves are always 100 per cent alternating and as just explained, the value of such pressures is down to a very small fraction of a volt.

Of course it is as foolish to try to measure ether waves with such a neon tube as it would be to try to get the dimensions of a disease germ with a yardstick. In order to make the Spark-C work it is necessary to apply powerful alternating currents to the system under test by a local oscillator. Such voltages would be thousands and probably millions of times as great as what would be obtained in practice. It is not safe to make tests under any such severe conditions and hope to get results which mean anything.

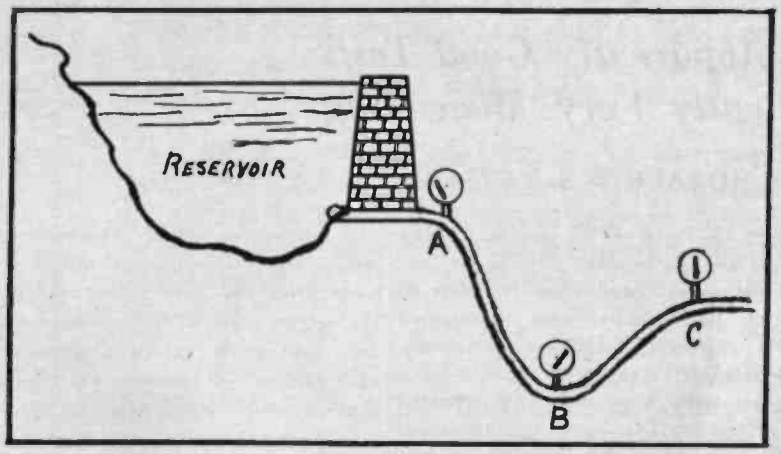


Fig. 2. Pressure on Water Depends on Height; Resistance to Flow Has Nothing to Do with Either.

Fell Off the Woolworth Tower

What would you think of this method of testing a radio set? Suppose we wanted to know which of two different makes was more rugged, and so we pitched them both off the top of the Woolworth Tower down to the pavement below. The conclusion we drew from such a severe experiment would not be worth very much in telling us which one would last longer when given ordinary use in your living room. Yet that is the kind of comparison which is made in testing low voltage equipment at high voltages.

There is a further objection to the conclusions drawn from the tests of Fig. 1. Corners of the wires under these conditions will make the tube glow much brighter than will the straight parts. A loop in the wire, just to the left of the condenser and the binding post at the right, will set up considerable light in the Spark-C. Does this mean that there is energy being wasted at such points? By no means. Remember that, as already noted, the neon glows because of a *difference* in pressure at the two ends of the tube. If such a device were put inside a covered tin pail, which was insulated and then excited to a high potential by a spark coil, you would find that the tube would give out *no light* at all. This would be because all parts of the tube would be at the same pressure. The fact that this happened to be a *high* potential would not cause the light to be given out.

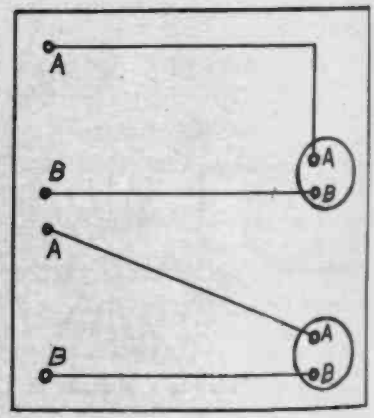


Fig. 3. Parallel Connections Are Not Always to be Avoided

Benjamin Franklin Knew It

With that in mind, we can see that

the change of pressure at corner bends and sharp points in general is more rapid than is the case along the straight part of a wire. However, this is no news, as it has been known since the days of Benjamin Franklin. You will remember reading that Franklin was the first to use lightning rods to protect a building. How did he shape the end? He filed the upper part of the wire as it rose from the house into a sharp point because with a point the change of electric pressure is greatest, and so therefore many electric charges in the clouds will be drawn off quicker by such a shape.

If a radio set used high enough pressures, so that electricity would jump in the form of an electric spark between one conductor or another, then there is no doubt that sharp corners would be bad. In a sending set, where thousands of volts may be used, this is a nature which must be taken care of. Furthermore, if the pressure is run up so high that it is near the condition of an electric breakdown, a glow will be seen in a dark room starting from all the sharp points of the conductors. This action is called, "corona."

Blowing up a Cannon

This phenomenon of corona is well known to electric power companies. The high pressure lines, which stretch across the country for hundreds of miles, will suffer severe power losses unless the transmission wires are arranged so that no corona forms on them. The laws of its action are very well known, as there have been many articles published on this subject in the proceedings of the American Institute of Electrical Engineers. It has been found by test again and again that no losses whatever occur until the pressure is up into the thousands of volts. To claim that the pressures of a radio set might cause losses at the bends, is like fearing to set off a toy Fourth of July cap in a sixteen-inch piece of artillery for fear of bursting the latter.

Another way of looking at the problem of wiring is to compare it with a water system. In Fig. 2, we have a reservoir which holds the water supply for three different towns. The first one is near the bottom of the dam at A. A little farther away in the valley is built town B while C is higher on the other slope. The big water main which runs from the reservoir has branches through the streets of A, then runs on to B, where it again divides, and finally over to C.

Where is Resistance Greatest?

Now let us put pressure gauges on this line in each of the three locations. The one at the left is not much below the surface of the water in the lake and so its pressure, as indicated on the gauge, will be fairly low. In the valley, at B, the gauge will indicate quite a heavy pressure owing to the large height which the lake will have as measured from the bottom of the valley. At C the pressure has fallen off again as its difference in height is not so great as at B. Can we say now that since the pressure at B is the greatest, that the water flowing through the pipe will experience the most resistance?

Of course, such a statement would be very foolish. If we say, owing to the heavy pressure at B, that the pipe is more apt to *burst*, we shall be absolutely right. But when we talk about the resistance to flow of the pipe itself, then that has nothing to do with the pressure. If the diameter of the pipe is small, or it is choked up with sand, or if its inside surface is quite rough, then the resistance of flow will be high.

On the other hand, if it is a large pipe, clean, and with a polished inside surface, the resistance to flow will be low no matter how much or how little pressure the gauge may show.

What Makes Resistance High?

Getting back once more to Fig. 1, if the wire at the bends is small or badly corroded, or made of poor conducting material, like iron, then the resistance at the bends will be great. But if it is large diameter, uncorroded, and is made of copper, then the resistance will be low no matter how much pressure is developed at the bend. Put in another way, the losses through resistance have nothing at all to do with pressure, and so measurements of pressure by a neon tube are absolutely worthless.

When it comes to wiring the set you see directions that high tension wires should not be run parallel to each other. This is often a mistake. Look at Fig. 3. Here we have two wires starting at the left and connecting to a unit at the right, which may be a socket, condenser, coil or any other part of our radio set. Is it better to run AA parallel to BB with two right angle bends, or would it be better to use a shorter wire and run it direct, and not

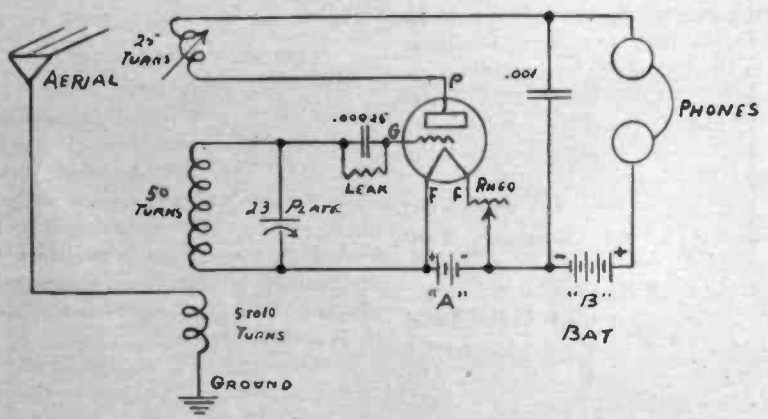


Fig. 4. Notice Capacity of .001 Condenser at Right Adds to That of Wiring

parallel?

Here Parallel Wires are Better

The increase in length of the bent wire over the straight is very small indeed, and if the coil which is connected at AB at the left is wound with say 25 feet of wire, then the extra length will be lost in the shuffle. Furthermore, the average spacing between the straight wire AA and its mate BB is much less in the lower figure than in the upper one. For this reason the leakage capacity in the lower case would be greater than the upper. That is why there would be less tendency to howling with the parallel bent wire than there would with the straight and furthermore the upper wiring would give slightly sharper tuning.

The whole idea of the "Straight-Parallel" advice is that the separation between wires should be as great as possible. When two leads are run close together and parallel, the objection is

Continued on Page 35.

American Radio Relay League

AWAITS ATTACK ON HAWAII

NRRL, the amateur experimental radio station, operated by Lieutenant F. H. Schnell, traffic manager of the American Radio Relay League, with the United States fleet in European waters, has succeeded in piling up some enviable records in the way of constant communication on short wave lengths.

Several stations in the East and some on the Pacific coast have worked with the Lieutenant, while stations that have heard NRRL, run from California to England. British station 5NN picked his message out of the air and relayed the information back to League Headquarters in the United States by radio.

Stations in Rochester, N. Y., Brooklyn, N. Y., and Longmeadow, Mass., were the ones on the Eastern seaboard that successfully conversed with Schnell, while Minneapolis, Long Beach, Cal., Altadena, Cal., and Ellensburg, Wash., also carried out two-way telegraphy with station NRRL.

Reports have been made to the American Radio Relay League headquarters in Hartford by stations at Gadson, Ala.; Baltimore, Attleboro, Mass.; Schuylkil, Pa.; New York City; Red Bank, N. J.; Port Arthur, Ont.; Hilton, N. J.; Mt. Ranier, Md.; Los Angeles and Baker, Ore., that the Lieutenant's messages from the special short wave station were heard and copied by the operators.

The test work has been suspended for a few days to permit the working out of the joint army and navy problem in the defense and attack of Hawaii, but it will be resumed soon.

CELESTIALS SOON TO SEND

The central Chinese government is planning to lift the embargo on radio material and supplies according to correspondence of the American Radio Relay League.

The Peking government Department of the Telegraph is reported at work on the first drafts of the regulations governing conditions of import. Those who advocate the removal of the restrictions point out that in Manchuria there are radio stations in operation at Mukden, Changchun, Harbin, Tungkiang, Marchuli, Yinkow and Hulatao. Others are now in course of construction, while plans for still other stations are being considered.

The American Radio Relay League correspondent points out that all of these stations are used for official purposes only, but it is the hope of radio enthusiasts in the Chinese republic that they may be opened to commercial and other uses in the near future. Mukden, the most powerful of the group, is in regular communication with the Philippines and Honolulu.

CURING YOUR TROUBLES

Vigilance committees, designed to reduce interference in radio communication, have been formed by the traffic department of the American Radio Relay League and are already at work in a number of communities in the United States. These committees are designed to promote local co-operation between broadcast listeners and amateur radio enthusiasts.

These committees usually consist of three transmitting amateurs, who are members of the League, a prominent local broadcast listener, and a representative of the press.

According to QST, official organ of the League, these organizations will solicit interference reports from the public, will endeavor to identify the causes of interferences experienced and cure them, and, when the causes are beyond their control, explain to the aggrieved parties what they are.

The committees will also be able to exercise the necessary influence upon violators of law or flagrant interference, should any be encountered.

TAKES THE HOOVER CUP

The highest honor in amateur radio, the 1924 Hoover Cup, has been awarded to a Californio radio man, B. Molinari of 653 Union Street, San Francisco. This was announced recently by the American Radio Relay League committee. The cup is given annually by Secretary Hoover to the operator of the best amateur radio station in the United States in which the bulk of the apparatus is the handiwork of the operator himself. The 1924 cup is the latest of the Department of Commerce trophies now authorized.

The station to which the award is made, 6AWT, has been unusually efficient in communication with foreign countries; its signals have been reported by amateurs in Asia, Australasia, South Sea Islands, Europe, Africa, South America, Central America, and Danish America. 6AWT was one of seven stations selected by the A. R. R. L., to transmit press reports to Captain Donald B. MacMillan in the Arctic. In addition to this country and Canada, the station has been in two-way communication with New Zealand, Australia, Asia and other countries.

The station uses for the transmitter one 250 watt tube. The receiver is of the conventional low loss type, the tuning of which is accomplished by a glass insulated condenser across the low loss secondary coil. The antenna is 150 feet long and 80 feet high at the free end. The counterpoise is a nine wire fan-shaped affair 40 feet in length.

SCHNELL CHATS 5,000 MILES WITH JUDKINS

The continent and half of the Pacific Ocean were spanned last week by amateur radio operators. Lieutenant F. H. Schnell, Traffic Manager of the American Radio Relay League, who is in charge of the special amateur short wave transmitting station, NRRL, with the United States grand fleet in Pacific waters, succeeded in talking with Neal Judkins of East Providence, R. I. According to one of the messages received by Judkins, the fleet is in the Pacific, 2,000 miles off San Francisco.

Aside from the test conversations passing between the two operators, Lieut. Schnell transmitted the congratulatory message from Admiral Koontz, commander in chief of the United States Fleet, to Hiram P. Maxim of Hartford, Connecticut, President of the American Radio Relay League, in which the naval officer sent his best wishes.

To North Pole in a Hurry

High Speed Waves to Cross the Frozen Arctic Circle

An Interview from R. H. G. MATHEWS, Chief Engineer, Zenith Radio Corp.

WHAT'S new this morning in radio? That is what many fans are asking. And when you look back over the last six or eight months, you do not notice any very startling developments in the way of receiving apparatus. Of course, there is a detail here and there, which has been touched up, but most broadcast listeners would have difficulty putting their fingers on any special improvement.

When it comes to the sending end there is a difference. The thing that is taking the first place just now is the experimental work being done with high frequency (short wave) transmitting. The developments along these lines are coming thick and fast.

Sending Somewhat Neglected

Although a lusty youngster, the science of radio communication is still an infant. Experimenters are constantly devising ways of increasing the range and improving the quality of the music which our sets pick up. This is especially true where transmitters are concerned, as a great deal of the engineering effort during the past several years has been spent largely in developing the receiving apparatus, to the exclusion of the sending end.

It has usually been thought that long distances should be covered by long wave lengths; that is, slow oscillation speeds. It is not at all extraordinary to use frequencies as low as 30 kilocycles per second (10,000 meters) for talking across the Atlantic. Higher oscillation speeds have been found to be somewhat unsuitable on account of greater absorption.

A somewhat similar idea is found along the line of sound. High notes of a violin or flute will carry well across a concert hall, but did you ever hear such notes over a distance of half a mile or so? Take the case of a fife and drum corps. Near by the fifes are heard as loud as the drums, but as the procession marches away into the distance, you will often notice that the boom, boom, boom of the drums is heard long after the squeak of the higher pitched instruments. Of course, the reason is that the drum gives a low speed vibration in the air, while the oscillations of the air particles which are caused by the fife, are very rapid.

Hearing an Explosion

Still, another illustration is the distance which a large explosion can be heard. It is the deep bass notes of the explosion which travel for miles, while

Fig. 1. Here Are the Men Who Developed the Set for High Speed Waves

any higher notes, which may have occurred are soon lost.

However, it is found that a change of the laws of radio waves occurs when the frequency is high enough. When the vibration speed reaches as high as 15,000,000 oscillations per second, (15,000 kc.), which is the equivalent of a twenty meter wave, the loss of energy from the waves being absorbed by water, vapor, trees, the ground, etc., is more than over-balanced by the penetrating quality which it is now found by test carries the signals to greater distance.

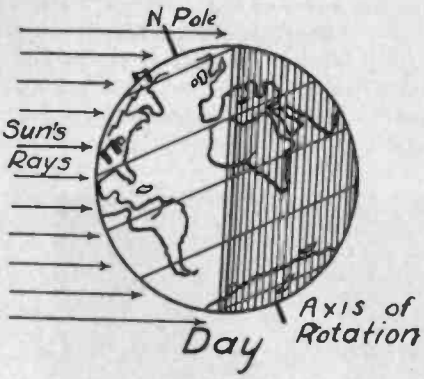


Fig. 2. This is the World with United States in Daylight

The exact laws for these fast oscillations have not yet been entirely worked out. That is one reason why further tests are so fascinating.

As Far by Day as by Night

The discovery of the possibilities of the new 15,000 and 7,500 kc. (20 and 40 meter) wave bands and the tremendous distances that can be covered by comparatively low powers on these fast vibrations has opened up a new field for experimental development. The 15,000 kc. (20 meter) band is especially interesting as it has apparently conquered the falling off in the range of transmitters in the daytime as compared with their normal night time distance.

In designing and building the equipment to be supplied to Dr. Donald B. MacMillan on his next Arctic Expedition sailing in June, the engineers of the Zenith Radio Laboratory of Chicago cooperated with the well known high speed wave radio expert, John L. Reinartz.

Fig. 1 shows the three men who are responsible for the design of the new equipment. At the left is H. C. Forbes, then Lieut. John Reinartz, with Dr. Kard E. Hassel, at the right. The designers have been forced to consider the daylight conditions under which communication must be maintained between the MacMillan Expedition and civilization, due to the fact that Dr. MacMillan will be in 24 hours of daylight during almost his entire stay in the north.

See in Looking Glass

It must be recalled that the range of any sending set is usually several times as great at night as it is by day. The underlying reason for this is the action of the sun's rays on the reflecting layer up in the clouds. Did you ever let a mirror stand for some time in the direct sunshine? Of course, if it is a well built one it probably will not be much injured. But a cheap looking glass is apt to be affected by the direct exposure to the sun and if you look at yourself in such a mirror you will find that the image is not very clear but is somewhat distorted.

The sun does the same thing to the mirror for radio waves which are located some fifty miles above the earth. Such a reflecting surface is found in the air of the right amount of vacuum which acts in such a way as to prevent the radio signals from traveling off into space toward the stars but instead bends the rays down again so as to keep them on the earth. When the sun shines directly into this layer it causes the same general results as you found in your looking glass.

Radio at North Pole

It might be well at this point to explain just why daylight conditions bother radio for 24 hours at a stretch when the receiving set is up near the pole. Of course, this is a matter of astronomy, but let us take a few minutes to get it well in mind. Fig. 2 shows the globe of the world with the sun's rays striking upon it. Of course, where the sun shine touches the surface it is day, while the part in shadow (to the right) is experiencing night. A sending station in the center of the east coast of the U. S. is shown transmitting radio waves, which naturally go in all directions. One of the waves, which is traveling north is illustrated as it is about to reach the receiving aerial of the Arctic party. It is in daylight, too, and of course, daytime conditions will be experienced.

One of the most peculiar facts about the rotation of the earth is that the North and South Pole line (about which the earth spins once in twenty-four hours) is not at right angles to the sun's direction. This is perhaps fortunate for all of us because if it were just at right angles then we should have no seasons of the year at all. While most of us (except the coal men) could do without the winter, still we should not have the spring and summer to cheer us up. Everything would go on a dead level with the same run of temperature day after day forever.

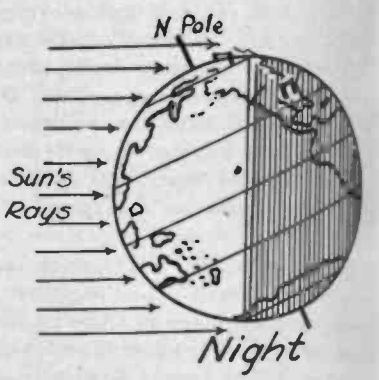


Fig. 3. Twelve Hours Later, U. S. A. is in Darkness, but Day Still Envelops the Pole

Why it is Summer

The difference between summer and winter, as shown in our diagram, is this. Notice that the North Pole is tipped *toward* the sun. In wintertime it is tipped away from the sun, and the South Pole, of course, in that case is towards it. Since we live in the northern half of the world, when the North Pole is pointed partly to the sun, we get the benefit of the more direct rays and that is why we have summertime. Naturally, when we are having summer, South America will be pointed away from the sun and so will be experiencing winter.

It is easy to see that during the day MacMillan will have the sun shining on his aerial. The question is, why does it still bother his radio when it is night? A glance at Fig. 3 will show this better. The sun is still at the same place in space that it was twelve hours before. The earth has turned around on its axis so that it is just opposite or 180 degrees away from its position in Fig. 2. Notice that the sending aerial in the United States is now at the extreme right in-

Continued on Page 26

A Brand New Type of Speaker

Why the Music is so Sweet from a Musicone

By VANCE

WHAT is the best loud speaker on the market? There are so many to choose from and each one of them excels all the others—the manufacturers admit it.

We can not say which one is the best all things considered, but here is a style that is new and is also found to give very fine performance. Its principle is easy to grasp and is quite instructive in showing some of the laws of electricity.

To begin with you are probably familiar with the way an ordinary horn works. It is just like a head phone in general operation with the addition of a long horn which helps the sound to be delivered into the room. The mechanism of the speaking unit itself is shown by Fig. 1, which represents an ordinary style of head phone. Notice that the construction is similar to what you will find in an ordinary Bell telephone as used on wire lines. The latter unit employs magnets, which are long and narrow, whereas the radio receiver uses magnets which are curled up into the shape of a circle.

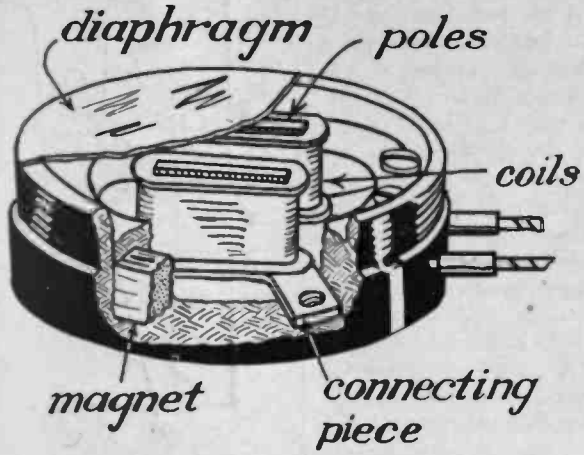


Fig. 1. This is Ordinary Phone. Same Principle Used in Most Speakers

Steel Would Not Do

The magnetism from this circular magnet is made to pass through two pole pieces and then across to the diaphragm. This diaphragm is a thin metal plate, which is made of soft iron. It would not do to make this of hard steel because in that case it would hold the same amount of magnetism all the time and so would not vary its pull very much. Soft iron, however, can respond very rapidly to changes in magnetic force and so by varying the amount of flux, which it carries, changes the pull in the same way.

So far, then, we have a magnetic circuit in which the so-called "lines of force" (which merely means the effect giving a pull) leave the North pole of the permanent magnet ring, go up through one pole piece, across the small air gap to the iron diaphragm, then down through the other air gap and pole piece and so back to the magnet. Wound on each of the pole pieces is a coil, which contains a large number of turns of wire. Owing to the many turns it is necessary that this wire be of small diameter, so that it will fit into the required space.

When the Disc Snaps Back

The way the device operates is this—when no program comes in the magnetism is constant and so there is no vibration. However, when a vibrating current is passed through the coil it affects the magnetism like this. When the current flows in such a direction as to increase the strength of the permanent magnet, then of course the disc is attracted considerably harder than before and so it moves over towards the pole pieces. When this current dies away again the extra pull is lost and the iron disc will snap again to its original position. If the current is now reversed so that its action is to weaken still further the magnetic effect of the fixed magnets, then of course the diaphragm will spring away still farther. This action is repeated as long as variations in electric current come into the phone unit.

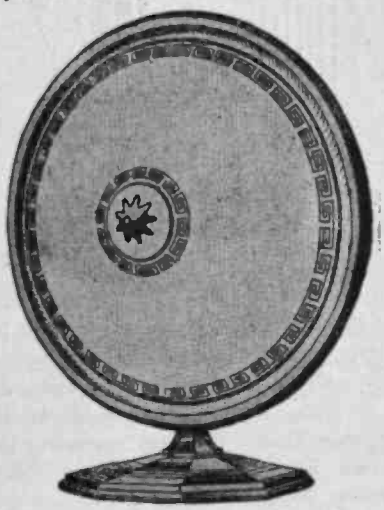


Fig. 2. The Musicone—a New Type

In the ordinary loud speaker it is customary to have some kind of a horn which tapers from the large bell to a diameter just the size of the opening in the cover of the phone. By means of this horn the sound waves, which are set in motion by the vibrating dia-

phragm come out through the hole in the cover and then as they travel onwards through the horn they are increased in size corresponding to the increase in diameter of the horn. When these vibrations finally go through the outside end

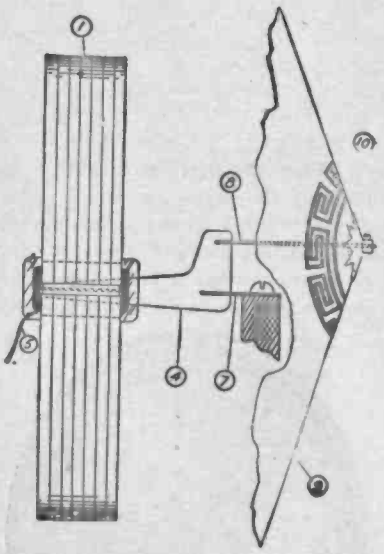


Fig. 3. How it Looks with Cover Removed

of the speaker they are thrown into the room with considerable volume.

Parchment Instead of Horn

The Musicone, which is made by the Crosley Radio Company, uses an entirely different construction. Fig. 2 shows its general appearance. Notice that there is no horn at all, but instead a cone or funnel shaped piece of parchment takes it place. On the outside of this cone, right in the center, is a reinforcing star, which shows up very clearly in the figure. It is the vibration of this cone, rather than a diaphragm, which gives out the music.

The inside of the device is also very different from the conventional speaker. Fig. 3, gives an idea of how this works. The cone, which we have already spoken of, is numbered 9. The reinforcing star of metal, with a set screw at its end, is numbered 10. The rod, No. 8, is held by the set screw, which has just been described, and so gives the cone the back and forth motion which it has.

Prying Up Stone with Bar

In order to get lots of pressure it is well to use a lever as you know if you have ever worked a crowbar. In this case, lever No. 4, gives the same kind of action. The left hand end of No. 4, is vibrated up and down by the armature and it works about spring No. 7 as a fulcrum, or pivot. Notice how long the left hand end is compared with the height from No. 7 to No. 8. It is this difference in length, which gives the advantage of the lever, just as you get it in prying up a big stone with a bar.

You may wonder why spring No. 7 is used as a pivot instead of regular bearings. The trouble with the latter is that they are apt to become loose and will certainly wear, whereas a flat spring like No. 7, has no wear at all and never loosens up. That prevents any rattle or chatter from ever developing at such a point. We now have a complete system so that if the left hand end of Fig. 4 is shaken up and down it will pull bar No. 8 back and forth and so vibrate the cone in the same way.

Seven E's Make Magnet

Now let us see what makes the end of lever No. 4 oscillate up and down. To get the idea refer to Fig. 4. This shows the system of magnets and coils The first thing you will notice is the upper and lower magnet punchings numbered 1. These are each shaped like capital letter E. They are magnetised so that the center pole is north and the two outside legs south in the upper half. The lower half has the magnetism just the reverse of this. Seven of these punchings are assembled together to make each half of the magnet.

The reason why a permanet magnet is much more efficient when it is composed of a large number of thin strips rather than one solid piece is this: When magnetising a piece of steel, it is found that the magnetic effect penetrates only a comparatively small distance into the mass of the metal. Like beauty, it is only skin deep. By dividing up the strip into six or eight thin pieces, the magnetic action will saturate each of these sub-divisions, and then when they are assembled together by rivets or screws the whole mass will be magnetic.

Rubber Pads Stop Flopping

Stretched lengthwise across this gap is the armature No. 2, which runs from the left hand end of the gap across the center, as far as the right hand end. A "U" shaped piece of soft rubber No. 6 makes a pad to support each end of the armature in the gap between the two magnets. These rubber pads fit tight in the air gap and so prevent the ends of the armature from flopping up and down. The center air gap has no rubber pad in it and so at this point the armature is free to vibrate.

This armature consists of a thin piece of springy or elastic sheet iron. The center may be sprung up and down through quite a distance without making it take a permanent bend. Even though its ends are held by the pads No. 6, the fact that the latter are of soft rubber allows enough play so that the center of the armature may vibrate without being jammed at the ends.

The Coils Buck Each Other

The coils through which the current from the radio set runs, are shown as No. 3. These are in series and the wire which connects them appears just under the "N" in the upper middle of the magnet. These coils take the place of the coils shown in Fig 1 of the ordinary ear phone. There is one difference, however—instead of aiding each other, as is customary, their windings are so arranged that they oppose one another

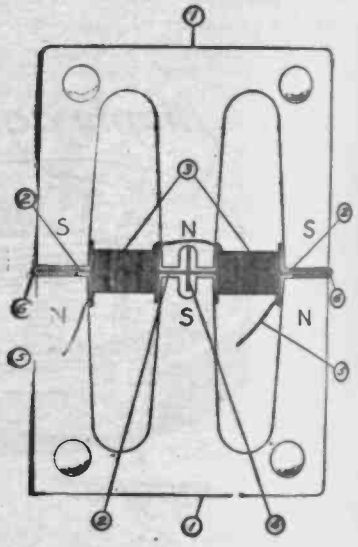


Fig. 4. Magnet and Coil System for Vibrations

with the result that when a current flows through them one sends the magnetism to the left and the other to the right.

As a result when the direction of the current flow is such that the magnetic

lines of force act towards the center, then the middle of the armature is a North pole, while when the current is reversed, each coil makes the middle a South pole. You will recall that opposite poles attract, while like poles repel. When the center of the armature is made North, as just described, it will be repelled *down* by the upper North half of the permanent magnet No. 1, and attracted *down* by the lower South half.

Two Poles Show Team Work

Notice that both these actions are in the same direction—that is, down. An instant later when the current through the coils has reversed and made a South Pole in the center, then the North Pole will attract it up while the South Pole will repel it up and again the two will give good team work to *raise* the armature. In this way an alternating current in the coils No. 3, makes the center of the armature vibrate up and down with a motion corresponding to the fluctuations of the current.

The center of the armature is fastened to the end of lever No. 4, which was seen in Fig. 3. You can easily see now where the action comes from, which was described as affecting the cone. To review it for an instant—the current pulsations coming from the radio set and passing through the coils, give a fluctuating magnetic effect in the center of the armature. The permanent magnet converts this magnetic action into mechanical motion, and so makes the armature oscillate in time with the current. This oscillation is picked up by the lever, which passes it along through the connection rod, No. 8, to the center of the cone. This is shown well in Fig 5.

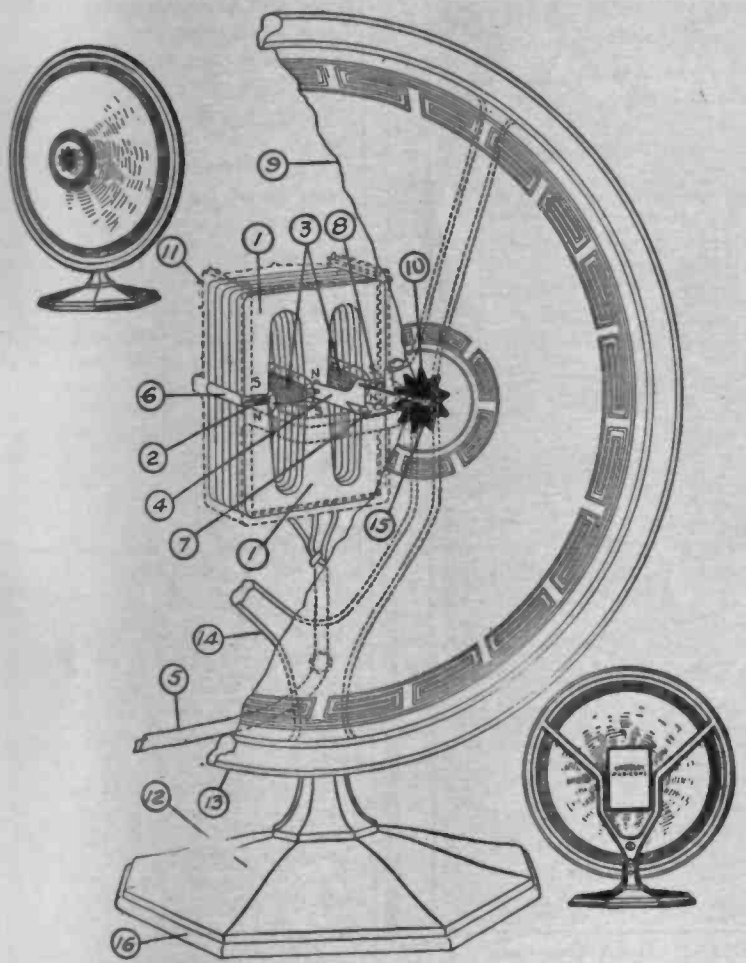


Fig. 5. This Shows How Parts Are Assembled. Rear View in Lower Corner

Cone Beats Flat Disc

You may wonder why a shape like a funnel or cone, is used for diaphragm instead of a flat disk. The reason is explained in Fig 6. A disk of this size when the center is pulled suddenly to the left would be apt to take up a motion like that shown by the dotted lines.

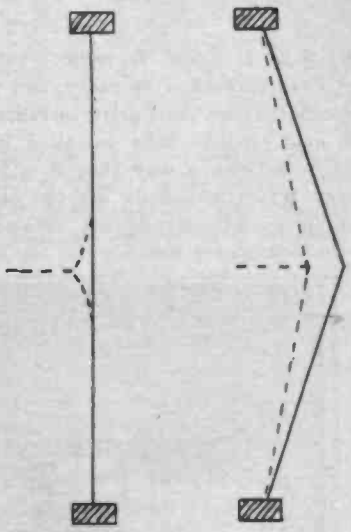


Fig. 6. Why Diaphragm is Not Flat

Here the center moves as the rod pulls it, but owing to the springiness of the piece of parchment the rest of the diaphragm does not move very much. This would prevent the music given out from being very loud. However, by having the diaphragm in the shape of a cone you can see that whole surface will have to yield more or less when the center is suddenly shifted. In this way the entire piece of parchment is made to set the air into vibrations corresponding to those of the electric current which was fed to the speaker from the radio set.

Some of the advantages of this type of construction are the lightness and small size of the device and its pleasing appearance. There is also very much less directional effect than with a horn, since the sound may be heard about equally well in all directions.

Now We Have the Radi-Car

Here is a Novel Combination of Radio and Automobile

WE have danced to radio, sung to radio, worked to radio, and now it seems that we shall drive to radio.

A new set has been installed in a machine in such a way that it is hard to say which was built for the other. The dials and controls are assembled on the instrument board while the loud speaker warbles sweet melodies from just above the windshield.

Fig. 1. Dials Are on Instrument Board. Horn Overhead

This is the installation (Fig. 1) which Joseph D. R. Freed, noted radio engineer, has provided for his automobile, and which is enticing the envy of his friends. His car carries in this manner the five-tube neutrodyne set manufactured by the company of which he is president.

No Battery to be Charged

Alongside the rear seat is a phone plug for attaching a head set, as is also provided for the front seat. The tubes are lighted from a filament switch, which is operated by the insertion of a plug carried on the key ring, so that there is no chance the tubes will be kept burning when the set is not in use. The power is furnished by the regular battery carried for lighting and starting the car, so that the battery is always charged by the generator, thus doing away with one of the troubles of the home radio fan.

Automobiles heretofore have carried radio equipment, but the installation has usually been unsightly and generally not very satisfactory. Wires have been put over the roof or on poles, destroying the beauty of the car. Never before has a set actually been made part of the car, as in this case. The antenna consists of sixty feet of wire, hidden underneath the roof of the car and covered by cloth or plush. It is absolutely invisible. The "B" battery is carried under the seat.

Texas on Loud Speaker

Mr. Freed has made several trips to investigate receiving conditions in all parts of the New York metropolitan district. Eighty stations were picked up the first three nights. These stations included PWX, Havana, Cuba; CNRO, Ottawa, Canada; as far west as WOAW, Omaha, and an impressive list of others, such as WSAI, WLW, WGN, WEBH, KYW, WSB, even WFAA—down in Dallas—all on loud speaker.

In the crowded districts of Manhattan and in the zones of tall steel apartment houses, there was noticeable fading in reception, but in public squares and in the parks the volume and tone were superior to ordinary home reception. Stations were tuned in as the car sped along and while it was parked in a location, such as on Riverside Drive, where receiving conditions were particularly good.

Listen to Opera in Spain

"In the near future as we travel along on trains, steamships and in automobiles, we shall be able to keep in touch with the affairs of the world, through super-power broadcasting," declares Mr. Freed. "International broadcasting, bringing us the voices of the great in statesmanship, the arts and sciences, is just a step away. Speeding along on a country lane, some evening, we may listen to the Premier of France or hear a song from the Opera in Madrid, as well as hear a singer in New York and a violinist in Los Angeles."

How Radio Inspectors Catch Trouble

Do You Help the Radio Bureau Locate Wireless Invaders?

By FELIX J. KOCH, Cincinnati, Ohio

DAH-de-dah-dah, comes the code cutting through the strains of your favorite soprano. Are you at all pleased? ****!!!?? (your unprintable answer.) Well, what are you doing about it to cut down this interference?

With the tremendous increase in amateur as well as professional broadcasting stations the wide world around about, governments everywhere have been forced to step in and see to it that each type of listener is granted its proper rights. Of course this means that the sending stations must be supervised to make sure that over-enthusiastic, or not extra-well equipped stations, shall not manage, somehow, to exceed their proper bounds and interfere with the rest.

Don't Know They Are Guilty

The matter of "amateur interference" (as it is now called officially) has, in fact, grown to be so serious a problem, that all over the United States countless amateur radio leagues and individual amateurs have volunteered to help the Government locate the offenders. Usually it is found that the people who are causing the trouble are entirely unaware of it.

Sometimes this results from the fact that an amateur thinks he is sending a pure wave at say 1,500 kc. (200 meters) as shown in Fig. 1A, when in reality his equipment is doing some broadcasting of its own at an entirely different speed of vibration. Notice that in Fig. 1B there is a pronounced ripple on top of the waves he is sending. In this diagram the extra wave happens to be going at a higher vibration speed than the one he is actually using. Such a wave in general has too high a frequency to interfere with broadcast listeners. However, if the same action occurs with a slower period of oscillation it may easily disturb the concerts from the big sending stations.

Motors Send a Ripple

Another class of people sending out interfering waves are the operators of some electrical machinery like motors and generators. The commutator of such direct current machines often causes a hum known as a "commutator ripple" and a big central station with powerful machines may disturb a whole section of a city. Such interference when known can be greatly reduced in volume. The problem is to find out where such a disturbance starts.

As pointed out by Mr. Elmer Schubert, of the Union Central Association of Cincinnati, the ideal way for a radio club to help out radio generally along these lines is to follow somewhat the plans Uncle Sam himself has made for Radio Headquarters at the Federal Building in Detroit,—the seat for the Eighth Radio District. At headquarters, or within easy reach by telephone from it, there is kept always ready for instant service a strong and speedy truck. Clubs might secure the use of such a truck from some local concern, for the advertisement given.

Rubber For Bad Roads

On this truck there is mounted a receiving set with a loop-antenna. Any good set will do which is designed with enough radio frequency amplification so that it will work from a loop. At least two steps will be required. However, sets like the neutrodyne, which are designed to use an outside aerial are not so satisfactory when this is omitted, even though they do have two tubes of RF amplification. Of course a radio like a superhetrodyne, which is intended especially for loop reception, makes an ideal instrument for such service. Special care must be taken that all parts be cushioned in order to reduce the result of jarring on bad roads. No one knows where the quest for trouble will lead, and it sometimes happens that the worst offenders are located in rather inaccessible places. Tubes should be set on rubber paddings or the like, and a rubber sling arrangement may be adjusted for further safety.

In addition to the set of course a good "A" battery and "B" battery will be needed. Oftentimes the storage battery of the automobile will serve very nicely as the unit to operate the filament. For this purpose a plug may be connected to the "A" plus and "A" minus terminals. When this is inserted in a convenient headlight or trouble light socket, then the rheostats may be turned and the tubes will light up. The loop aerial also must be mounted on the truck in such a way that it can be rotated so as to point in any direction.

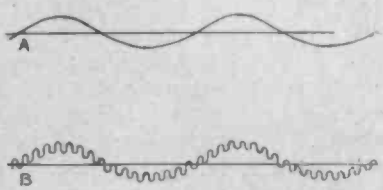


Fig. 1. A Sharp Tuned and a Broad Tuned Wave

They Want to Hear of Trouble

A truck driver and a set operator are needed on the truck. The average Federal district is rather too large for these men and the truck to go cruising around as the fancy takes them, hunting only for such cases of interference as they may, by chance, run into. Instead, they let it be known that folks listening in and having any trouble of the sort may communicate with the station at once, and that they will then look up the difficulty.

Suppose now that last night you were picking up WGY and in the middle of one of their plays you began to get a lot of interference. If this was the fault of your set, buy a new one. But let us further suppose that your radio is a

good one and that the interference was coming in at the same wave speed as the sending station. What could you do? Nothing but grin and bear it for the rest of the evening. But this morning let us say that you called up the inspector's office and told them all about it.

Working in Day Time

Right away they sent out their truck. Of course, if it is code which has bothered you they will need to wait until evening when the same trouble will probably be repeated. On the other hand if the disturbance originates in some piece of electric machinery, like a motor, it is quite likely it will be heard during the daytime and so the hunt may be started in the morning.

The truck comes up to your door and is halted at the side of the street. Then the receiving-set is put into action; and the operator proceeds to turn the loop, —this way, that way; back and forth, as sounds grow louder, dimmer (quite as one might graduate an opera-glass to secure the right focus), until the loop is in such a position that sounds come in plainest of all.

Experts at this work of getting the "flare" of the loop squarely in the direction of the interference are seldom so long as five minutes in detecting exactly from what direction the trouble comes. The disturbance is known in such a case to be arriving from the direction in which the edge of the coil points. The axis will then be at right angles to this line. Some operators prefer to use the softest or zero indication in the phones, instead of the loudest. The reason for this preference is that the position of *no* noise is usually considerably sharper than the position of loudest noise. When the coil has been turned so that the signal has dropped to zero, the axis of the coil points towards the source of the sound. Of course, either of these two methods will give the same line of direction.

Perhaps Across a Bog

But even after making certain of this direction, it isn't quite so easy to reach the point of trouble. The radio wave will have reached the investigator on a path straight as an arrow's; but this path may have cut through sky-scrapers, city blocks, hills, nasty bogs or forests, —and the truck must go squarely 'round.

Always, in such a case, having circumscribed the seat of the obstacle, the operator stops to adjust the antenna and make certain of his trail. Like the mariner on the high seas at the compass, he knows he is taking the proper general direction, but it is better to be safe, by glancing at the needle again and still again. A sensitive loop will guide the men unerringly in their quest, if they will only stop occasionally on their way to graduate its direction to be certain.

By and by the investigators *do* reach the source of trouble. But it is not so easy to find the exact spot as it might seem. The trouble is that a loop set, as already mentioned, picks out the *line* of the sending station but does not tell

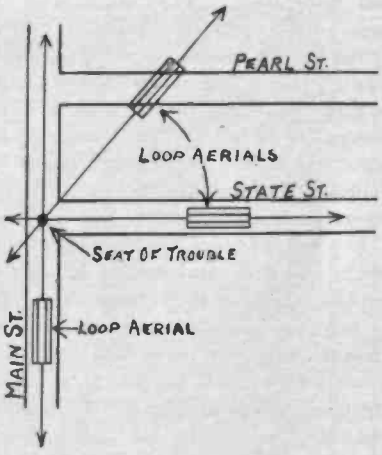


Fig 2. The Coil is Used on Different Streets to Locate Trouble

from which of the two directions the waves come. For instance, the loop will tell you that Station CNRO lies in a north and south direction. As you known it is a Canadian station, it must be to the North, but unless you happen to realize that, you might easily think it lay due South.

Trouble on Main Street

When an offending sending set goes on the air, it can easily be found with the loop that it lies perhaps northeast or else southwest. But which of these is correct? The only way you can tell is by using the scheme illustrated in Fig. 2. Assume that we live on Main Street, which runs north and south. In the evening, there is a large amount of humming heard, which seems to suggest that the heavy load on a transformer is perhaps causing a large amount of leakage and is responsible for the noise. A loop test shows that the line is north and south. Let us draw on our map a long arrow through the coil in the position in which it is loudest.

If we had used the *zero* method of sound as just described, the coil would have pointed east and west when the humming disappeared and so we should have drawn a line at right angles to that, which would again be North and South. That is, either method gives the same results.

A Leaky Insulator is Found

Of course we cannot tell from this one reading whether we must go up or down to find the source of the trouble. So we now go off on a cross street some distance to the right. A measurement will next be taken on Pearl Street. Here we find that the disturbance comes from a line running northeast and southwest. By drawing this line on the map, the two intersect at the junction of Main and State. To make doubly sure of this, testing apparatus is taken to a position on State Street as shown. Sure enough at this point the disturbance is east and west. By drawing in this line it also intersects at the same spot and by proceeding to that point a leaky insulator is discovered.

The test is not always quite as easy as described for the reason that the disturbance from such a source travels along the electric wires which act as broadcasting aerials over quite a length. That is why a loop will often be somewhat undecided in its indications. When the source of the trouble is spread out over two or three blocks, you can readily believe that at no point in its rotation would the loop give a *zero* signal and the maximum would not be at all sharp. When such a condition arises the radio operator has to use his ability as a detective to catch the trouble.

A Little Detective Work

Often just a few queries through the neighborhood serve to help the officials locate the exact house in question. A city the size of Cincinnati—which may be taken as typical of the larger American communities—has three really large broadcasting stations, and then a hundred and fifty smaller, or "amateur" ones. Large as this number may be, such is the interest in radio to-day that folks of every neighborhood very generally can tell at once who it is that is broadcasting nearby.

In order to conduct even an amateur broadcast-station, the Government re-

quires that the operator take a pledge against practical joking, and things of that sort, "on the air,"—and rarely, indeed, is that pledge broken! He is also forbidden to send any false messages or matter which would be objectionable to anyone who might be listening. Messages of a private nature, which he happens to pick up, must not be revealed. Often the investigators discover that the interference results from extra enthusiastic amateurs getting out of the wavelength assigned them. This may be caused either by improper setting of the coil or condenser with which tuning is done, or perhaps from the effort to get more out of a sending station than the equipment is designed for.

As you are well aware, when you hitch up a single horse to a two horse load and force him to drag it, you cannot expect very good results, and the same thing applies in broadcasting. One of the effects of such overloading is that the wave sent out departs from the smooth oscillation already shown in Fig. 1A, and becomes like B. Or perhaps, the seat of the interference is a particularly poor receiving set or else a thoughtless operator who jams on all the regeneration he can. Either of these cases will result in listeners-in getting much the same effect one does when two ordinary telephone wires cross,—or, in the slang of the profession, a "mush."

Fans Are Very Glad

Almost always, when discovered, the owners of the set will confess and promise very solemnly to be good and never, never offend again. Radio-fans are one big fraternity, and, reaching an offender of the second group, investigators sit down to show him exactly *how* to perfect that set, then and there. The owner is delighted, gives every assistance in his power, often scurries out instantly for parts or supplies, and when, finally, the radio-patrol folk depart, they leave behind a perfected broadcasting-station and delighted owner.

Amateur interference isn't the work of a practical joker at all, as so many persons suppose. It is the result of over-enthusiasm, or of poorly-constructed sets. Curb the first—gently, but very firmly; show the way of overcoming the latter, and, far from earning the ill-will of any one you have located, investigated, or caused to be investigated by the radio-clubs or the Government, you've made a friend of him, through thick and thin, to the end.

What the Six Meters Do

Some of the equipment which may be used on a truck to trace out the source of trouble is shown in Fig. 3. There is much more here than absolutely needed for a portable set, however. The apparatus installed on top of the desk at the right is a complete sending equipment. The six meters measure current in the antenna, ground, counterpoise, and plate.

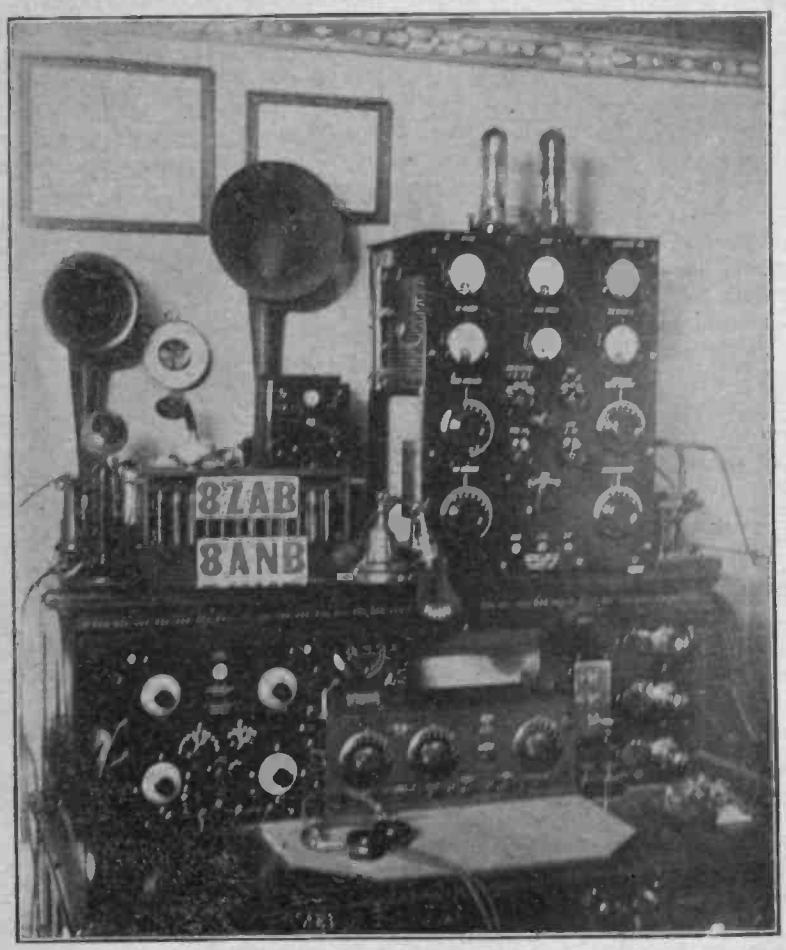


Fig. 3. Apparatus Like This is Carried on Truck and Will Find Where Noises Start

The voltage of the filament and "B" battery are also shown. The sending helix, or coil, can be seen in the upper left of this instrument.

A storage "B" battery is also on top of the desk. Below are two sharply tuned receiving sets, which will work on a loop. At the right appears a three-step audio frequency amplifier. Below that are the sending keys for code work.

THEY THINK IT UNCANNY

The value of amateur radio communication to those whose business takes them into the far-off corners of the earth. is being demonstrated this year as the Alaskan fishing fleet gets under way from the ports of the Pacific Northwest. Members of the American Radio Relay League are always among the first men to be sent north. They take with them receiving and transmitting apparatus by which the fleet and canneries keep in touch with the home ports through the medium of other amateur stations along the air line.

In cases where the ship or cannery has not enough equipment to do transmitting, arrangements have been made to broadcast code messages at stated intervals. Thus the home stations will keep men in the fleet abreast of the news from home,

Hot Weather Programs for Summer

What the Studio Director Will Do For You Soon

By CHARLES B. POPENOE, Manager Stations WJZ and WJY

HOW would you like to be a broadcast manager? Keeping the air filled with good things—that is his job. To do this requires organization—a staff of specialists. From the first day of January, 1924, till the last day of December station WJZ was on the air a total of 3,085 hours, transmitting 4,935 separate program features. The twin station WJY was broadcasting 686 hours in all, sending out 1,174 separate numbers during the same period. This gives an average of 37 minutes for each event.

Back in the early days of radio broadcasting, the program manager didn't have to worry about how to fill in his time on the air. One or two phonographs and an automatic piano were fixtures of the studio, and when there was a "hole" in the program the announcer ran off a few of the latest record releases or pianola rolls to fill in the time.

Music Must Be First Hand

That practice, however, is a thing of the past. The radio audience no longer wants to listen to canned cantatas or other "fillers" to kill time, so to speak. To-day, everything that comes over the air must be fresh and first-hand. Moreover, the various features must be fitted into the program with care and judgment, so as to make a harmonious whole.

Occasionally, when a singer or a speaker fails to appear on schedule time, the studio staff must improvise a feature to stop the gap in the program. Gifted studio announcers are now a necessary part of the staff, and their musical talents serve to good advantage for just such emergencies. Going even one step further, the leading studios have skilled musicians among their regular operators, available for all occasions as accompanists or even to play solos. For instance, WJZ and WJY of the Radio Corporation of America, are fortunate in having Godfrey Ludlow, an accomplished Austrian violinist, on the regular staff. Mr. Ludlow not only plays with the rare skill of a great artist, but he possesses one of the very few real Stradivarius violins in existence.

J. Louis Reid, announcer at twin stations WJZ-WJY, who started his public career as a leading man on the stage, but was weaned away from the footlights by the call of the microphone. He is one of the veterans in the announcing line and has developed a huge following in the radio audience.

Getting Dash of Seasoning

Radio is no longer seasonable. The recent technical advances in transmitting and receiving equipment, the increased power of the broadcasting stations and other improvements have done much to overcome the early handicaps of warm weather. Then, too, the program managers have come to recognize the importance of summer-time radio, with the result that their efforts go on just the same in summer as in winter. If anything, program managers consider that summer-time radio has some decided advantages over winter-time sending, in the matter of securing sporting events from the great outdoors, thus giving their programs a dash of seasoning.

We must take into consideration the changing seasons and the varying interests of our vast family of listeners-in. Speaking for stations WJZ and WJY, we are going to broadcast many things to please our summer-time listeners. We shall have excellent talks on swimming, which is a subject of very general interest. We shall have stories about golf. We shall have talks on tennis, basketball, baseball and other American sports. Practical campers will address campers and motor tourists; and once those travelers are in the far-off corners, we shall keep them in touch with the world and furnish them with the best of musical entertainment. We shall explain about the care of the automobile, motor tours and other subjects of interest to the vast army of Americans who travel the highways of our vast country during the coming months.

Tracking Down Events

Summer-time being the outdoor period of the year, the program manager goes more than ever after out-of-the-studio features. During the past year such events amounted to 54 per cent. of the programs from stations WJZ and WJY, the remaining 46 per cent. being studio features. The program manager to-day no longer waits for radio performers to come to the studio. When something good happens, which cannot be brought to the studio, he sends the radio re-

Continued on Page 26.

Six Best Sellers of Radio

How to Pick the Popular Types of Receiving Sets

ARE three tube sets more popular than four? What proportion of broadcast listeners put away their sets for the summer? These and other similar questions have recently been looked into at length by many of the big radio companies.

Among others the International Carbon Company has made a survey of the radio conditions through the United States. They paid special emphasis to the farmers, as many previous investigations have neglected this part of our population and have let it go at the cities, only because they were easier to find out about.

How Many Have Sets?

In the first place, about what proportion of houses are equipped with radio sets? This is not such an easy question to answer. Of course, the number of sets sold by manufacturers can be found out with pretty good accuracy. The trouble is that so many people have built their own sets. Another point is that many a radio has been torn down and rebuilt perhaps half a dozen times, and then finally sold or even given away to some neighbor, who did not know as much about the art.

The number of tubes sold is not much of an index either, as to the sets in operation. Some radio users are so fortunate that they will renew their tubes only every couple of years or so. Part of it is good luck, and part is careful attention to operating their filaments at the proper voltage. Others on the other hand, either through carelessness or bad luck, will have to buy one or more new tubes every little while. If the tube makers were to divide the number sold in such a way as to get some indication of the sets in operation, they would probably make a big mistake in the figures.

Take it all in all the proportion of those who have sets and those who have not is best illustrated in Fig. 1. These cuts, it should be explained, indicate the proportion by the *length* of the lines. In other words, it is not the area or amount of room in the houses which is to be compared, but the overall length. The same thing applies to the other diagrams in this series.

69 Per Cent. of Homes Are Deaf

Notice that 69 per cent. of the homes are not equipped for listening in, while 31 per cent can pick up what is on the air. This shows that there is still a large field for radio selling. There are very few homes outside the cities which can not afford the $15.00 or $20.00 which will install a pretty fair single tube set, able to pick up the programs within 500 or 1,000 miles.

When it comes to the city, of course, there are numerous families which are in poor circumstances. They undoubtedly could not afford such a sum. But consider that there are mighty few cities of any size which do not have at least one local sending station. In that case a poor family, which could not afford a tube set, could usually manage to find $5.00 which would be enough to put in a crystal set which can receive the programs broadcast within five or ten miles.

It seems reasonable to think that in the next few years the proportion of houses with and without this convenience (we almost said necessity) will be reversed so that at least two-thirds will have a radio. It will not be surprising as prices continue to fall and receivers to be improved if in ten years

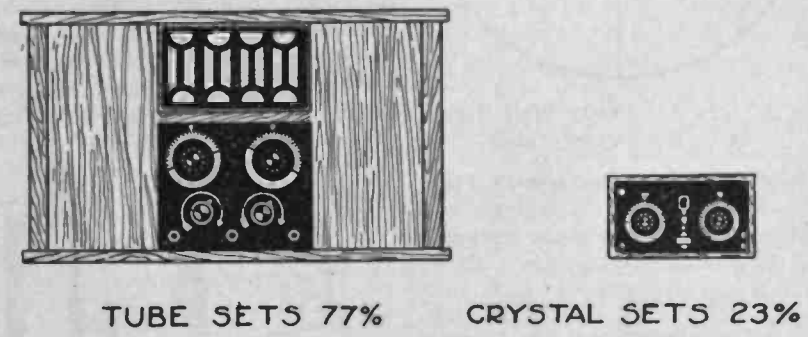


Fig. 2. Tube Sets Overshadow Crystals in Spite of Cost

Fig. 1. You Live in the House at Right; See How Many Belong at Left!

or less the proportion of those who listen regularly to broadcast programs should go up to 90 per cent.

Speaking along these lines, it may be interesting to see how the figures compare on these two types of instruments. It is found that 77 per cent of the installations use tubes, while 23 per cent

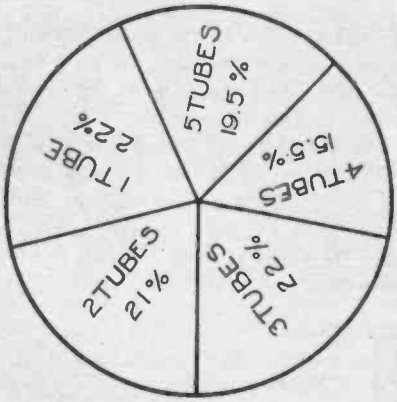


Fig. 3. Sets Are Pretty Well Divided as to Number of Tubes

depend on the humbler crystal. However, it is only fair to point out that price is not the only reason for adopting the crystal. See Fig. 2.

Crystal Cannot Cause Squeal

It is well known that the reception from the latter is always undistorted. Neither will squeals ever come from such a set to disturb the neighbors. This is because no source of outside energy is used with a crystal. It takes only what it is able to pick up coming in from the aerial, and sorts out the audio vibration from the combined modulated radio wave. If there are no squeals in the vibrations coming down the aerial, there is no chance for the crystal deftly

to insert a few of its own. In this it is very different from the tube. The latter has a source of energy in its "B" battery, and if improperly built or operated, can use this power to spoil the music for the operator, and also for his neighbors.

Taking up next the users of the more ambitious style, let us compare the sets using one, two, three, four, or five tubes. It is surprising how evenly the different radios are divided in this respect. The few sets using more than five tubes are included in the figures for the latter.

Two Kinds of Single

The single tube set almost always employs this unit for a detector. This will ordinarily be hooked up with a regenerative tuner. Such a set will have a range of about a thousand miles on a good night, and may even reach considerably farther than that under particularly good conditions. The other possible type using one tube is the style which has a crystal for a detector, and then one amplifier bulb which is reflexed into a single step of radio frequency amplification, before the waves reach the crystal followed by one step of audio amplification after the crystal. The single tube sets form 22 per cent of the total.

When a second bulb is added, it usually means a detector and one step of audio. The range will be increased a few hundred miles by the addition, but the principal advantage is the great increase in loudness in receiving by the head phones. Such a set will be able to work a loud speaker very well on music from a local station. A few sets will employ a crystal which is reflexed with two steps as described above. The proportion of two tube sets is almost the same as those with a single unit,—that is 21 per cent.

A Very Good Combination

When we get to the radios with three tubes, we find the standard as a detector and two audio steps. Although it will cost more than the set using a single step of amplification, it is so much more satisfactory that the more expensive set is slightly more popular—22 per cent. It is possible to build a hook-up showing one radio amplifier, a detector, and one audio amplifier. However, the number with such a connection is quite small. It is found that with such a combination it is an advantage to take off the radio step and build it over in a second audio amplifier.

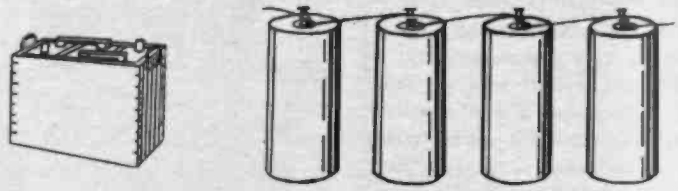


Fig. 5. Dry Cells Are Coming Up in Popularity Very Rapidly

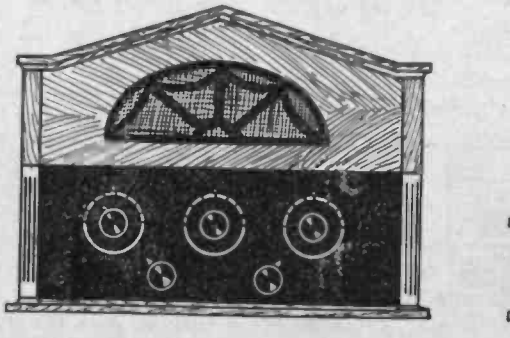


Fig. 4. Proportion of Home-Made Sets is Now Falling

The Most Unpopular

Four tube receivers show the lowest popularity—15½ per cent. They are usually like the three variety with the addition of one step of radio amplification. If the detector uses its regeneration, the gain in range by adding the fourth bulb is not very startling. There is one big advantage though, as it might be called a "Squeal Extractor." Unfortunately it won't take squeals out from the noise your friends may be putting in the air, but at least, it prevents your set from adding to the din.

Five to Eight Tubes

Five tubes and up fill out 19½ per cent. They include the popular Neutro-

dyne sets and others with two radio, detector, and two audio stops. It is rare that more than two audio amplifiers are hooked together, as they are apt to howl. The superheterodyne will use from

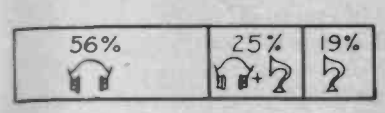


Fig. 6. The Phones Are Still Much Favored for Distance Work

6 to 8 tubes. Such sets are very efficient and the main reason why the proportion of them is not greater is because of the high cost and the heavy drain on batteries.

The next question of interest is the proportion of fans who build their own sets. It is somewhat difficult to get accurate figures here, as naturally the home builders do not make reports to any authorities. A year ago, the home sets were very popular indeed, but at the present time the craze for "Rolling your own" has largely abated. Some think that the crossword puzzle helped to kill it. It is more likely that the improvement in broadcasting made the better sets more necessary in order to bring out the full value of the programs. At any rate, the proportion of sets now stands at 69 per cent factory built, while 31 per cent are home-made, as shown in Fig. 4.

Why the Dry Cell Wins

Have you tried out the UV-199 or the WD-11 tube? The principal point in these styles is that they do not need a storage battery to light the filament. When you realize that the ordinary size of battery such as is used in a Ford automobile (the size usually used for radio) weighs fifty pounds and costs about sixteen dollars, it is easy to see why a dry cell at forty cents appeals to a great many fans.

A couple of years ago, the dry cell tubes were not on the market. Then 100 per cent of the sets would have been found to need storage batteries. The use of the junior bulbs has increased so greatly that in Fig. 5 we learn that at the present time only 21 per cent of the radios need storage batteries while 79 per cent employ dry cells.

56 Per Cent. Use Phones Only

Which is the best loud speaker? A good many listeners answer that question by sticking to head phones. And there is no doubt about it—a good set of phones cannot be beaten for clearness and lack of distortion. Besides that, the amount of electrical energy needed to work a horn, is very much greater than that required for the humbler phone. Indeed it usually requires one extra tube for speaker operation. So the latter is handicapped not only by cost, but by volume of tone to be had from a given set. That is why 56 per cent used phones alone as Fig. 6 reveals.

Some people call phones a selfish way of listening. Only a few persons can be accommodated at once. Besides it is a lot of bother to have these ear muffs clamped on your head all night. "Radio sore ear," is a new disease, which is quite catching among recent radio fans. It is not known to be fatal, although it is claimed to have led to some divorces. A loud speaker taken in time is a complete cure for such sickness. Nineteen per cent. of the fans are shown by Fig. 6 to have taken this treatment. On the other hand 25 per cent employ regularly both phones and horn.

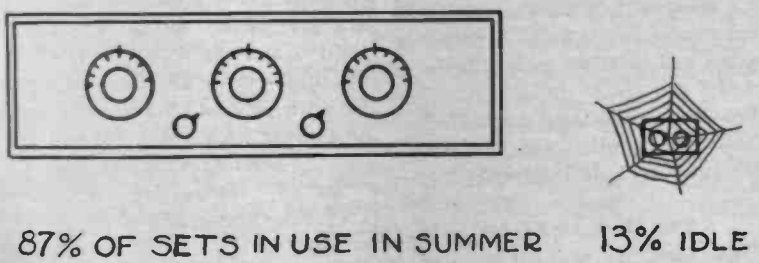


Fig. 7. Don't Let Your Set Get Covered with Spiderwebs This Summer

We Welcome the Summer

Hail the hot weather! It means that we can get out of doors a lot more, and vacations are now lurking in the middle distance. Does that mean that you are

Continued on Page 35

CUTTING THE DRY CELL COST

By EVERETT SCANLON

DID you ever try wet batteries instead of dry cells to work your radio set? The kind referred to is often used to operate door bells. There is an outer jar of glass which contains the solution. This is made by dissolving a quarter of a pound of salammoniac (ammonium chloride) in water. Dipping in the solution is a cylinder of carbon, which forms the positive pole and through the center of the carbon is an insulate zinc rod for the negative.

You probably have seen such jars standing on a shelf down cellar. They are quite inexpensive to run, but are more sloppy than dry cells, and so have been largely displaced for doorbell work. Since a dry cell will usually last about a year or so, for ringing bells, most people prefer to avoid the mess and bother of the wet battery.

Only a Few Cents Each

For radio use where considerably more current is required the expense of dry cells cuts much more of a figure. The small amount of bother with the salammoniac cell is much more than offset by the savings in cost. I have been using them for some time and find the cost only a few cents for each renewal of zinc and salammoniac.

I just keep the carbons and zincs good and clean and use heavy No. 14 guage connecting wires. Squirt a little machine oil into each jar, which floats on top of the salammoniac solution and prevents it from crawling up and corroding the terminals.

The pressure of the wet battery is lower than the dry cell, being only 1¼ as compared with 1½ volts when new. However, three of them in series will operate two or three UV-199 tubes. A single cell works a WD-11 or 12 tube. If you have more than one tube it is well to connect several wet cells in parallel.

After the cell has run for some time it polarizes. This means that a thin layer of gas (hydrogen) collects over the surface of the carbon and prevents the liquid from carrying the current to it easily. If the carbon is taken out and dried thoroughly, the trouble is removed and the carbon can be used over and over again. In the dry cell the same polarizing action occurs, but a special

Continued on Page 31

Fone Fun For Fans

But He Wears Two Ear Phones

John—"I just bought a new suit with two pairs of pants."

Jim—"Well, how do you like it?"

John—"Fine, only it's too hot wearing two pairs."—Crosley Radio.

Must be Katherina

"I envy that fat woman when she laughs."

"Why?"

"There seems to be so much of her that is having a good time."—Good Hardware.

To the Last Man

A motor car has been invented that can move sideways across the road. It was felt that pedestrians were getting altogether too artful.—Punch (London).

But You Need 'Em to Throw at the Loud Speaker

I went to look at an apartment in a spiffy new building. "There is no built-in bookcase," said I, "nor do I see where my own bookcase would fit in." "Books," said the sleek young agent, "why, madam, no one needs books these days, with the radio."—Chicago Tribune.

Completely Cut Off

Tired Business Man—I'd like to go where I'd be entirely cut off from the world.

Friend—Why don't you try a telephone booth, old man?—Good Hardware.

Who is Slated?

"Want to go on a sleighing party?"

"Sure. Whom are we going to slay?"—Rutgers Chanticleer.

Sudden

"'Aven't seen yer 'usband about lately. What took 'im orf so sudden?"

"Seizure!"

"Wot? 'eart?"

"No. P'leece!"—The Humorist (London).

Or the Naught in Naughty

"The boy who draws the grand prize for being able to get something for nothing," said a chap who dropped in on us the other day, "is the feller who puts the vacuum into vacuum tubes!"—The Microphone.

Quick Results

"Do you find that advertising brings quick results?"

"I should say it does. Why only the other day we advertised for a night watchman, and that night the safe was robbed."—Boston Transcript.

Many Bites

A man in a mental hospital sat dangling a stick with a piece of string attached over a flower bed. A visitor approached and, wishing to be affable, remarked:

"How many have you caught?"

"You're the ninth," was the reply.—Pittsburgh Chronicle-Telegraph.

Too Much to Expect

"Look here," he said, "I'm going to leave. I've never seen such dirty towels in my life, and I can never find any soap."

"But you've got a tongue in your head," was the landlady's reply.

"Yes," was the quick response, "but I'm not a cat."—Tidbits (London).

HOT WEATHER PROGRAMS

Continued from Page 22

porter after it with the microphone and the "pick-up" wires which radiate from the studio in all directions.

Surely the enthusiastic radio fan is not going to wrap up his radio receiver in cotton and put it up in the attic this summer, when he knows that the great open spaces will be packed with special summer-time events. He'll want to get some of those good things out of the air, even if his set, after the long winter, needs a simple overhauling for its new job. If the radio enthusiast is going away, he'll not forget to take along his home set or a portable receiver so as to furnish some much appreciated entertainment at the summer resort or in camp.

So, before we sign off, we are going to ask the fan to stand-by during the coming few months. We want our audience to feel that they are with us during summer as well as winter. Like actors on the stage, we want to perform to a full house.

TO NORTH POLE

Continued from Page 14

stead of the left. That is, it is night all over America.

Day at Midnight

Of course, the receiving aerial has also shifted 180 degrees. You will see it up near the top of the circle at the right. But notice that it is still in broad sunshine. Although it is "midnight" the rays of the sun are streaming down in all their glory directly on the receiving equipment. Indeed no part of the Arctic Circle escapes from the sun's rays day or night, during midsummer. That is how the Arctic Circle is located—it is established at those points which just escape darkness on the night of June 21.

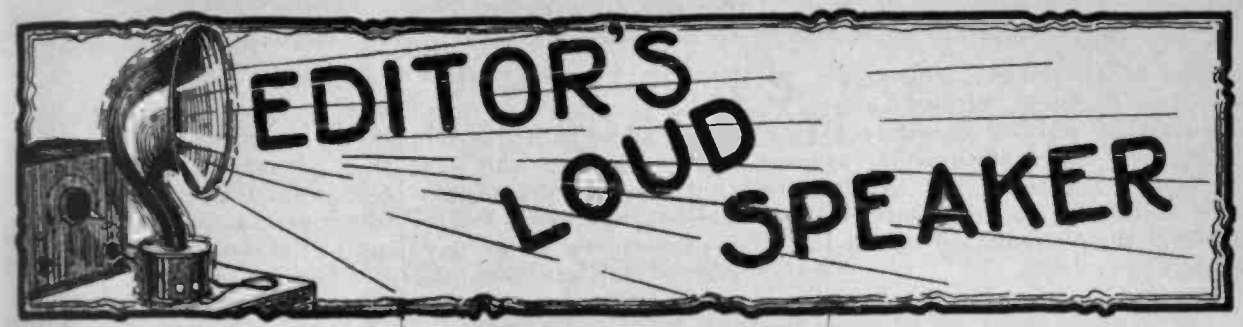
In addition to the equipment supplied the MacMillan ship for communication with the United States, the two Navy amphibian airplanes which will accompany the expedition are also being equipped with very low powered high speed wave equipment for talking with the mother ship. These transmitters for airplanes of necessity are very light and small, being entirely dry cell operated. Of course, it is a common thing to operate a *receiving* set on dry cells. The UV-199 and the WD-11 and WD-12 are all tubes which are intended especially for such service. But did you ever hear of *sending* with a dry cell set?

Sending with Dry Cells

As a transmitter the ordinary UV201-A tube is hooked up to four dry cells in series. These have an output of six volts when new, which is reduced to five by the filament rheostat. These tubes are the same as are ordinarily used as amplifiers or even as a detector in many of the popular receiving sets. The current consumption is ¼ ampere per tube which is easily handled by a single set of cells. Of course, it is not economical, however, and so a storage battery is universally used to light the filament except in an airplane where the weight would be so objectionable. This gives an idea of the extremely small power of the sending station.

During the past month the MacMillan ship equipment as well as the airplane apparatus has been given its initial tests with some astounding results. On the night of April 20th, Engineer Reinartz, testing one of the small plane transmitters at his home

Continued on Page 31



VOTING ON THE AIR

When election times rolls around, do you help save the country? It is well known that many of our so-called "best" people do not bother to go to the polls. On the other hand, those at the other end of the scale are often very much interested in their civic duties.

Indeed, it is reported that some citizens in the poorer quarters of a town are so much concerned with civic improvements and general affairs of state that they vote not once, but over and over again. While we do not go so far as to advise you to emulate their example, still it is a good thing to cast your ballot.

Jazz vs. Classics

In the same way there has been a good deal of talk recently about voting for various radio programs. The studio director has just one business in life—to please you. He naturally goes almost entirely by the comments and requests from interested fans. Taking music as an example, the listeners are at present apparently divided into two camps—those who prefer mostly jazz and those who would rather have a great part of their music of a more or less classical type.

While the number of requests for the livelier and more popular pieces has fallen off during the last year, there is still a large demand, according to the letters and postal cards which arrive at the large stations. However, the proponents for classical pieces claim that the reason is that those who want dance music are more apt to write in and express their desires, while those who like opera are the ones who do not express themselves.

Not a Mind Reader

If this is true, as is claimed by some of the studio directors, then it is largely the fault of the broadcast listeners. You can not expect that the chap who makes up the program will include on his list a lot of numbers which he *guesses* would be wanted by a large number of his audiences. If he gets in a thousand cards asking for "All Alone," and ten for "Madame Butterfly," which do you suppose he is going to run? Perhaps there are ten thousand who want to hear "Butterfly," but not being gifted as a mind reader, our station director can't know about it, and so it will not appear.

The moral is that all the requests for various pieces which the mail brings to the studio are read with great interest by the staff and are then tabulated. So if you want to hear certain types of music it is your move to let the directors know about it. And unlike the elections which were spoken of above, you may vote early and often without having to run when you see an officer.

CALLING OFF THE FIGHT

"And they were married and lived happily ever afterwards." No, this is not a fairy story, but an account of the action taken recently by the Associated Press. At their New York Convention they decided that the members of the Association would be no longer forbidden to use radio to spread news upon the air.

You see the trouble in the past was that the newspapers were afraid that even though it cost only two cents to buy a paper, still if you could clamp on your head set and get the same news for nothing, then no one would invest even the necessary two cents.

Who Won the Game?

This seems reasonable at first sight. But it has been found that there is a big difference in the effect of these two ways of geting the news to the reader. The radio is right up to the second. You know immediately how the election came out or who won the big fight. The newspapers can not hope to compete in this *instant* appeal. But on the other hand, radio can not give a complete account of the various interesting happenings.

There are so many different stories which someone wants to know all about that the broadcasting stations can not possibly send out very much more than a brief summary of each. You naturally turn to the newspapers to get the details. And if you know there is an interesting story to be read there, you are much more apt to buy that newspaper than you would be if you thought it printed only the dull round of everyday news.

The Villian Discovered

It is like the summary of a play which you get in the Tuesday papers. They give you just enough of the plot to whet your appetite so that you will go to see the show itself. They would never think of explaining that in the last act the villian was discovered as being the hero in disguise. You must spend your money if you want to learn that fact.

It is a good sign that the Associated Press has come to recognize its condition and will not forbid its enterprising newspapers to take advantage of it. Quite a

number of progressive papers in the United States either have broadcasting stations themselves or can use other stations on a toll basis. The periodicals which have made use of such service find that their circulation has increased.

Mary Lawton—The well-known actress who was a personal friend of Mark Twain and therefore particularly adapted to the task of informing the world of the interesting events in the life of that famous writer. "A Lifetime With Mark Twain" is being given through WJZ on Friday evenings, during May, by Mary Lawton.

So radio now works both ends of the game. The news of many important events is sent to the paper by the ether waves and after the various items have been properly sifted and assembled, the same journal makes use of the radio again to tell all its prospective customers of the main points of the stories which they carry.

WHEN DO THEY STOP?

The radio programs as found in the daily newspapers are a great help to radio fans who want to pick out the type of entertainment which they prefer. Most all the newspapers these days carry pretty complete schedules of the various numbers which will go on the air from stations that may be picked up.

All such programs tell the time at which events are expected to start. And the studio directors now have it down to a science so that the times as noted are adhered to pretty well by the artists. Of course it is well known that many performers have the "artistic temperament," which oftentimes seems to mean that they do as they please. That perhaps accounts for the fact that they will sometimes arrive quite late and not at the time when the director is wringing his hands for something to fill up the hole in the air

A Sample Program

Sometimes the printed programs tell when an event is scheduled to be closed. More often each number is intended to run until the next one is announced. For instance:

8:00, John Smith, tenor solo.
8:30, The PDQ Orchestra.
9:00, Lecture by Mr. Whozis.

We naturally assume that Mr. Smith will sing for one-half an hour, and that the orchestra will be on the air until nine o'clock. But there the program seems to leave us in the lurch. Is Mr. Whozis going to talk for ten minutes or until midnight? We may fish quite a while to pick up his station at around nine-thirty, only to find that he must have quit the air at nine-fifteen.

A Joke by the Star

We recently saw a schedule announcing that a famous radio star would talk at ten o'clock. Hurrying home from an engagement to listen to the interesting adventures which would no doubt be told, we tuned in expectantly. The star, after telling what picture of his was appearing in the local theatres, told one funny story and then signed off. If the broadcasting station had announced in its schedule, "10:00 to 10:05, speech by Mr. Screen Star," we should not have broken our neck to get home to hear that one funny story.

If you have ever been troubled by the same lack of finishing time as noted on the programs, just drop a line to the offending station and also to the newspaper printing the list. Concerted action by many broadcast listeners would bring it to the attention of the program maker and remedy this condition.

Combined Long and Short Wave Set

How to Be a Ham or Fan With the Same Receiver

By CLARENCE H. WEST, Brooklyn, N. Y.

BANG! down go prices. So do wave lengths at the same time. Do you remember how a few years ago you tried to pick up Europe on 12,000 meters? Then the ship stations were set at 600 meters. Broadcasting was developed at 360. The range was next extended as low as 225. The amateurs or hams took 200 down to 150 meters. Then KDKA started broadcasting at less than 100. The latest talk is how to pick up signals at 20 meters. If this development keeps up the waves will soon be so short that several of them can sit in your radio cabinet at the same time without stepping on each others toes.

It has often occured to the writer that the ideal receiver would be one that would work on all waves using the same tubes and the same tuning controls.

Three Sets Needed

In amateur work it is essential to have a receiver capable of picking up short waves at frequencies above 1500 kc. Then for the low frequency (long wave) code stations he generally has to use another receiver, and still another for broadcast wave lengths. This makes three sets to pull in all the different frequencies within radio range.

Of course there are many combination sets that have all three properties combined but such a receiver is generally an elaborate affair with too many controls for the average layman and experimenter. The three coil honeycomb system of reception is very good but requires a complete set of many coils for covering the entire band down to 15 kc. (20,000 meters).

In addition, there are four controls (exclusive of rheostats which play important parts) namely: Antenna series condenser; secondary shunt condenser; coupling and tickler.

In further addition one has the fuss of finding the right coils that will cause oscillation for any particular wave frequency. However, all of the above is not too much from the commercial standpoint, but on the amateur side there is a little bit more then is necessary.

As the type of receiver to be described is really a universal one, two stages of audio frequency amplification is added for loud speaker operation on broadcasting.

When Only One Step is Used

In our diagram Fig. 1, only a single step is shown so as not to make the hook-up too hard to follow. However, a second step may be added following the first step jack in exactly the same way that the first step follows from the detector jack. For short wave amateur and long wave code, one stage will be sufficient for use with head phones.

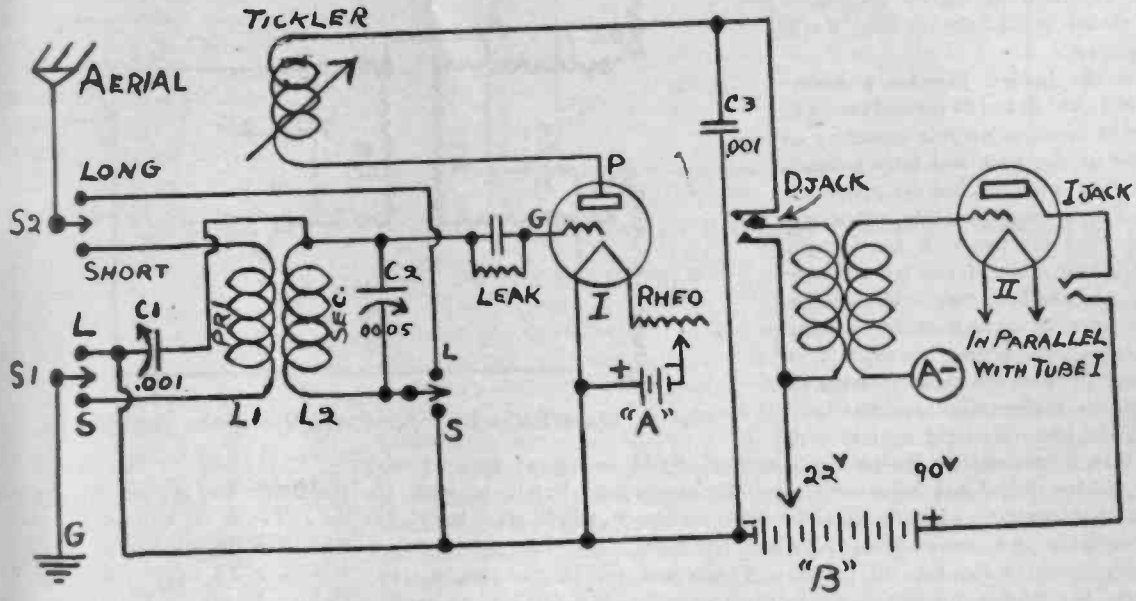


Fig. 1. Hook-up Which Will Take in Entire Range of Waves Used in Radio and Wireless Code

Fig. 1 shows the diagram of connections and the constants are as follows: L1 is the primary inductance which may be fixed. It has ten turns of No. 20 S. C. C., wire on a three-inch tube. Of

course, this may be adjustable if it is desired to get the sharpest primary tuning. As this is the coil which is used for high frequency (short wave length) it is particularly necessary to keep the amount of wiring down as much as possible. For that reason the coil may be tapped by building one-half inch loops into the winding every two turns.

Connection is made by a small clip, which is snapped on to the loop which experience shows to be the best.

How to Get Selectivity

L2 is the secondary. This should be a honeycomb coil in a standard mounting. The 25 turns size will be about right. It should be placed end to end with the primary so that the axis of each is in the same straight line. A spacing of about half an inch between the two windings will give loose enough coupling so that the set will be quite selective. This secondary is likewise fixed and does not vary with respect to the primary. This coil may be removed and one of higher inductance value placed in adapter for long waves if necessary.

L3 is the tickler. likewise a honeycomb coil, and it has 35 turns. It must be supported in an adjustable mounting so that the spacing back and forth between it and the secondary can be easily adjusted. Maximum feedback action will be had when the two coils are brought close together while if the set starts to squeal or oscillate this objectionable feature can be prevented by moving the tickler coil farther away. It is necessary to have the right polarity on L3. If no regeneration results from putting the two coils tight against each other, then it means that the terminals of the tickler coil should be reversed.

These combinations of coils will be found sufficient for waves from 3,570 kilocycles down to 750 kc. (80 to 400 meters). For higher broadcast waves a 50 turn secondary and 50 turn tickler may be added.

Change From Short to Long

S1, S2, and S3 are two-point switches for changing from short to long waves. The latter switch changes the hook-up from a two circuit on short waves to a single circuit connection for long waves.

C1 is a .001 mf. variable condenser, (usually 43-plate), while C2 is .0005 mf. (23-plate.)

In place of switches S1 and S2, a small panel, double throw, double pole switch may be used. They are on the market at present and measure two inches in length, and one-inch wide. They offer a very neat method for change-over.

Across the detector jack and primary terminals of the first audio frequency transformer will be noticed a .001 mf. fixed condenser, C3. When using the receiver on amateur and long wave reception this may be left out (although it does no harm), but on loud speaker operation this condenser will afford much better reception without distortion as it provides a path for the radio frequency waves.

When to Set on Zero

In using the receiver on amateur short waves the .001 mfd. variable condenser should be set at zero. Tuning of the secondary circuit is with the .0005 condenser which may be of the vernier type.

The reason for this is that the two condensers C1 and C2 are in parallel when the set is adjusted for short wave lengths. This may be readily seen by referring to Fig. 2. When two condensers are in parallel of course their capacities are added together. So if one of them is set at zero then it becomes practically out of the circuit at the start.

If, when tuning in a station, the tickler is advanced towards the secondary and the signals decrease instead of increase this denotes that the tickler connections will have to reversed as already explained. This can be done at the mounting for the honeycomb coil.

In tuning our receiver for broadcast wave lengths use as much of the .001 variable as necessary and tune sharply with the .0005 vernier.

Tracing the Current Path

The connections with the three switches in the "short" position are indicated in Fig. 2. Notice that the waves coming in from the aerial go to switch 2 to the primary L1 and from there by switch 1 to ground. The secondary oscillations are tuned by condenser C2 and also by condenser C1 which is now in parallel owing to the operation of switch 3. The voltage from this oscillation is impressed directly across the grid and filament.

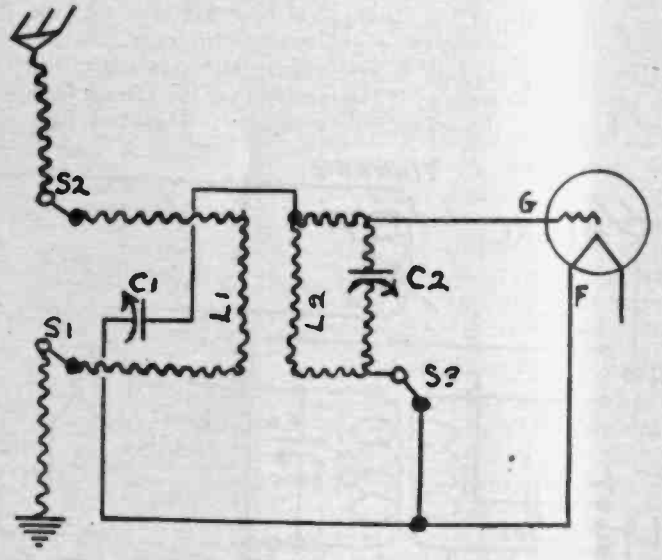


Fig. 2. Wave Paths for High-Speed Vibrations. Switches at "S"

The action of the output through the tickler coil is just like any standard set and so is not indicated in this sketch. Of course the amplifying action of tube two is in accordance with that of any regular hook-up. As already explained a second step of audio may be added when picking up broadcasting stations. The fact that the the two condensers, C1 and C2 are added together by switch S3 results in a total capacity at this point of .00015 mfd. This means that a honeycomb even of only twenty-five turns will be able to receive pretty well up into the long wave length region. If it is desired to go still higher with this same connection then 50 turn secondary and tickler coils may be quickly snapped into place.

Pulling in the Code

When the switches are set up to the "long" position the scheme of connections is as shown in Fig. 3. Notice that the aerial feeds the waves through switch C3 to the secondary coil after which they pass through series condenser C1 and so through switch S1 to ground. The voltage for the grid of the detector tube is tapped off across condenser C1. The latter is the main tuning unit although condenser C2 may be turned way on to give the longest wave length possible. Such a hook-up is like a standard single circuit set except for the addition of condenser C2.

This receiver will work satisfactorily on a very short aerial. The writer has copied long wave c. w. code, DX broadcasters and scores of transcontinental amateurs on an antenna only 30 feet long.

Won't Be Back Number

This instrument becomes an ideal receiver with not much chance of becoming a back number owing to wave changes for many years to come. If broadcast waves should decrease down to 100 meters or less, all one has to do is take a few turns off from the secondary honeycomb coil and tickler, and if waves should go up—why they have honeycomb coils that reach up to many thousands of meters. So you are safe, and best of all, there is no tearing the set to pieces whenever these changes are made.

It will work and work well, but is a strong transmitter and might cause lots of interference. However, on long waves up to 20,000 meters or more, no interference will be noticed on the part of other listeners (who cannot tune up as far as that), and as for the long wave receivers of the commercial companies and foreign governments, there is little chance of them hearing it, as they are too far away.

It is the writer's view that no all around general receiver will give any better satisfaction than this type if pains are taken to construct it neatly. His model measures 12 x8 inches and has taken the place of one long wave receiver, one broadcast receiver, and one short wave receiver at station 2 CSM.

As to what this set will do it is interesting to note that in one evening I logged 46 amateur stations including three "sixes" (stations in the sixth district, which is across the Continent); 22 broadcasters as far as Denver, Colorado; six long wave length sparks including three foreign—not so bad.

So anxious am I to have the boys construct this receiver that I will make the following offer. Any one who wants to receive further pointers may write to me enclosing a self-addressed stamped envelope and I will gladly answer. (Very foolish move I know—there might be 10,000 who write.) Address: 1028 44th Street, Brooklyn, N. Y.

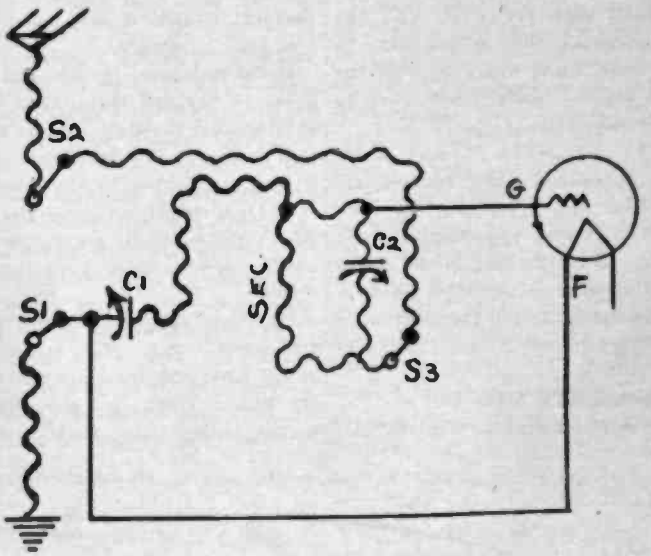


Fig. 3. Wave Paths for Low-Speed Oscillations. Switches at "L"

TO THE NORTH POLE

Continued from Page 26.

at South Manchester, Conn., carried on communication with amateur radio station 8CIC, owned by Johu Benedict at Kalamazoo, Michigan, a distance of approximately 800 miles, using a 10,000 kc. wave (30 meters). This establishes a remarkable new world record for low-power fast wave transmission. This work was accomplished with the regular equipment which will be supplied the plane, the only power supply used being dry cells and the transmitter tube being an ordinary receiving set tube as just described. The total power available was therefore, approximately 1/40 of that *used in an ordinary electric light bulb.*

4000 Miles in Daytime

The MacMillan ship transmitter also had its share in breaking world's records. On the morning of Sunday, April 19th, in a test carried on from the Zenith Radio Laboratories, in Chicago, this outfit operating on wave speeds of 15,000 and 7,500 kc. (20 and 40 meters) was heard very loudly by Lieutenant F. H. Schnell, Radio Officer of the USS "Seattle," flag ship of the United States Navy Pacific Fleet now engaged in war-game maneuvers on the way to Hawaii. At the time Lieutenant Schnell heard these signals he reports the distance of the "Seattle" from San Francisco as 1600 miles. This test was carried on in daylight and the total distance covered was approximately 4000 miles—an astounding range for a low power transmitter! Further tests will be conducted with both the airplane and the ship set before Dr. MacMillan sails for the North. It is possible that even these records may themselves be broken in further tests with this apparatus.

CUTTING DRY CELL COST

Continued from Page 25.

chemical called a "depolarizer" is placed around the carbon to absorb this gas. It is the absence of this chemical which reduces the capacity of the wet cell as well as dropping its cost so low.

A few of these cells connected together in your cellar with wires running up through the floor to the radio set will work well and considerably reduce your dry cell expense.

TALKING TURKEY

The Turkish government has admitted on principle the installing of private radio receivers all over Turkey, but radio transmitters for private use are strictly forbidden.

Sailors Depend On Time Signals

Radio Helps the Captain Keep His Bearings In Mid-Ocean

By OLIVER D. ARNOLD

HOW do you like daylight saving? Many people prefer it, and the farmers oppose it. But no one likes to be on the border line where some of the clocks are set to standard and some to daylight saving time.

And yet, strange as it may seem, there are occassions when such differences in time are welcomed. In fact, on the sea it is very important to look out for this very difference in the clocks and that difference is depended on to a considerable extent to tell the location of vessels as they plough across the trackless deep.

When XYZ Signs Off

It may be interesting to explain just how this information is of help to the helmsman as he steers his small sloop or perhaps his ocean liner. To begin with, various parts of the world do not all have the same time. This has become well known to radio listeners as they pick up the time of signing off of various distant stations. In the Eastern part of the United States it very often happens that the announcer will say, "This is station XYZ, signing off at five minutes past ten." Yet when you glance at your watch, it reads five after eleven. In that case you know that the sending station was located one time zone to the West, and that it was Central Standard Time which he gave, while Eastern Standard was displayed by your own timepiece.

If the difference in time had been two hours or perhaps three, then you could have located the time zone as the Mountain or the Pacific Standard. When the listener is located in the Western part of the United States, of course the time signatures seem to occur one or more hours *earlier* than your own watch shows.

Doubtless everyone realizes why these differences occur. The sunshine starts at the East and travels across the country to the West. No one now believes as the ancients did, that it is the motion of the sun which causes this, but rather it is the earth revolving on its axis which gives the effect of sunrise and sunset. Way back thousands of years ago, the ancient Greeks believed that the sun was carried across the heavens in a flaming chariot, drawn by four horses. This team was drlven through the sky every day by a charioteer. Perhaps you remember the legend that one day the horses became unmanageable and took the sun so near the earth that all the vegetation was scorched. This happened to be over Africa and the desert of Sahara was the result. It also singed all the inhabitants nearby and blackened the skin so much that they became the race of Negroes.

We know that the true cause of day and night is the spinning of our immense globe around from West to East. The period of rotation is called a day, and is divided into twenty-four hours. Naturally the sun is overhead at only one meridian at a time. The meridian is a circle which passes through North and South poles. When the sun has reached its highest point during the day, it is noon or twelve o'clock by local time at that place. You can easily see that it will be earlier than that time to the West and later to the East where the sun has already passed its noon.

Fig. 1. Ships Depend on Correct Time to Know Where They Are. There is a Difference of Four Minutes Between Meridians.

If you know that when it is noon at your town, it is exactly eleven o'clock by local time at some point to the West. then you can say immediately that the one hour's difference is 1-24 of a day's time away. Since the world turns always at the same speed, you know that this second town has a difference of its meridian of 1-24 of a circle from you. Since a circle is divided into 360° (degrees), 1-24 of 360 is equal to 15, so the difference between the two meridians must be 15 degrees on the earth's surface.

The location of each meridian is

called its longitude. We could start anywhere on the earth as a zero line, but since the observatory of Greenwich in England was the first to investigate this subject thoroughly, it has been used as the starting point by most all the civilized nations. So when we say that a city in the Eastern United States lies at 75 degrees west longitude, we mean that it is 75-360 of the distance around the earth as measured from Greenwich.

Relayed by KDKA

Getting back to our time signals again, when it is ten o'clock at Arlington by the Standard clock of the United States Government, the time signals are broadcast to the world. The slow waves (long wave dengths) of the signals are unsuitable for being picked up on the ordinary radio set, and so these time signals are relayed by a number of broadcasting stations on the more ordinary wave. For intsance, KDKA, at East Pittsburgh, has for a long time specialized in this relaying, and has been very careful to give the best of service.

Suppose you happen to be out in a vessel at sea, and in some way you know that the local time is just eleven o'clock. If, at that instant, you heard the time signals coming in showing that it was ten o'clock at Arlington, Virginia, you would immediately realize that your longitude was just fifteen degrees east of Arlington. Of course, if your local clock said midnight, you must be thirty degrees east. As each fifteen degrees has a difference of one hour, or sixty minutes, then one degree causes a change of the clock of four minutes.

When the Sun Has Set

The next question is this. When a sailor out on the water, hears ten o'clock come ticking in over the ship's radio set, how can he tell just what the local time actually is? He can get it pretty accurately from the position of the stars. The most satisfactory way, however, is this. Instead of using the stars, it is much more convenient to tell local time by the sun. As the sun has a habit of setting considerably before ten o'clock at night on the Atlantic Ocean, it is impossible to compare directly the time signals with the sun's position.

However, the ship can set its chronometers (which are especially accurate clocks) exactly right by the radio signals at ten o'clock every evening, and if they run as well as they should, they will be right by noon the next day. Then the mariner can determine when it is noon by observing the position of the sun. The difference in time between the local or sun time and the Arlington time, which he received by radio the night before, gives him a measure of the difference in latitude between the position of his ship at that time and the meridian at Arlington.

This can be seen easily by referring to Fig. I. Notice that the time signals are those of exactly longitude 75. That forms the basis of Eastern Standard time. The radio waves sent out by KDKA pass over to the vessel in such a short flash of time that the ship's instruments cannot possibly detect that almost zero fraction of a second. To avoid correcting to the ten o'clock basis, our figure shows the clocks pointing to noon instead of ten o'clock. Of course, the idea is the same and the two periods of the day easily compared by an accurate clock as already described.

Four Minutes Per Degree

When it is just noon on the 75th meridian, our ship captain finds it is four o'clock by the ship time. Since it is fifteen degrees to an hour, he knows he must lie 4/15 of 60 degrees to the east of 75, which would be 15 west longitude. If he had been on the fourteenth meridian it would have been four minutes later still.

You will understand that the essence of this method consists in knowing what time it is in the United States. For this purpose, chronometers were in use long before the advent of radio. However, such instruments are likely to get out of order. That is why ships of any size must carry at least two, so that one will check up on the other. If, through accident, both should happen to stop, the ship would be forced to guess at its exact position, unless it could pick up the correct time from some other vessel.

As an illustration of this Captain Dingle, author of the sea tales that appear in the Saturday Evening Post, Liberty and several other magazines, as well as some novels, has written to Station KDKA, protesting agninst a small irregularity in the relaying of the time signals, and describing the service this feature of the station's program renders mariners on the smaller sea-going vessels. As a result of the captain's letter and those from other men who follow the sea, the Westinghouse Company is arranging its program for the Pittsburgh station so that the signals are relayed almost without fail every day.

Captain Dingle of the "Gauntlet"

"I, personally, fare to the sea only for fancy now," Captain Dingle writes. He is captain of the schooner "Gauntlet" of Stamford, Conn., and his name is A. E. Dingle. "I live in Bermuda," he explains, "and cruise in my little schooner wherever and whenever the fancy urges me. But I do depend on the time signals. They are a boon. And I know of a score or more of small vessels that have installed radio receivers on my advice just for this purpose.

"Four minutes of time are equal to one degree of longitude, which is 69 miles at the equator. So four seconds equals one mile there. And all navigation depends upon a knowledge of the precise Greenwich time, since one knows position east or west of Greenwich, the zero meridian, only by a comparison of time piece. So you will readily see how important it is to navigators who are using this modern method and whose receiving sets make them dependent on a commercial station such as KDKA, that the signals should be regular."

Big Vessels Get Arlington

The big steamers have sets that are independent of relayed signals, the captain goes on, getting the time direct from Arlington or other naval or governmental stations. But hundreds of navigators look to KDKA relayed signals to check their watches by radio instead of depending on a single chronometer, which is all most of them can afford.

"You will see that if a man is uncertain of his time when making a coast, perhaps in a fog, or thick weather," Captain Dingle concludes, "he is likely to experience a bad time, and perhaps lose his vessel. But if during the same day he has been able to make an observation and then the time signal comes in telling him how his time-piece is acting, he has all the confidence needed to bring him safely in."

Fig. 1. Some of the Movie Celebrities Who Used Radio Waves Instead of Silver Screen

WERE YOU AT THE RADIO MOVIE PARTY?

This Was a Chance to Get Acquainted with Favorite Screen Stars.

"Lillian Gish and Jackie Coogan were over at the house last night." Did you have a chance to say this last Tuesday, May 12? Not that they were really present in person, but every one within range of Station WIP, Gimbel Bros., Philadelphia, at least had the chance to hear what they had to say.

Indeed it was one of the most unusual gatherings of famous stage and screen folk which was held at the studio of WIP May 12 at 10:30 p. m. Moving picture stars of the Metro-Goldwyn Picture Corporation, together with such famous men as Marcus Loew and noted stage stars, gathered around the microphones to entertain the radio public and to answer all personal questions which had been sent in to the station.

It was a real party—the stars sang, dined and danced to two orchestras; and the microphones were on duty all the while.

Some of the Invited Guests

Lillian Gish, Jackie Coogan, Barbara LaMarr, Johnny Hines, Mae Busch, Dorothy Mackaill, Marion Davies, Anita Stewart, Harry Morey, Dagmar Godowsky, Louise Glaum, Fritzi Brunette, Ben Finney, Flora LaBreton, and many more screen players were among those present.

Raymond Hitchcock, Eddie Cantor of "Kid Boots" fame, with Mary Eaton and her sisters, Doris and Pearl, Cecil Lean and Cleo Mayfield, who made "No No Nanette" famous, and the leading men and women of the two "Music Box Revue" shows represented the stage and Broadway. Nils T. Granlund, famous "N. T. G." of Station WHN in New York City; Marcus Loew, president of the Metro-Goldwyn Picture Corporation, and head of the Loew chain of theatres, and the great "Sir Joseph Ginzburg, Broadway's biggest "nut."

Eli M. Orowitz, the famous "Emo," whose weekly movie broadcasts from Station WIP have created a sensation all over the country, arranged the party and was the announcer for the evening. "Emo's" witty remarks were aided by those of Johnny Hines, to say nothing of the other comedians present.

An Informal Frolic

The party was quite informal, according to reports from the broadcasting station. No program for a set series of events was arranged; it seems that most of the stars are at their best when they speak on the impulse of the moment. So the movie fans who had seen their favorite screen star as many times as they possibly could, had the opportunity to hear their voices.

There was one unusual feature in the program. That was the answering of questions by the stars themselves. Owing to the publicity which had been given to the event, the station had received a great many inquiries from interested fans. These questions ranged from the most serious to the very foolish. Most of them were quite personal as well,—what Barbara LaMarr thought of vamps, and why Dorothy Mackaill bobbed her hair, for instance.

Although all the questions which came in naturally could not be taken care of within the time limits, still the selection made was very good, and those who were fortunate enough to get their queries answered got such swelled heads that they could hardly be spoken to the next day. Everyone who heard the stars actually talk, felt that the next time they were seen on the screen, it would not seem like make-believe players, but more like real flesh, and blood performers.

SIX BEST SELLERS

Continued from Page 25.

going to wrap up your radio with moth balls? Let us hope not. Two years ago, it was quite fashionable to forget radio for the summer. And no wonder either, as the receivers of that time gave very poor results during the hot weather.

Last year, conditions were greatly improved. Owing to refinements at both sending and receiving ends, there was a great deal more fun to be had by listening in during the summer, and this season has seen such a big increase in the power output in most of the large sending stations, that static in comparison has faded to a whisper. It is very likely that more than ever before listeners will keep up that interest in the particularly good programs which are promised for the coming summer.

Get Out of 13 Class

Last year the proportion of sets which were not taken out of service was 87 per cent. See Fig. 7. Thirteen per cent languished in the attic behind the spider webs. Undoubtedly this year, that figure will be greatly reduced. If you have been one of this 13 class, don't be so unlucky again. Keep your set in commission and you will not be sorry.

LOW LOSS WIRING

Continued from Page 11.

that they are so near each other for such a great length that they make a good condenser, which is undesirable. To change such wires so that they run at an angle, preferably at right angles, would be to increase the average spacing between them very greatly, and that is why such a change is for the best.

Where We Pay for Capactly

Right here it is well to point out that it is the *high* frequency wires which we are now discussing. The low, or audio frequency, needs no precautions to reduce such capacity. Indeed it is quite customary to put a .001 microfarad condenser across the audio frequency part of the circuit as shown at the right of Fig. 4. This is added for the purpose of straining the high radio frequency out of the circuit, and any additional capacity, which the wiring itself might have, would be more of an advantage than a drawback.

The direct current circuits need no care. The "A" and "B" batteries do not make any use of capacity at all, and it is sometimes advised to put a big capacity, even as much as a half microfarad (.500) across the terminals of each of these units. Again it is foolish to separate such leads and the practice of some companies in making up a cable with two A, three B, and one ground lead altogether is a very good scheme. But notice that they never include in such a cable the aerial lead. Sometimes the ground is also omitted, although it does no harm either way.

How About Spaghetti?

When it comes to a covering on the wires you naturally must use insulation on the turns of a coil to prevent short circuiting. It is also well to cover the copper with spaghetti at places like coil taps where there is danger of one tap touching another. In the rest of the set, that is in opening wiring, spaghetti or cotton insulation on the wiring does absolutely no good in preventing losses. If it has any effect at all it is a slight detriment since losses in air insulation are less than in any solid dielectric which is known. However, the power wasted in a spaghetti or cotton covering is so minute that it can be detected only with very high voltages. In practically all radio sets, such insulation does no harm at all. If you want to use it as a matter of looks, it is all right to do so.

IZZY A. NUTT—PERHAPS IT WAS A USED ONE

New Products of Special Interest

A RADIO TIME TABLE

Anyone who has listened in at odd times during the day and wondered what he ought to be able to get will be interested in a new directory just out. This is called, "Who's on the Air," and is published by the Air Guide Publishers, of Cleveland, Ohio. See Fig. 1.

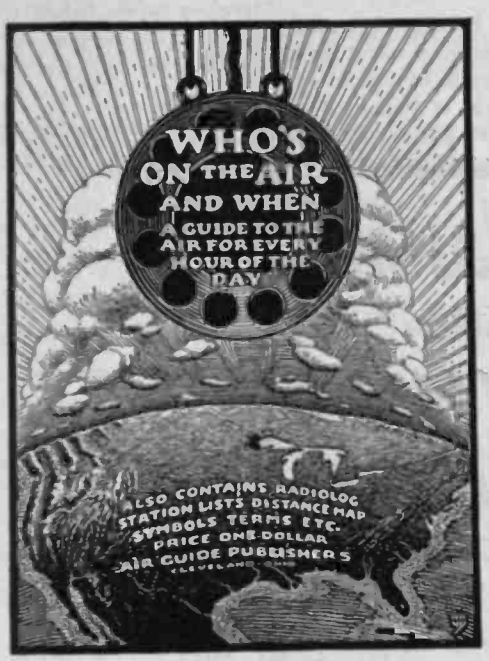


Fig. 1. This Tells You What is Going on Day and Night

The arrangement of the book is rather unusual. In addition to the ordinary alphabetical list of call letters, the main table consists of seven columns headed, "Sunday," "Monday," and so on through the week. Breaking into these columns across the page are the various times of day. Every fifteen minutes a new schedule is printed. The time runs from ten o'clock in the morning right through the day and evening, but instead of stopping at midnight, the list is continued on up to three o'clock in the morning. These times refer to Eastern Standard, but corresponding figures for other belts of the United States are included alongside.

Following each division of time is a list of stations which may be heard at that period on every separate day of the week. These columns have the different call letters arranged according to wave lengths so that if you know on your dials where some station of a similar wave comes in, you will be able to locate the one you are after if it is within range.

When It's Tuesday at 4:30

Suppose, for instance, that it is half past four on a Tuesday afternoon, and you get tired of the local station which is sending an uninteresting talk. Pull out "Who's on the Air," and run your eye down the Tuesday column until at 4:30 you will find there is one station 15 meters above the local, and another 25 below it. By turning the knobs a small amount to correspond you will be able to pick up what you want without a tedious hunt.

The author of this book certainly must have been a radio fan because in this book he has given just what his brother fans are most apt to want. The center spread is a distance map. There are six pages of broadcasting stations arranged by call letters and three arranged geographically; a page showing the power of the stations, four for logging stations, and numerous other pages showing symbols, terms, etc. It is only 8½ by 11 inches and is printed on a fine grade of paper with an attractive two-color cover.

HOLDING UP THE OTHER END

ALMOST anybody can find a convenient place on his house to attach one end of the aerial. The lead-in wire usually runs up the outside of the building to some high window. The aerial insulator is held by a hook screwed into the top of the window frame. Or perhaps if the roof is flat enough the aerial may be supported from an insulator fastened above the ridge pole.

But what of the other end? Perhaps you have a tree conveniently located to support it. Or maybe an accommodating neighbor will lend you a piece of his wall to hold the screw eye. If so, you are in luck. But many a fan finds that there is no good place to hang up the distant end unless he puts in a pole. It is not an easy job to build a good pole unless you have a lot of special tools.

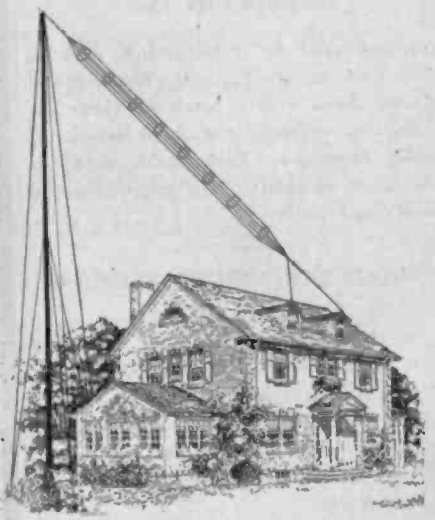


Fig. 2. No Danger of This Aerial Blowing Down

It is usually more satisfactory to buy a pole. One that has recently been placed on the market by S. W. Hull and Company, of Cleveland, is called the "Hercules." This aerial mast is made in three standard lengths, 20 feet, 40 feet and 60 feet, using all steel construction. See Fig. 2.

This gives great strength and light weight, thus making a rugged mast easily erected. At the same time it presents a pleasing appearance by its graceful lines. A specially designed foundation eliminates the use of concrete and permits all sizes of masts to be erected in the earth or on the roof, as desired.

Every mast is tested at the factory to withstand a 500-pound pull at the top. The substantial construction makes them ideal for supporting the heavy

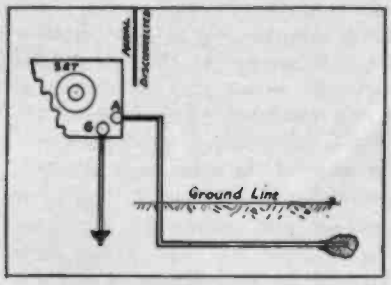


Fig. 3. Static Does Not Visit a Set Installed Like This

antenna used in transmitting, such as shown in our illustration. The low cost places them within reach of those desiring an efficient one wire aerial for radio reception. Each mast outfit is furnished complete with guy-wires and mast-head pulley.

WHAT THE "STATIC ELIMINATOR" IS

In the present method of receiving broadcasting by an overhead aerial, all electrical disturbances, such as electric motor hum, power noises, neighboring radiating sets, and natural static, are picked up and delivered directly to the receiving set.

The Static Eliminator, which has recently been perfected, does not absorb static, nor does it receive these disturbances and then try to pass them off thru some other channel. Rather it is an underground antenna, properly insulated, designed to receive only the electrical energy sent out by the broadcasting stations and deliver it to the receiving set practically free from all objectionable squeals, crashes and other noises termed "static."

This system is non-directional and will receive signals just as clearly as the overhead antenna without all the objectionable noises. This is being proved every day. The Static Eliminator replaces the overhead antenna and is connected to the "Aerial" post on all sets whether they are super-hets or just plain crystal; the ground wire remains untouched, as shown in the sketch. This system must not be confused with the so-called grounded system as there is no similarity between the two. The location or weather conditions do not affect the operation of this underground antenna at all.

THEY WONT FORGET STATION

Travelers on trains on one of the railways in France are to be notified of the next stop by means of loud speakers.

MOST POPULAR QUESTIONS

When you go to a radio store, what questions do you usually ask the clerks about the various sets? It is interesting to hear what other people ask. Some of them seem very extraordinary, while others show good, common sense.

An agent for the big advertising firm of Livermore and Knight, recently conducted an investigation as to what people wanted to know most about radios before buying them. Here is a list of the questions which were asked, those at the top being heard the oftenest:

"What stations can I get on this set?"

"What else do you need to go with it?"

"What parts of this set wear out, and how much do they cost?"

"Must I use an outside aerial?"

"Is it hard to learn to operate it?"

"How do I know it will work as well home as it does here?"

"What do I do if it gets out of order?"

"Can I install it myself?"

"How long do you guarantee it for, and what do you guarantee anyway?"

"Have you any cheaper set that gives as much distance?"

"Will this set work in the daytime as well as at night?"

"Will dust hurt it; does it get broken easily?"

"How much does it cost for batteries?"

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. Is copper tubing better for an aerial than stranded, insulated wire?

Answer. An aerial, made of copper tubing is slightly better than one of stranded.

Such a construction is better than one of stranded wire, even though the strands are insulated, *provided* that the outside diameter is somewhat larger than the diameter of the wire it replaces. In other words, owing to the skin effect the radio waves travel only the surface of the wire without penetrating to the interior. By spreading the surface out into the form of a tube and making it greater than the sum of the surfaces of the separate wires, the resistance will be lowered. To make such an aerial effective the tubing should be at least 3/16 in. diameter and preferably ¼ or 5/16 diameter.

By using such a construction the resistance of the primary circuit will be lowered. Whether this has any distinct effect on the set or not depends on the rest of the installation. It is the *neck* of the bottle which slows down the flow. If you already have a low resistance aerial, but a high resistance ground or primary coil, then cutting the aerial resistance still lower and keeping the high resistance in series will not make very much of a percentage in the total. Usually careful attention to reducing the ground resistance will bear greater fruit than diminishing the resistance of the aerial, which is already small in proportion. The capacity to ground depends on the length and height of the aerial and is not changed by the variation in its diameter.

Question. I have a peculiar noise in my set. It sounds like a sort of tapping and this is not removed by changing tubes or by disconnecting the aerial. When I take off the "B" battery and then re-connect it, it is quiet for a short time, and then the noise begins again. What causes it?

Answer. The case you describe is undoubtedly due to a noisy "B" battery. Such units do not get in this condition because they are run down, but for the reason that a poor contact exists somewhere in the connections between cells.

Sometimes such a poor connection will become entirely open circuited, and in that case of course, the battery can not be used any further, as it gives out no voltage at all. Again the contact may keep jarring on and off, which gives a noise like static. The peculiarity which you note, i. e., that of becoming quiet for a short time after re-connecting the unit, is caused by the heating effect. The poor contact warms up slightly when current flows through it and the consequent expansion of the metal causes a shift in the ends which starts the tapping noise. When disconnected for a while the contact cools down and remains quiet until it again gets warm. The usual remedy is to scrap the battery and get another one. If, however, you have the patience to pull off the wax on top and test out the connections of the individual cells, you will be able to resolder the bad spots and the battery will work all right.

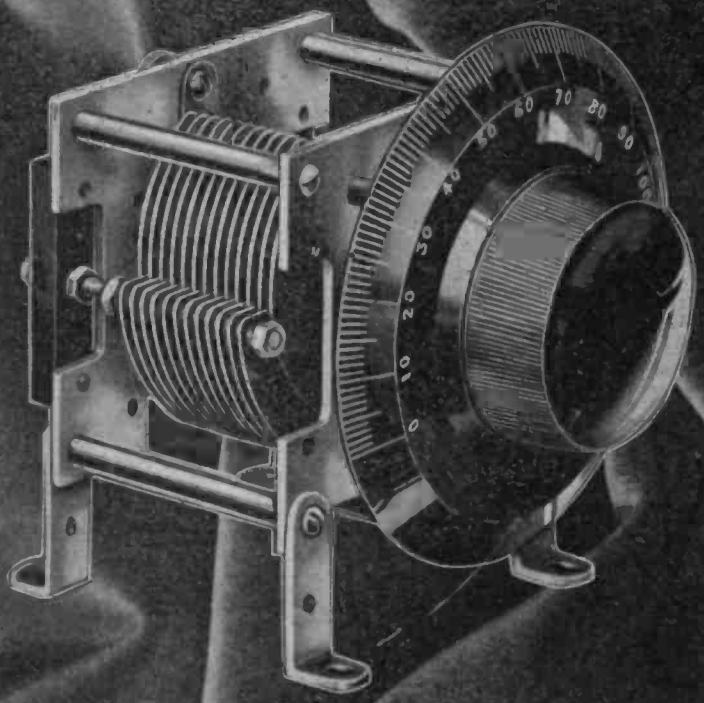
Question. Why does a potentiometer control the feedback of a radio frequency set?

Answer. When the grid of an amplifier is strongly negative, there is no flow of electrons through it. If, however, it is positive or if the "B" battery voltage is high compared with the negative grid charge or bias, then a small current will flow from grid to filament. Such a flow represents a loss of energy since no good is done by it. Remember too, that the power feedback in regeneration is used to supply the losses, and if these are large it requires a big amount of feedback to set the tube into oscillations. If then, we have a definite amount of feedback from the leakage capacities of the coils between stages of radio frequency, then unless the losses are big enough to use up this energy, we shall get oscillations.

Let us suppose we have a certain amount of power fed back in this way, and that it makes our tubes squeal. By adjusting the potentiometer so that it becomes positive enough then the loss through the grid can be made just to balance the energy supplied from the feedback with the result that oscillations will be damped out. Of course, a better way of preventing these vibrations is to reduce the capacity effect between grid and plate and so remove the cause instead of killing the effect.

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.