April 15, 1925
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RADIO PROGRESS

"Always Abreast of the Times"

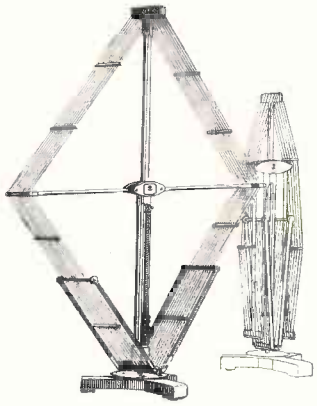
In This Issue

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

PUBLISHED TWICE A MONTH

TOBE C.
DEUTSCHMANN
Fine Radio DTW *Apparatus*

STATIC ELIMINATION



WITH the approach of summer, every radio fan looks with a certain amount of dread to the Enigma of Radio—Static. For more than a quarter of a century, scientists in many parts of the world have applied their knowledge and skill to the problem of eliminating Static. Most of their attempts have resulted in failure.

Science recognizes but one device capable of curbing the annoying electrical disturbances, and that is the loop antenna. Electrical storms, like other weather disturbances, find their origin in various points of the compass. It is obvious, then, that by the use of a directional loop turned to a direction away from the disturbance, the disagreeable static noises may be tuned out.

The superior construction of the DTW IMPORTED COLLAPSIBLE LOOP enables it to perform this function to much better advantage than other loop antenna devices. Forty-two inches high by forty inches wide, its inductance consists of fourteen turns of genuine Litzendraht cable, made up of sixty individual strands, insulated, twisted and covered with double green silk.

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RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2 Number 3

Contents for

APRIL 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.

These Will Interest You in Our Next Issue

Do you hate to get up on a cold morning? One fan wanted to follow the broadcast setting up exercises when the weather was warm, but on a cold morning preferred to sleep. He fixed his set so that it was automatic. See **"Weather Controls Radio Alarm,"** by Arnold.

The newspapers have recently carried various notes on the patents of Professor Latour. Apparently they underly many of the devices used in the popular sets. Will all the manufacturers have to pay royalty? This is discussed in an interview with C. O. Mailloux, **"Latour's Patents Control Radio."**

The women are showing as much interest in radio as men these days. It is not surprising that a new radio college for women is just being started. The details and a list of the courses are given in **"A New Radio College for Women."**

You hear a great deal these days about distortion and how to avoid it. Yet at times it is quite necessary. Do you understand this? Professor Wold gives a clear explanation in **"Distortion a Good Thing —Sometimes."**

Most of us use or expect to use some day, one or more vacuum tubes. As they are expensive, it is worth while taking care of them. Why do your neighbor's bulbs last twice as long as yours? You will enjoy reading Standiford's **"Keep Your Tubes in Good Health."**

Some years ago honeycombs were quite popular, but later went partly out of style. They are coming back again strong and a construction article on their use is timely. See **"A Selective Honeycomb Hook-up,"** by Taylor.

Radio has saved many lives by an SOS call for help. It is also a life saver for sickness on small boats. Read **"Radio, the Doctor On the Deep."**

To Radio Manufacturers

You probably wonder why RADIO PROGRESS does not carry more advertising? Two reasons; and both of them so unlike that of any other magazine that we hardly could expect you to know what they are.

FIRST. Because we did not send several advertising salesmen out to sell space to you. You know a good salesman who makes enough calls can sell almost anything he wants to. Witness, the space you have probably bought in some radio or other publications which did not bring results, because they were too new, were not established, had insufficient editorial influence and low reader-interest. But, RADIO PROGRESS is unlike any other radio magazine.

SECOND. And this dove-tails with Reason Number 1—We knew that it would take one year for any kind of a magazine to build a permanent, intimate, worth-while reader-clientele, a year to develop and maintain our editorial influence and a responsive, buying-power amongst our subscribers for your products. (Very few good advertising agents will recommend a new publication to their clients until it is over one year old. Ask yours if this is not true.) So we took a year to do it in, and that we have succeeded, is proven by hundreds of "love-letters" from our readers, which will be published in our next issue.

Now we are ready to solicit your Advertising, with the knowledge that we have prepared a productive market for you. One which is sure to make your advertising so profitable that RADIO PROGRESS will carry your announcements for years to come.

Our Advertising Manager will be glad to quote you our low rates and explain our unique service.

Bolster Up Your Summer Sales By Advertising in Radio Progress

RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. 2, No. 3 APRIL 15, 1925 15c PER COPY, $3.00 PER YEAR

The Inside Story of Resonance

You Carry it Around with You in Your Watch

By HORACE V. S. TAYLOR

WHY is your watch like a radio set? This looks like a conumdrum, but there is a real answer to it as this article will explain. The same principle that makes your watch keep time is what lets you pick up New York, or Chicago, or San Francisco.

The name of this principle is a word which you often hear these days in radio magazines—resonance. It is a nine letter word meaning to keep time. We all like to keep time. When the music plays and we march down the street or in the dance hall we keep in step with the music we are doing exactly the same thing a violin string does when it hears the right note played.

Singing Into a Bottle

In such a case the string will start to vibrate. If we have a musical instrument and it is tuned to a certain note it likes to hear that note played and responds to it just as our feet respond to a lively piece of jazz. In the same way if you take an empty bottle and blow across the neck of it with your breath, it will give out a hollow sound at a certain definite note. This note is the one at which the bottle happens to resonate. If you sing the particular tone to which the bottle is tuned it will amplify this sound tremendously, but if you sing any other note the bottle acts entirely dead.

The way this principle is applied in your own pocket is shown in Fig. 1. If you have ever had the back off your watch you will recognize the balance wheel which oscillates back and forth first spinning a half turn or so to the left and then the same distance to the right. It keeps this up hour after hour until the main spring, which furnishes the energy, has run down.

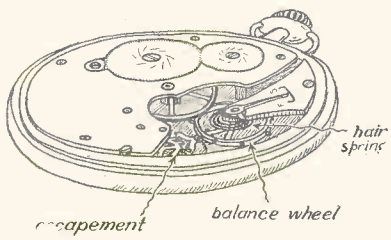


Fig. 1. If it Were Not for Resonance Your Watch Would Stop

What Makes a Watch Go

Attached to the shaft of the balance wheel is a fine hair spring. This by the way is the most expensive steel in the world as a pound of hair springs is worth thousands of dollars. This spring returns the balance wheel to the center position after it has swung away in either direction. The escapement pushes the balance wheel slightly in one direction or the other and it in turn is oscillated by the escape wheel whose teeth bear first against one prong and then against the other.

All this may be seen provided your watch has run down enough so that the motion is not too great to escape your eye. In other words, when the main spring is wound up tight the balance wheel spins back and forth through a large arc, while when it is nearly run down the amount of oscillation is slight.

An interesting experiment may be performed with a watch which has had the balance wheel removed. We do not advise you to try it with your own time piece, but you can take our word for it that it is true. After the balance wheel has been taken away, get a tooth pick and wiggle the escapement lever or pallet back and forth slightly. You will notice that the mechanism of the watch tries to push your tooth pick first one side and then the other. The amount of pressure, however, is very slight indeed—so small that you can hardly feel it. Now replace the balance wheel with its hair spring. Push the wheel around by pressing against the little pin which keeps meshing with the pallet. Do not push against the outside or rim of the balance, as this would not be fair. The pallet can not touch the rim, but pushes only on the escapement pin.

Where Does It Get Its Strength?

When you turn the balance wheel back and forth by pressing slowly on the pin you will find that it requires quite a fair amount of push to make it turn half way round. As a matter of fact this pressure will be 20 or 30 times as great as that given out by the escapement, and yet in the regular running of the watch this same escapement is able to give the big motion. How can you account for it?

To get at this principle let us use the swing analogy which was discussed in these columns a month ago. Fig. 2

shows a boy swinging back and forth with a motion similar to the balance wheel of the watch. The escapement is replaced by the chap on the ground who gives the swinging one an occasional push. He presses on his back with a force of perhaps five pounds. As a result of this push repeated just at the right time the swing oscillates higher and higher until it reaches the position shown by dotted lines. After a while it stops going any higher but continues to vibrate back and forth as long as it receives these regular impulses of five pounds.

Making Five Pounds Act Like Sixty

Instead of working up the swing in the manner just described, what would have been the result if the boy on the ground had wished to make the swing occupy the position of the dotted line by

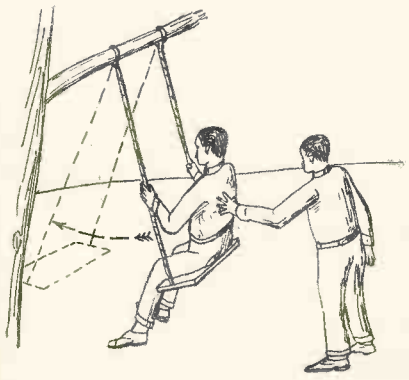


Fig. 2. Illustrating Team Work of Two Members

a single motion. He would have had to push the swing from the straight down position with a very considerable force, probably 60 or 80 lbs. This is just like the experiment described above, where we push the balance wheel around in a single motion with our toothpick. And in each case we find that by working the vibration up with a good many different small pushes we can get as great a deflection as we could by a single push twenty or thirty times as big.

In this case it is easy to see why such a result is obtained. When a single push is given to the swing the force of gravity causes the latter to try to return to the lowest position and we must overcome this force of gravity which is getting stronger and stronger all the time owing to the fact that the boy is swinging farther and farther away from the zero position. The same thing applies to the balance wheel of the watch except in that case it is not gravity but the hair spring which returns the wheel. The farther it is turned from the zero position the more the hair spring is wound up and so, of course, the stiffer it gets.

Wasted in Friction

When we remove the pressure which was holding the swing out then the same force which opposed us now returns the boy down to the starting point. But unless he suddenly runs into something he will not stop but will swing up in the opposite direction for quite a distance. He can never travel higher on the return stroke than he went on the forward one. Indeed he can not quite reach the same height since some of the energy which the pusher gave him has been lost in overcoming friction.

This friction is of two sorts. One is that of either bending the rope or making it slide around on the hooks or the tree limb and the other is the friction through the air. By using ball bearing hooks instead of letting the rope rub around the tree limb we can reduce the first source of friction and this will allow the swing to continue its oscillation for a longer time after it gets no more impulses. Naturally, this friction can not be reduced to absolute zero.

Clocks Don't Need to Breathe

If the boy could be persuaded to swing back and forth in a vacuum (which would be bad for his health) we would also find that the absence of air losses would also allow a longer motion before coming to rest. This can be proved by allowing a pendulum to swing in a glass jar in the laboratory. By exhausting the air out of the jar it is found that the motion does not die out so fast. That is the reason why astronomical clocks, which are used to keep the most accurate time in the world, usually are sealed into an air tight case and a vacuum maintained inside for the pendulum to swing in.

When the chap on the ground wants to work up a big amount of oscillation he will give a push to the other fellow when he gets to the right place and keep repeating this over and over again. In this way the swing goes higher and higher because he does not use his own strength only, in making the other fellow move but depends on the force of gravity to help him out. So in the watch the pallet is able to push with perhaps 1-50th of an ounce. This is not enough to make the balance wheel move any real distance. However, by adding on the return stroke which is given by the hair spring the combination of the two is big enough to make the wheel turn almost a whole revolution.

Where Team Work Counts

Notice that the whole idea of this action depends on the proper timing of the impulses. If these are given in a haphazard way they will not work up any real oscillation. The reason is that sometimes the pushes will help out the

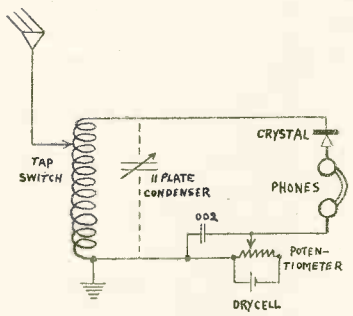


Fig. 3. Why Resonance Separates Two Stations

forces of gravity and at that instant the oscillations will be increased. A little later as the impulses happen to get out of step they will oppose the outside force and in that case they will diminish. To get up a big vibration it is necessary to have team work between the two sets of forces.

To get this team work and bring the two into "synchronism" as it is called, you can easily see that we may vary the timing of the swing to meet the pusher or of the pusher to meet the swing.

To do the first of these let us assume that the boy on the ground takes out his watch and decides to push the other one once every 4 seconds. As the second hand on his watch reads, 4, 8, 12, 16, etc., seconds, he will give a push no matter what position it is in. Then to get the proper timing let us vary

the length of the swing rope by attaching it to a higher or lower limb. The longer we make the rope the slower will be the vibration and to increase the speed or frequency, we must shorten the rope. If we get it just the right length (which will be about 15 feet, for this speed), then the swing will have its natural time or period of vibration to correspond with that of the impulses and the oscillations will be large.

Picking Up Atlantic City

This is what we do in a radio set. We wish to pick up a station like WPG, Atlantic City, which has a frequency of one million swings per second (300 meters). If we vary the length of the wire in the set (which corresponds to the length of the rope) we can speed up or slow down its natural period. Of course, a similar result can be obtained by adjusting a tuning condenser. The point is that we must make the radio set *want* to oscillate back and forth at just the frequency at which WPG is pushing-in the same way that we altered the swing so that it wanted to vibrate at the exact speed the boy was pushing. When either of these actions occurs the motion becomes large. We can *see* this motion in one case while in the radio we can *hear* it.

The simplest way of illustrating this action in radio is shown in Fig. 3. Here we have a coil in series with the aerial and ground. This coil is adjustable for turns by a tap switch. It is tuned by a 11-plate condenser. The crystal detector rectifies the radio waves or reduces them to audio frequency, after which they run through the phones. This hook-up can be operated on a loud local station even if the condenser is disconnected, but by being able to tune it much better results will be had.

Crystal Set Like Swing

Suppose you are using it and wish to bring in a certain station. Its wave will vibrate at a certain speed or frequency. By adjusting the circuit (varying the capacity of the condenser) so that the set naturally vibrates at the speed of the station you wish to pick up, you will get the two pulling together in team work just as our two fellows did in Fig. 2.

The other way of accomplishing this team work as has already been mentioned is to vary the timing of the pushes. That is much easier to do when we have a swing, as illustrated. It accomplishes the results just as well, but, of course, that scheme can not be used in radio receiving sets since the pushes are the radio waves coming in and their frequency has already been fixed by the time they reach our aerial.

However, the broadcast station uses this latter method of adjustment. The Department of Commerce, at Washington, assigns the various wave lengths and says to Station WPG, "You must radiate energy at the exact speed of one million oscillations per second (one thousand kc.)," so the engineer on the job varies the lengths of his wire (or else his condenser) so that a wave meter designed to measure this frequency, points to 1,000 kc.

Fig. 4. Smooth Modulation of Code Letter "D"

Increasing Twenty Times

One other question naturally comes to mind. That is, just how much more of a swing can we expect in a case of proper timing (resonance) than we get with a single push of the same strength? You will notice that in this article we have mentioned that with a swing it may be 20 or 30 times as great. Why would this vary? The answer may be found in the amount of resistance of losses which the motion has to overcome.

You can easily see that the energy lost in friction depends on the amount of the motion. Thus when the swing first started the rope slipped only a little on the limb and the air currents stirred up by the clothing of the boy were also small. When he had worked up considerable speed the rope slipped quite a lot more on the limb and the fanning action through the air was very much greater. Both these losses represented a certain definite amount of energy wasted. By "wasted" it is meant that it did no good in making the swing run higher. Where did this wasted energy come from? Its only source was the arm of the boy who did the pushing.

We are now able to see what the law of this motion is. Suppose we represent the energy by figures corresponding to the force which the pusher uses as he sets the oscillation going. That is, we have an energy of 5. The boy on the ground continues to give this same energy of 5, timing it accurately at the proper instant. When he first begins to push gravity does not help him at all in returning and so the first deflection from the zero point is quite small. For that reason the losses are very small. That is why 1 pound of energy goes to supply the losses and the balance, 4 pounds, are used in speeding up or accelerating the motion of the swing.

To be exact, energy should not be measured in pound units. But we will call it that as being an easy way to understand the reasoning. On the next swing, since gravity is now helping, the amount or amplitude of the vibration will be considerably more, and this time 2 pounds will be used up in slipping the rope on the limb and fanning the air. That leaves 3 of the original 5 for still further increasing the swing's motion.

When It Stops Climbing

Of course this 3 pounds of energy make the swing go still higher, which still further increases the losses. This action continues on and on, until pretty soon the vibration is so large that 4½ pounds are used in overcoming the friction. Only ½ pound is then left for further pick-up. You can easily see that at this point the increase in further motion is very slow. In other words, the swing has got up pretty nearly to its highest point. It continues to crawl, however, until the whole 5 pounds which the pusher supplies are all used in overcoming friction. As there is nothing else left over, naturally the swing will not receive any further increases. Instead, it will continue to oscillate with this amplitude just as long as the pusher keeps on supplying the five pounds of energy.

From this we can state the law that a vibration keeps increasing until the energy used up in losses just balances the amount supplied in exciting it. If we want to get more vibration, then we must increase the input of the pusher or else must reduce the friction of the vibration. Such a way of reducing the swing friction is to oil the hooks or to reduce the air pressure as has been ex-

Continued on Page 8

Portrait of Popular Performer

Maria Carreras, pianist of international fame, who broadcast her first radio recital through WJZ, Saturday evening, April 11th. Mme. Tetrazzini, the opera star and a close friend of Maria Carreras, listened to this recital in her home in far away Italy.

INSIDE STORY OF RESONANCE

Continued from Page 7

plained. The method in a radio set is to use low loss condensers or other parts.

Getting Still More Height

Thus if we suddenly oiled the swing which we left vibrating, in the next to the last paragraph, it would immediately cut the losses *at that height* to say three pounds. This would liberate two for further increasing the motion, and as a result the boy would once more go higher and higher until the losses at the new increased motion again equalled the input (5 pounds).

In conclusion, it is well to call attention to the fact that although the *height* of the swing's vibration and the *velocity* with which it moves through the air keep increasing with greater excitation, still, the *speed of oscillation* is the same whether it goes only a short distance back and forth or a long one. In our illustration it takes 4 seconds with the 15-foot rope for one vibration, whether the amplitude is big or little.

This seems like a very strange fact, but on it depends the accuracy of your watch. If when it was wound tight it ran fast, and when half run down, the seconds ticked off only half as fast, what use would it be as a timepiece.

And by the same law when your radio set is tuned to 1000 kc., it keeps in step with the wave of that frequency, whether it is a faint one coming from a long distance, or a low one from a local station.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Radio Progress, published semi-monthly at Providence, R. I., for April 1, 1925.

State of Rhode Island, County of Providence, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared John F. O'Hara, who, having been duly sworn according to law, deposes and says that he is the owner and publisher of the Radio Progress, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, John F. O'Hara, Box 728, Providence, R. I.; editor, Horace V. S. Taylor, Box 728, Providence, R. I.; business manager, John F. O'Hara, 8 Temple Street, Providence, R. I.

2. That the owner is: John F. O'Hara, 8 Temple Street, Providence, R. I.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN F. O'HARA.

Sworn to and subscribed before me this twenty-eighth day of March, 1925.

(Seal) ELIZABETH O'HARA,
Notary Public.

(My commission expires June 30, 1926.)

Prize Radio Song of America

Here is Your Chance to Win A Fat Royalty

DO you like all the music which you hear over the radio? Very probably not, as some people complain of too much grand opera, which they say lacks any tune, and others object to some of the low grade "popular" songs.

It is a remarkable fact that a great country like ours lacks a National Song, which is generally approved. "The Star Spangled Banner," is often objected to as having poorly written words (O, say can you) and a subject dealing with war. The music has such a large range (nearly two octaves) that many people get lost either on the low or on the high notes. Of course, there is "America" too, but this is really England's National Song, "God Save the King."

Radio to the Rescue

Radio is having such a wonderful influence on the musical ears of broadcast listeners, that it seems quite appropriate that some of the prominent stations are making an effort to develop a new National Anthem. Of course, the first requirement is the music itself. Fortunately, that has already been found.

One of the most remarkable cases of musical talent on record in the United States is the writing of this patriotic melody by a 13-year old Pittsburgh boy. It has received such high praise by musicians that KDKA, Pittsburgh, and its sister stations KYW, in Chicago, WBZ, in Springfield, and KFKX at Hastings, Neb., operated by the Westinghouse Company will conduct a national contest to obtain words to fit the music and thus obtain a new patriotic song.

The melody, written by 13-year-old Robert Saudek, has been the first to qualify as a "song of the people" in many years. Musicians state that the folk song is one of the hardest of compositions to write. It seems that the more experienced and talented a musician becomes, the more difficult it is for him to produce a melody that has the required simplicity. It has remained for young Saudek in the freshness of his youth to produce a clean, sparkling melody, unhampered by technical difficulties which might suggest themselves to older musicians.

The Barber Shop Quartette

The melody as written contains every qualification of the ideal patriotic song. On account of its simplicity and easy range, the tune is within the register of

This is the Composer of the Prize Song—Robert Saudek

the average voice and it is, therefore, "singable." One of the reasons for the popularity of the distinctive folk songs of America lies in their "singability" as musicians term it. Young Saubek's composition has this quality to a very marked degree.

It will appeal just as much to the barber shop quartette that specializes in close harmony as it will to a big patriotic gathering of people, who want to sing something before listening to the Fourth of July orator.

KDKA started the contest for words to this melody Sunday, March 29, at the 2:30 P. M. concert by the Westinghouse Symphony Orchestra. This was the first time the melody was played by radio, and those listening in had an opportunity to judge its qualifications. During the following week the melody was played periodically and a distinctive announcement made prior to each rendition to enable the radio listeners to familiarize themselves with all details of the contest.

How to Get Your Copy

Three verses are required for the melody and these must be of a patriotic nature. To those writing to station KDKA, a copy of the music will be sent free, in order that those who want to compete in the contest may be able to fit their verses to the music. Details of the contest will also accompany the music sheet.

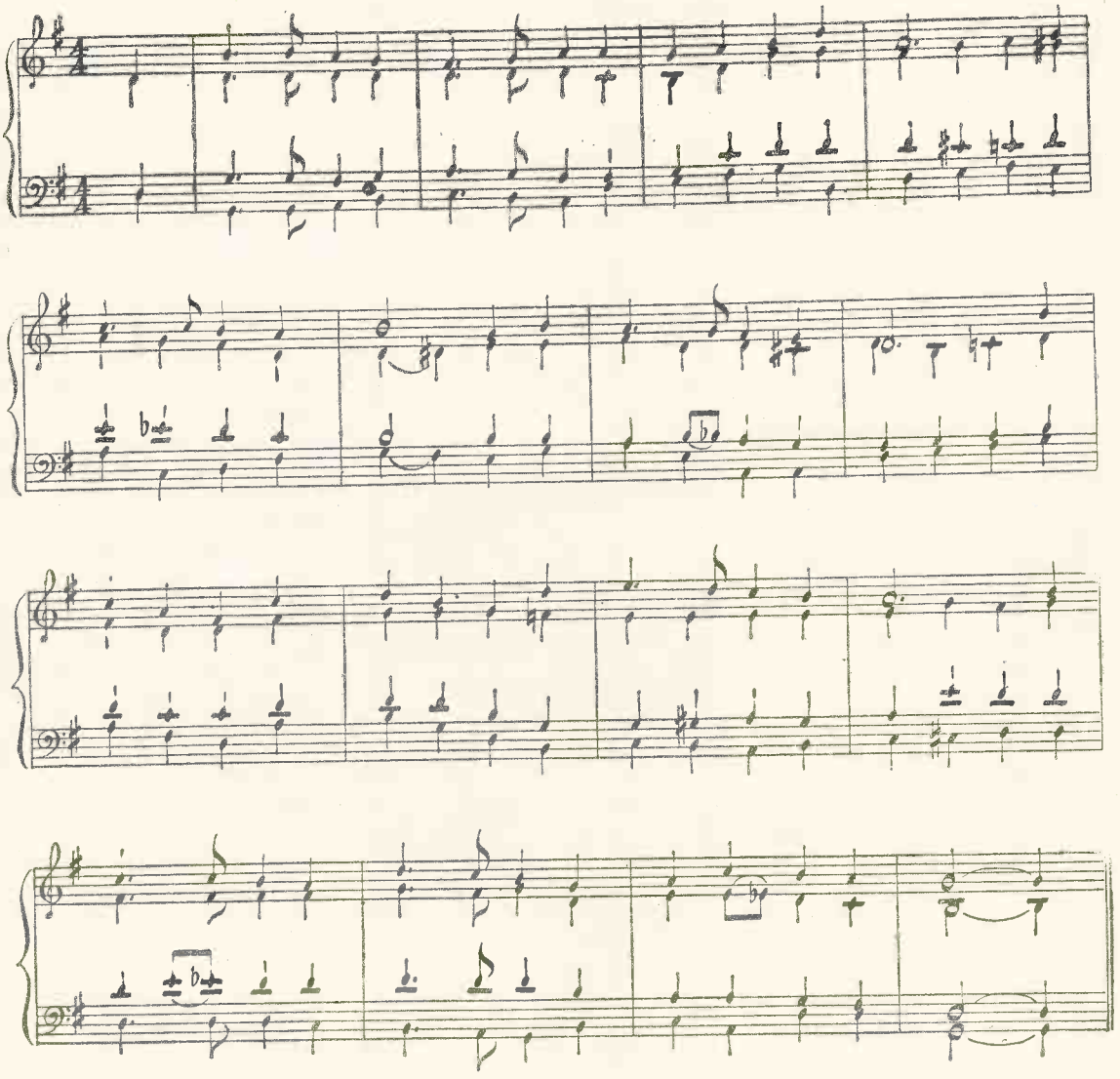
The author of the verses which are chosen by the judging committee as being the best will share in the royalties which may accrue from the sale of the song after it is published in its complete form. Arrangements have already been made to make phonograph records of the song by one of the leading phonograph music companies of America. It will be published by one of the largest publishing houses of the world.

Splitting Up the Money

Perhaps you have felt a secret desire to write songs, as you no doubt believe you can do better than some of the verses that have recently been sung. Of course, the trouble is to make a start. The publishing houses are naturally somewhat partial to their own writers, and very likely you feel that it is impossible for you to get an unprejudiced hearing for your first attempt. But here is a chance for you to spread your efforts

Song of America.

Robert Saudek



If You Can Fit the Best Words to This Music, You Will Attain Fame and Fortune

before the eyes of impartial judges who will not be biased against you in any way. And think what a reward you will get. When the royalty money is split up you will be among those present.

"A song of America" is the title given to the melody, and this has been approved as suitable for a patriotic song by William Mengelberg, conductor of the New York Philharmonic Orchestra and recognized as one of the world's foremost musicians; Dr. Will Earhart, President of the National Supervisors of School Music, probably the most outstanding figure in American School Music; Harvey B. Gaul, nationally known composer and writer; and Richard Kountz, one of the most promising and active of America's younger composers. These endorsements came spontaneously and were not asked for. The idea of having the words written in competition by the people of America with the added incentive of the

Continued on Page 16

A Non-Radiating Superhet

A Compact Eight-Tube Set for the Distance Hound

By R. B. WILDER

HOW much rent do you pay for your house? If you are living in the city, close to your neighbors, you are doubtless paying more than if your dwelling is out in the country. And if by chance you live in a modern apartment house, the closer you are squeezed to your neighbors the more it is probably costing you. Such high rents show that there must be many advantages derived from living near your neighbors. One of them, however, is *not* that you can enjoy radio more.

Indeed it has reached the point where apartment dwellers are finding it hard to get much pleasure out of broadcast programs. Not only is it difficult to get a place to put up an aerial, as this can be got around to some extent by using a loop set, but worse than this there is the terrible amount of squealing and cat calls which operators of single circuit sets are continually shooting into the air. As has been pointed out time and again, there is no way to avoid picking up these squeals when they have the same wave frequency as the station you are trying to get.

One fact stands out clearly among the things that we can predict for the future of radio. Either the type of receiving sets in use must radically change or the fans must learn how to operate their radios in such a manner so as not to create interference with surrounding receivers.

Why the Squeals are Bunched

To listen in some evening in the crowded residential districts of any large city you will be amazed at what you hear: squeals and howls surround the location of every distant station. The reason you find that the squeals on your dial cluster around the setting for a popular station is this. When an operator has his set oscillating, he will transmit his radiations just like any broadcasting station at the particular wave speed he happens to be tuned in on. Owing to the fact that this tuning dial is probably not quite accurately set at the exact kilocycle or wave length which he is trying to pick up he will cause the disturbance in your receiver when you turn your dial nearly to that spot. The popular stations will have several fans in the neighborhood who are all trying to get the same wave and so you will find a lot of squeals all bunched together. Of course, this destroys your fun. Either the squeals must go or the enjoyment and pleasure of listening to distant stations will be taken from all of us.

Most of the blame for this condition has been foisted upon the owner of regenerative receivers. If the truth were known, improperly neutralized neutrodynes and poorly balanced superheterodynes are in many cases causing more trouble than regenerative sets. At the same time, their owners are in the happy frame of mind that *their* receivers can not possibly be the cause of any disturbance.

Hunting a Remedy

For the good of the whole future of radio, it behooves each and every one of us to tune our sets with consideration for the other fellow, or else build sets that cannot cause interference even if improperly handled. A great many superheterodyne receivers can be classed among the worst offenders and the worst squealers.

This type of superheterodyne positively will not radiate energy and interfere with other sets. In addition, the receiver will be capable of bringing in stations with loud speaker volume from distances up to 1500 miles with a loop aerial.

The first tube, shown at X-2 in Fig. 1, amplifies the radio frequency before passing it on to the second. It also does double duty by amplifying the audio frequency just after it leaves the detector tube X-1. Besides its function as radio and audio frequency amplifier, it also has the effect of preventing oscillating energy from being fed back into the loop and so makes the set absolutely non-radiating.

An Oscillating Detector

The second tube X-3 also plays two different parts. It acts as a detector and also as an oscillator Here the vibrations are started which react with the incoming waves and form the beat notes which the detector rectifies in the ordinary way. Owing to the adjustment of the parts this rectified wave has an intermediate frequency, depending on the design of the intermediate transformers. Somewhere between 50 and 150 kilocycles is an ordinary value for this intermediate speed of vibration. This particular set works well at about 130 kc. (2200 meters).

The next three tubes, X-4, X-5, and X-6, are the conventional intermediate frequency amplifiers. They take the output from the first detector X-3 at 130 kc., and increase the volume (loudness) some hundreds of times. Their output is impressed on the second detector X-1, which reduces the wave speed down to audio frequency. These audio waves are then reflexed back through the first tube X-2, as has been described and the output can be taken off at jack J-1.

Transformer or Resistance Step

If further amplification is wanted to work a speaker then it is plugged into jack 2, which adds two stages of resistance coupled audio amplifiers. Of course, a single step of transformer coupled amplification might be used instead. The advantage of the former is that less distortion is caused provided the set is properly adjusted.

Two dials are used in tuning the receiver and the settings of one closely follow out the other. This makes for simple tuning and a positive logging of the stations. Like all good supers once a station has come in at a certain place, it will repeat indefinitely and so to find out whether your favorite is going all that is needed is to adjust your two controls, condenser C-1 and C-2 to the readings which you had last week or last month and if it is running it will come in.

While at first glance this may seem to be a complicated receiver, by following the picture wiring diagram, Fig. 2, in conjunction with the hook-up diagram

C-11, .0005 mfd. variable filter condenser.
T-1, Superheterodyne input transformer.
T-2, 3, and 4, Intermediate radio frequency transformers.
T-5, Radio frequency transformer, 200 to 600 meters.
L-1, Oscillator coupler.
A-F Audio frequency transformer, 3½ to 1.
X-1, 2, 3, 4, 5, 6, 7 and 8, Standard vacuum tube sockets.
J-1 and 2, Double and single circuit telephone jacks respectively.
R-1, 2 ohm rheostat.
R-2, Potentiometer, 400 ohms, (Amsco).

supported to the baseboard by means of small brass brackets. The whole receiver can be assembled on a panel 7 x 24", with a baseboard 9½ x 22¾ x 1½".

The receiver should be used with a loop which will cover the broadcast range when tuned with a .0005 variable condenser. UV-201A or C-301A types should be used throughout and it is suggested that you try shifting the tubes around in the sockets to find the arrangement that works best.

Turn the loop aerial in the direction of the station you wish to receive and slowly move both condenser dials over the scale until the signal from a station is picked up. Increase the setting of

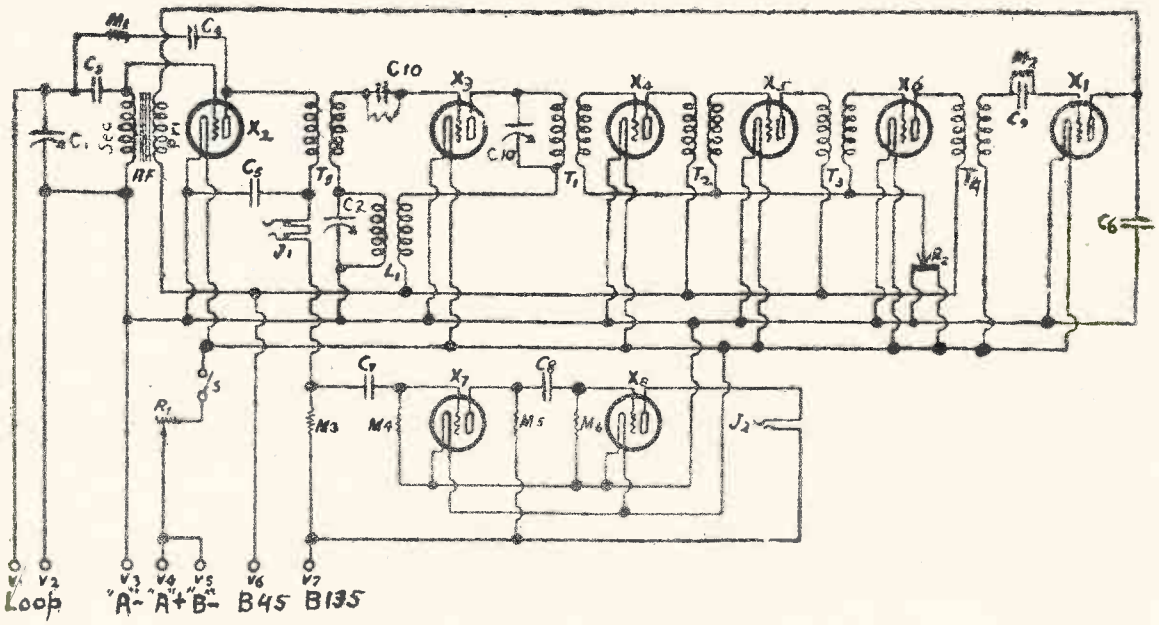


Fig. 1. One Reflexed Radio Tube, Two Detectors, Three Intermediate Steps, Two Resistance Audio Steps

anyone who has had even a limited experience in construction of radio rereceivers should be able to assemble the set without trouble.

To construct the receiver, you will need the following list of apparatus:

A List of Parts

C-1, .0005 mfd. low-less variable condenser.
C-2, .001 mfd. low-loss variable condenser.
C-3 and 4, .0001 mfd. fixed mica condensers.
C-5, 6, 7, and 8, .006 mfd. fixed condensers.
C-9 and 10, .00025 mfd. fixed grid condensers with grid leak mounting.
M-1, ½ megohm grid leak.
M-2, Grid leak (adjustable).
M-3, .005 megohm resistor.
M-4, ½ megohm resistor.
M-5 and 6, ¼ megohm resistors.
SW Filament battery switch.
V-1 and 2, Loop binding posts.
V-3, Negative "A" battery.
V-4, Positive "A" battery.
V-5, Negative "B" battery.
V-6, Positive 45-volt tap on "B" battery.
V-7, Positive 135-volt "B" battery.

A Standard Panel Size

The seven binding posts are necessary for the loop and battery connections. These should be mounted on a bakelite or hard rubber binding post strip and the potentiometer and the variable grid condenser until maximum signal strength is received.

Where the Waves Start

The way the set operates is this. The loop picks up the oscillations and is tuned by condenser C-1. If your loop is a good one and the condenser really has low losses, this one adjustment together with the directional effect of the loop will make the set sharp tuning. The radio frequency waves travel through stopping condenser C-3 to the grid of the radio amplifier X-2. The other end of the circuit lies on V-3, which is the negative of the filaments. Notice that the grid has a small negative bias vol-

tage, applied from terminal V-3 through the secondary winding of transformer AF.

The radio frequency waves, much amplified, come out from the plate of X-2 and run through the primary of radio transformer T-5, stopping condenser C-5, back to the filament. This radio transformer must not have a peak transmission curve but must treat all frequencies in the broadcasting range from 500 up to 1500 kc. (600 to 200 meters) alike. The output from this transformer

What the Oscillator Coils Do

Notice, however, that there is another coil in this circuit. The oscillator L-1, is hooked up with its primary in the plate circuit of tube X-3 and its secondary in the grid circuit, as shown. Since condenser C-2 is connected right across its windings the secondary is tuned by adjusting the capacity. This oscillator causes radio frequency vibrations for the same reason that a single circuit regenerative set squeals, namely, the feedback from the plate is hooked to

be discussed in a later paragraph. From the output (secondary) of this transformer the intermediate frequency waves pass in succession through tubes X-4, X-5, and X-6. The grids of these three tubes have the proper bias voltage applied by adjusting potentiometer R-2. The output from the last of the intermediate transformers P-4, runs through grid condenser and leak to the second detector X-1. The high frequency from the output uses condenser C-6 to re-

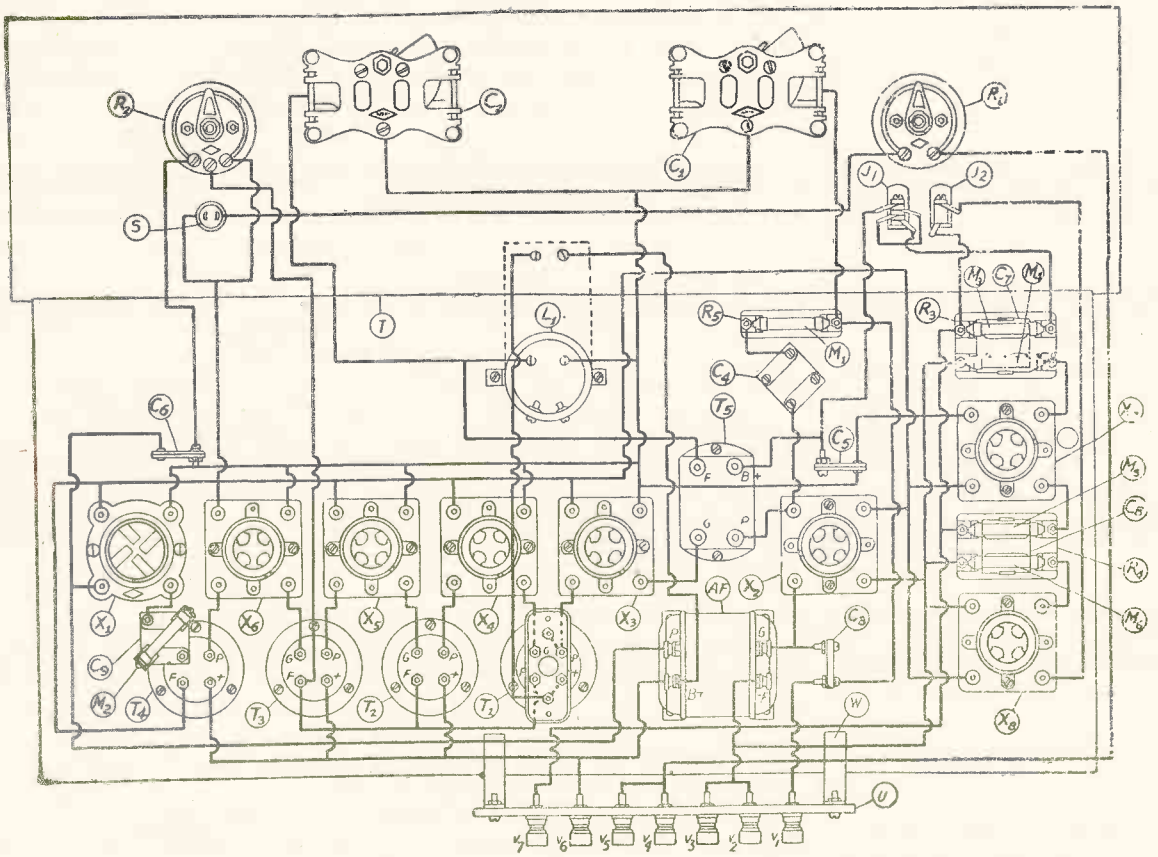


Fig. 2. Compact Arrangement of Parts. Panel Shown Above, Base Below

reaches the grid of the first detector X-3 through grid condenser and leak C-10. The condenser and leak may be omitted here, but it is an advantage to use them as in that case the action is not so critical. The other end of the transformer conducts the RF waves to to the filament through condenser C-2. The adjustment of this latter condenser has practically no effect on the tuning of the input waves since it is not in parallel across the transformer windings.

the grid with the ordinary regenerative action. Condenser C-1 is tuned to a frequency which is 130 kc., either above or below the speed of the wave you wish to hear. In this way the beat note which it gives out with the incoming station has an oscillation speed of 130 kc., and this intermediate frequency is what is fed to input transformer P-1.

This transformer has a condenser C-11 across its primary. This acts as a filter and should be adjusted once for all to work at 130 kc. This point will

turn to the filament, while the audio frequency travels through the primary of audio transformer AF to the "B" battery. Notice that the pressure of the "B" battery for this tube is 45 volts from terminal V-6. This same pressure is also applied to each of the amplifier tubes. In case you prefer to work the amplifiers at a higher pressure than the detector, then it will be necessary to use one binding post for a 67 or 90 volt "B" terminal. In that case, tubes X-4, X-5 and X-6, will run from a higher

"B" pressure, while detector X-1, will still be on 45 volts.

Loop, No Short Circuit

The output from the secondary of transformer AF is not short circuited by the loop, since that low speed of vibration can not pass condenser C-3. Instead its oscillations are impressed on the grid of tube X-2, which is thus reflexed with audio as well as radio frequency. The output from this tube threads the primary of radio frequency tube T-5 without being affected owing to the small number of turns and the absence of a large iron core.

The audio waves leave T-5 for the jack J-1. When a phone plug is inserted it operates this unit as usual. If the plug is withdrawn it would leave an open circuit in the ordinary jack, and so J-1 has the two middle contacts soldered together as shown. This allows the waves to pass through the jack without being affected whenever the plug is missing. From there the output current runs through resistance M-3 to the high voltage tap of the "B" battery. The drop in pressure resulting from M-3 is impressed on the grid of X-7 through stopping condenser C-7. This condenser is needed to stop the direct current from impressing a high voltage on this grid. Of course, if a transformer coupling were used for amplifiing the second step instead of the resistance, as shown, the ordinary connection of jack J-1 to the primary of the transformer would be used and the wire which now runs to the 135-volt terminal of the "B" battery V-7, would instead run to V-6.

The effects of the resistance coupled units X-7 and X-8 are just like those of any ordinary set. The final output from the receiver is obtained from jack J-2 in the plate circuit of the last tube.

Adjusting the Set

How to Make the Adjustments

This set is easy to control after it has once been adjusted correctly. To make the first adjustment it is necessary to get the proper values of resistance and capacity at several points. The best way to do is to tune to some local station at first so as to be sure to hear the signal coming through. First adjust condenser C-1, until it is loudest. This tunes the loop. Then change condenser C-2, until the station is again at its loudest point. Like all supers, there will be two spots on your C-2 dial where the volume will be greatest. One of these is 130 kc. lower than the frequency of the station you are picking up and the other is 130 higher. Either one of these may be used. It makes no difference which.

When it comes in well, the next thing to do is to get the right setting for condenser of C-1. This is a variable condenser which combined with the primary coil of T-1 makes a filter allowing only waves of the right frequency to pass into the intermediate transformers. Of course, the transformers, T-1, T-2, T-3, and T-4, must all have the same tuning point—that is, they must amplify the one wave speed only and all other waves must not increase materially in passing through them. If this point of amplification is 130 kc., then condenser C-11, must be adjusted to allow this and no other waves to pass.

Matching Filter to Transformers

There is no simple way in which you can check to see if the various transformers are correct for frequency, and so it is necessary to get these parts all of the same make manufactured by a concern who is known to put out good equipment. To match them to the filter condenser, C-3, it is necessary to try various settings of the latter and notice which one gives best results. However, you will need to readjust condenser, C-1, and C-2, for each change of C-3. Otherwise one of these units will be set for one wave and another for another, with the result that the signals will be poor.

Once you have got the best setting for the condenser, C-11, it should be left in that position and *never touched again*. With this adjustment it is tuned to your transformers, and since the latter can not be changed without rewinding, there is no reason why the filter should ever be readjusted. For this reason do not mount this condenser where it can be adjusted from the outside of the panel. Instead the whole unit should be inside the cabinet where it is hard to get at, and then it is a good idea to use a set screw to prevent the dial from being inadvertently turned.

If Signals Are Mushy

The next thing on the program is to try various resistances or grid leaks at M-1. The function of this resistance and condenser, C-4, is to feed some of the energy back from the plate to the grid, and so prevent this tube from breaking into oscillation. A grid leak of around half an ohm, which can be varied, is probably easier to adjust to the right value than it is to try out a number of fixed leaks. However, it is surer with a fixed leak that some visitor will not shift the setting and so throw out the adjustment of this important part. If resistance, M-1, is much too high or too low, reception is apt to be mushy and squeals will often develop in the set.

When the values have once been found and the adjustments made, then the only controls used in tuning are condensers C-1 and C-2. The first one, which tunes the loop is fairly sharp, but will allow a little interference to pass. Condenser, C-2, adjusts the oscillation frequency and so changes the pitch or speed of vibration of the intermediate frequency. Since it feeds its output through tube, X-3, to the filter circuit, its tuning is even sharper than that of C-1.

Working the Loud Speaker

When phones are to be used for tuning or listening to a distant station, they are plugged in to jack, J-1. To operate the loud speaker, J-2, is employed. Notice that even the first jack has the advantage of having one step of audio, X-2, following the detector, X-1. That is why the first jack gives loud signals, even on distant stations. J-2 will add two more steps of resistance amplifier, which is somewhat more powerful than a single step of transformer coupling. This is ample to give loud results on a horn.

Potentiometer, R-2, will not need very much adjustment. It is sometimes used as a volume control to reduce the great loudness of some local stations. When adjusted to get the maximum possible volume, there is danger that the intermediate tubes will break into oscillation. In such a case the remedy is to shift R-2 enough to prevent any squeals arising from this cause.

In conclusion, it may be said, that while this set is an ambitious one and justifies the use of good parts, it will perform very well and will give you the satisfaction of knowing that you can pick up stations as distant as any one can.

A Train Without An Engineer

Radio Accomplishes Train Control With No One on Board

By G. Y. ALLEN

OF course you are familiar with the new development in street cars—the one man trolley. Instead of the old scheme of having a man to run the car and another one to take up the fares, a single one is needed at the front of the car, who controls the speed when in motion and collects nickels (or should we say dimes) when the car is at rest.

Radio has now been developed to such an extent that one more step might be taken—that of dispensing with the motorman entirely. Through the use of modern developments in radio, it is entirely possible to operate electric trains from a central control office.

I do not wish to be understood as advocating the elimination of the motorman, conductor and crew, for no mechanical device however perfect, can take the place of human intelligence, but it is interesting to note some of the possibilities of radio control.

Shows Almost Human Intelligence

It is now entirely feasible, through combination of automatic relays and radio supervisory control, to start a train without any crew from a station, run it full speed over clear tracks, slow it down or stop it, in accordance with the signals of an automatic block signalling system, start it up again, when the signals clear, stop it at its next station-stop, and open its doors.

The supervisor at the central office would receive complete information by radio at all times as to the position and operation of the train; he could take personal charge of its operation at any time; and he could talk directly to the passengers to give them any desired directions.

Getting Waves Into Trolley

The radio features of this system are of the "carrier current" type; namely, radio waves which travel along the power lines of the railroad instead of spreading out through the ether as in ordinary broadcasting. This is shown in Fig. 1. The station where the train dispatcher works has a wire aerial which may be several hundred or a thousand feet long. It runs along the car tracks, and is supported a few feet away from the main power wire, which carries the electric energy to run the trains. Since it is parallel and so close, a wire of that length will transfer a large part of its radio frequency energy to the trolley wire.

Power Cannot Reach Radio

When these radio waves reach the trolley they go down the pole as shown in Fig. 2. The main power supply goes to the left through the speed controllers down to the motors. This speed controller is the manual device which is ordinarily operated by the motorman to start and stop the train. The high voltage power can not take the circuit to the right as condenser C blocks anything except high frequency current. However, the radio waves find no difficulty in passing the condenser, as shown

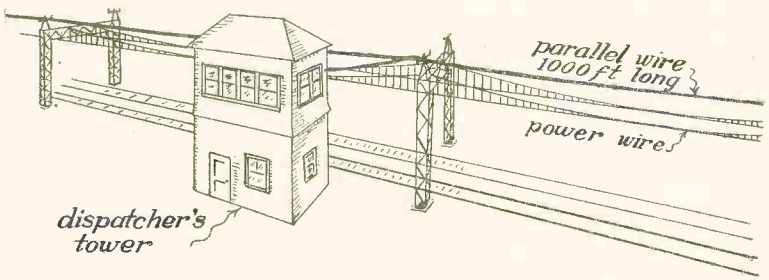


Fig. 1. The Dispatcher's Office Connects with 1000-Foot Wire

This is the sort of action which is often found in the home made set where two wires run parallel and close together. The difference is that in the latter case you do not want your radio waves to carry energy from one circuit to the other as such a transfer will not only weaken the signals because of the power lost, but also is likely to cause oscillations and squealing. In this train control scheme, on the other hand, it allows the central dispatcher to get his messages into the trolley wire and so to the train which he is controlling. Since the spacing of the wires is several feet there is no danger of the high voltage of the power line getting crossed with the aerial and so damaging the sending equipment.

by the wavy arrows. They go to a radio receiver and from there to ground. The ground consists of a contact rubbing against the shaft of the driving wheels of the train, which of course, rest on the iron rails.

The radio receiver is tuned to respond only to the wave speeds which the train dispatcher sends out. By using combinations of certain signals, he can operate the relays, which in turn move the controller handle just as if a motorman were driving the engine. By the the proper operation, the train can be started slowly from rest or can be speeded up rapidly as desired. If a block system is set against its motion it is brought to a sudden stop by an application of the emergency brake. By using this system, the waves can be directed

to any desired point and can be utilized to operate switches and other devices, as well as to carry on conversations. This system is now being used practically by electric power and street railway companies for controlling distant switches and for talking between any points on the system.

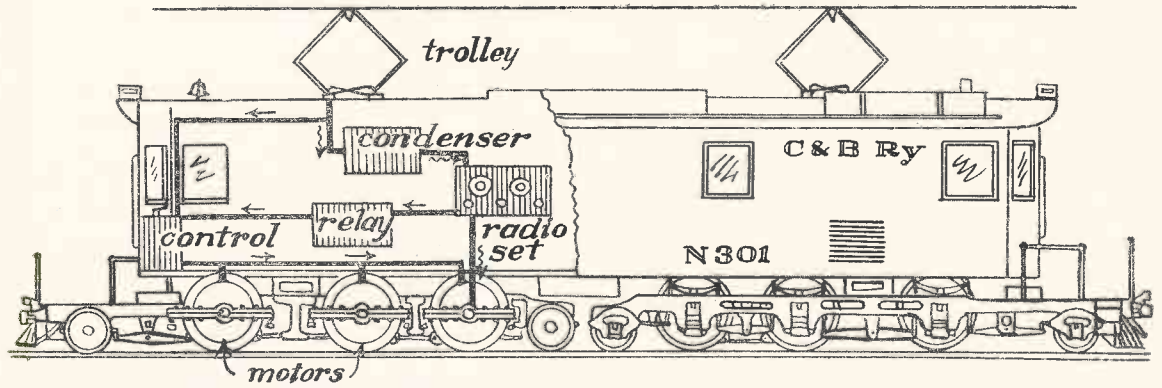


Fig. 2. How the Control Waves Find Their Way Around the Locomotive

Radio Phones for Freight Trains

An interesting railroad application of this system is its use on long freight trains. Some of these are upwards of a mile long and the ordinary methods of communication between the engineer at the head of the train and the conductor in the caboose at the rear, or the engineer of a pusher locomotive, become difficult to use. It isn't easy to shout for a mile, particularly if a storm is in progress. The older system is to use some sort of signalling by the waving of arms or lanterns. This is a slow process and is likely to be misunderstood. Carrier current radio telephones can now be installed on a train which makes communication between various parts of it as easy as between the offices in a building.

Fig. 3 shows the idea. A radio set is installed in the caboose as well as in the engine. But instead of the sender broadcasting waves to the community at large and so disturbing the concerts from the regular sending stations, the waves are confined to the power wire overhead. Since the waves do not branch out in all directions, but stick to the one conductor, it means that there is no danger of interference from static and a small amount of energy makes very loud signals at the other end of the train. When the engineer is ready to proceed instead of waving his arms to that effect, he merely calls up the flagman in the caboose and gives him his instructions.

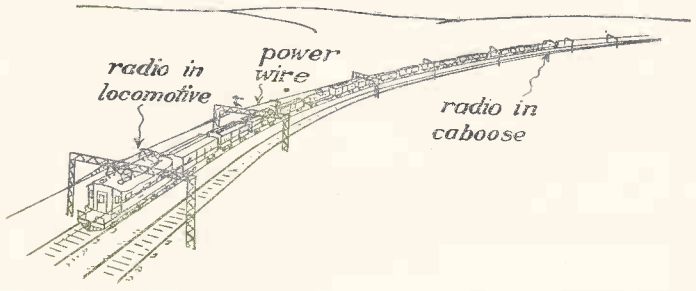


Fig. 3. The Engineer Can Talk to the Flagman in the Caboose

PRIZE RADIO SONG

Continued from Page 10

winner's sharing in the financial return from the sale of the song is new and compelling, thoroughly American, and of national import.

Song Publisher is Enthusiastic

This idea has the unqualified approval of William A. Fisher, one of the leading music editors, who represents one of the largest music publishers of the country, and is anxious to get the song before the American public as soon as possible.

Young Saudek is a pianist and has been a member of the Calvary Episcopal Church choir, Pittsburgh, Pa., under Harvel Gaul. The boy inherits his musical ability not only from his father and his mother, who is an accomplished violinist, but also from his grandfather, Emil O. Wolff, a nationally known orchestra leader.

The boy traces his ancestry back to Roger Williams, founder of Rhode Island and so he is eligible for membership in the Sons of the American Revolution. Thus his ancestry establishes his inclination to compose a patriotic melody.

Address your letter inquiring for a copy of the piece to Song Contest Department, Station KDKA, East Pittsburgh, Pa.

99 44/100 PER CENT. PURE

The weekly Monday evening concerts by the A & P Gypsy String Ensemble are now being broadcast simultaneously through seven stations, namely: WEAF, New York; WEEI, Boston; WCAP, Washington; WCAE, Pittsburgh; WJAR, Providence; WOO, Philadelphia, and WWJ, Detroit. During a recent program by these artists the announcer requested that the listeners-in voice their approval by written word and asked if they would also state whether they wished the type of their program to be changed. It was peculiarly interesting to note that ninety-nine and a fraction per cent. of the hundreds of letters received told the Gypsies to keep on giving them the same kind of program as before.

What the Old World Thinks of Radio

An Official Account of How Other Countries Do It

By B. D. DAHL, Department of Commerce, Washington, D. C.

HURRAH for America! That is undoubtedly the way you feel about your country in radio as well as in most everything else. Of course, you know that United States leads the world along this new science. In fact, it isn't a case of leading, but of being at the winning post before the others have much more than started. However, it is oftentimes interesting to see what the other fellow is doing and to compare the progress that some of the other countries have made along these lines.

During the last few years popular interest in radio has grown very rapidly not only in the United States but in most of the countries in the world. The resulting demand for broadcasting and receiving equipment has created a fine field for manufacturers and salesmen. At present this industry, although new, occupies a position of real commercial importance.

$6,000,000 Sent Away

The output of American manufacturers of radio material exceeds that of any other country in the world. But other nations are also actively engaged in this business, and it has reached varying degrees of commercial importance, notably in several European countries, and in a few of the South American Republics. American radio manufacturers, in addition to supplying the wants of the United States are active in the exportation of their products. That they have been successful in satisfying foreign users is shown by the increase in our exports of radio apparatus from $378,806 in 1918 to slightly over $1,000,000 in 1921, increasing three-fold by the end of 1923, and during 1924 reaching a total, according to preliminary figures of $6,030,914.

Europe and Canada, although they have developed a considerable domestic industry, are our best foreign markets for radio equipment. Sets and parts of American origin have a good name in these markets, and sell on a quality basis. It can reasonably be expected that our exports to these areas will continue to increase.

The following survey based on numerous reports submitted by foreign representatives of the Department of State and the Department of Commerce, discusses the radio situation.

BOOKS BY AIR

A literary adviser for various leading publishing houses has recently been giving some international book reviews. This is Dr. Clifford Smyth, who is also a journalist, newspaper, and magazine editor. Next to reading them yourself, the reviews which Dr. Smyth has been broadcasting, give you the best idea of what is going on in the literary world.

The Islands of the Azores

There are as yet no local broadcasting stations in the Azores, and it is not expected that any will be constructed in the near future. As the nearest station is Lisbon, Portugal, approximately 1,000 miles distant, high powered receiving sets are necessary on these islands. There are, at present, only a few radios in operation in St. Michaels, the principal city, but the government has, since lifting the ban on receiving sets, encouraged their installation and use. Consequently, this market should develop somewhat in the near future.

Belgium

The Belgians show considerable interest in radio, due, very likely, to the ease with which they can pick up the nearby broadcasting stations in France, Germany, the Netherlands and England, in addtion to those in Belgium. Therefore an expensive receiving set is not needed in order to reach sufficient broadcast material to satisfy the average listener. The sale of radio sets and parts in Belgium is largely determined by price, which, at present favors Belgian and French manufacturers. There are, however, several American receiving sets in use and they have in general been found more satisfactory than those of our competitors, but the higher price of the American product is against its extensive use in Belgium. This unfavorable condition is, at the present time, augmented by the existing rate of exchange.

Do Not Live in Bulgaria

The importation, sale and use of radio receiving or broadcasting apparatus is prohibited by the Government. Aren't you glad you don't live there.

Czechoslovakia

Radio is very popular in Czechoslovakia, but the market is at present restricted to the wealthier class of people. An attempt is being made by Czechoslovakian electrical manufacturers to supply the domestic demand, but there is, nevertheless, some importation of parts. The government requires that those desiring to import radio sets and parts must procure an import license, which costs five per cent. of the invoice value, from the Minister of Commerce.

France—Nice Reception is Poor

Reports from various parts of France reveal that the development in the use of radio receiving sets is not uniform throughout the Republic. In the neighborhood of Calais, American receiving sets of the lower priced type meet with a great deal of favor and are in general use, while in the vicinity of Nancy radios are practically unknown. In Nice reception is reputed to be very poor and there are only two sets in use, these being employed for publicity purposes. In the vicinity of La Rochelle, however, considerable interest is manifested in radio and it is estimated that there are 400 receiving sets in operation. Most of them are of French manufacture.

Germany

Receiving sets and parts of German manufacture, although in some cases showing faulty mechanical construction and lacking many of the refinements displayed in American sets, dominate the domestic market. The importation of complete sets and parts is permitted but an import license, which is quite difficult to obtain, must first be produced from the government.

Great Britain

It is estimated that there are approximately 1,200,000 receiving sets in operation in England at the present time. Interest in radio is widespread and continually increasing and an expanding market should result.

Prior to January 1, 1925, at which date the ban was lifted, an applicant for license to operate a receiving set could obtain it only on the condition that he would agree not knowingly to use a set manufactured outside of Great Britain, Northern Ireland, the Channel Islands, or the Isle of Man. As a result of the removal of this ban, it is expected that the importation of low priced tubes, telephones, transformers and other parts, as well as complete crystal sets will increase considerably. As regards tube sets, it is understood that the patents held by the Marconi Company will, in effect, prohibit their importation. This company holds English patents on basic inventions.

Buying Tubes Cheaply

Considerable radio material, chiefly of Continental origin, has been placed on the British market at prices considerably below those asked by British manufacture. German, Austrian, Dutch and French tubes, for instance, can be purchased in London at prices ranging from $1.06 to $3.63, while British tubes are listed at $2.93 to $7.00.

American manufacturers should keep in mind that in addition to meeting the competition of other foreigners as well as that of low priced British sets, they must also arrange satisfactory means of marketing their products. This is necessary because the leading British makers of radio apparatus, through their National Association of Radio Manufacturers, have declared that they will not supply dealers in England who also represent foreign firms. It appears, therefore, that Americans desiring to establish a demand for their radio sets and parts in that country would get the best results by establishing branch houses rather than dealing through British representatives. An import duty of 33 1/3 per cent. ad valorem is exacted on radio tubes imported into England, but radio parts are admitted free.

The demand for radio sets and parts in Scotland is determined largely by price and for this reason, purchasers prefer British, rather than American equipment. The Scotch, you know are always thrifty.

Ireland.

The radio ban was lifted in the Irish Free State about a year ago. There is considerable interest in radio. In general, however, dealers in the Irish Free State import parts rather than complete sets, and assemble them for their customers. British and German competitors must be met in this field and up to the present the chief factor militating against the sale of American radio apparatus is its price, which ranges from ten to twenty per cent. higher than that of competitors.

Netherlands.

Regulations which will place broadcasting on the same general system as is used in Great Britain have been adopted in the Netherlands. A broadcasting monopoly will be given to a company which will also be empowered to collect fees from receivers.

There is a considerable market for radio parts in the Netherlands, but the demand for complete receiving sets is rather limited because most purchasers prefer to build their own equipment. In some cases dealers also make receiving sets to order.

As is true in Belgium, long range receiving sets are not imperative in the Netherlands because of the proximity of numerous broadcasting stations. Dealers in Holland state that sets of American manufacture, although well adjusted to the fixed wave lengths of American broadcasting stations, are not usable in Holland without considerable adjustment. American manufacturers should bear in mind that the sets in use in Holland should reach to 60 kilocycles (5,000 meters.)

Norway—More Than One Paper Crown

Norway's first broadcasting station, located at Oslo, was opened December 15, 1924. There was considerable interest in radio among the Norwegians prior to the opening of the Oslo station because they could receive the material broadcast from neighboring countries. The opening of this station, however, increased this interest and subsequently the demand for receiving sets and parts. The person of average income is more favorably inclined toward one and two tube receivers rather than the larger models, and consequently the former are, and very likely will be, in greatest demand. Norway maintained an import tax of 1.68 paper crowns per kilogram on radio sets and loud speakers.

Spain.

As is true in France, the development in the use of radio receiving sets varies considerably throughout Spain. Around Malaga the radio market is very limited, while in Seville there are several sets in operation. The making of sets at home is very popular in this region, but there are also a considerable number of Italian, French and American receivers in use, the sale of the former being very actively pushed by local dealers. It is reported that in the neighborhood of Valencia, reception is rather unsatisfactory, due, possibly, to poor electrical installations.

Canada.

Canada offers a very good market for radio equipment of American manufacture. That the widespread interest in

Continued on Page 30

A Low Cost Receiver Transmitter

How to Make One Tube Talk as Well as Listen

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

MAYBE you are one of those people who like to buy vacuum tubes. Then again, maybe you are not. If you aren't particularly excited about spending $3.00 for a bulb, then you will be interested in a way to make a single tube do the work of two.

The writer has perfected a receiver and transmitter that uses the same vacuum tube for both purposes. Although not new in principle, it has been rearranged to give the best results in this combination. The bulb used should be of the UV-201A type, WD-12, UV-199, or any good hard tube.

Do not try a detector of the 200 type, as this is not suitable for sending. Furthermore, be sure that the brand you select is a good one, as many a tube which will receive fairly well, is not so good when it comes to be used for oscillating and sending its signals out into the world. As will be noticed in the diagram, Fig. 1, 22½ volts is applied to the tube when it is used as a receiver, and maximum plate voltage when used for transmission.

Adjust Your Plate Potential

You may find by experiment that a higher pressure up to 45 volts works better on your detector. If so, then of course you will move the tap, which is labelled 22, to the point where best results are to be found. The high pressure is necessary to give the powerful oscillations which you will want to use in order to get the message out as strong as possible.

A 25-turn Honey Comb Coil will give the wave speeds permitted in amateur transmission, and this same coil will act as a tuner for receiving fast waves up to 1500 kc. (200 meters.) To listen to the broadcasting band a larger coil of 50 or 75 turns will be needed, depending on the size of your aerial. By using a honey comb coil adapter as shown, you can snap one out and another in in an instant.

Talking to Friend Bill

One of the features of this receiver-transmitter is that the coils do not have to be re-tuned when changing over to transmitting. As an illustration, suppose you pick up a wave at 1800 kc. (167 meters.) You recognize the sender as your old friend Bill. Naturally you want to talk back to him, but instead of having to fool around with your transmitter to try to get the same wave, all you have to do is throw your switch (Fig. 2) to the sending position and presto, you are already in tune as a sending station to talk without further adjustment.

Two-way communication, in this case,

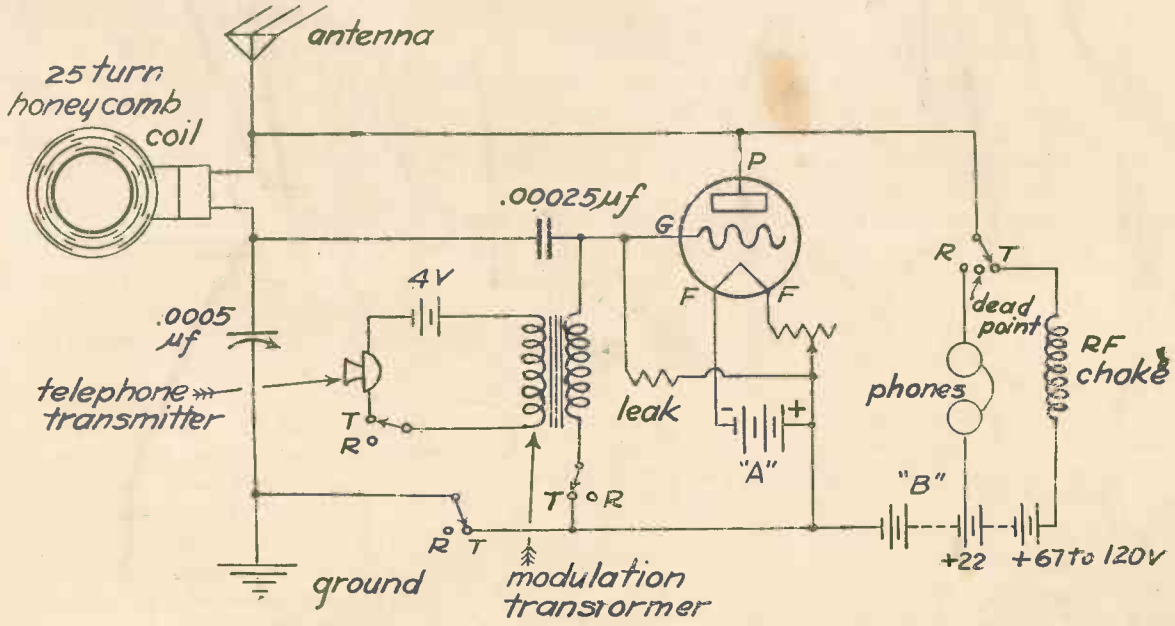


Fig. 1. This Set Will Send and Receive at the Same Wave Frequency

will be carried on equal wave speeds. If the opposite station should change his wave, the receiving point on your dial will likewise change, and transmission be on the new wave, too. In operating this set as a *receiver*, do not force the rheostat so as to produce squeals and radiation. Of course, this would not interfere with broadcast listeners at lower wave speeds, since your set would be tuned to the higher frequencies (lower wave lengths) but in that case you would mess up the air for other amateurs, who are interested in getting in code at about the same wave as you are using.

Getting the Listeners Mad

When the clock gets around to eight and the quiet hour starts for hams, you will want to hear your favorite broadcaster. Take out the 25-turn honey comb and substitute the coil of 50 or 75 turns. Be mighty sure, however, that your change over switch is on the receiving position because if you inadvertently leave it at "send" you will call down on your head the wrath of all the surrounding broadcast listeners.

In explanation of this set, let us assume that all four switches are set to the "receive" position. Of course, individual single pole double throw switches may be employed, but the scheme shown in Fig. 2, is better, since this prevents any forgetfulness when it comes time to make a quick change in the position of all the switches. The waves coming from the aerial go through the honey comb coil, and are tuned by the .0005 condenser before reaching ground.

Unusual Grid Leak Connection

The voltage across the condenser is impressed on the grid through the .00025 unit. Notice that the leak is connected to the plus end of the "A" battery, since the usual location across the grid condenser would allow "B" battery pressure to be fed to it through the honey comb coil. It works just as well with the connection as shown and avoids this difficulty.

The output from the plate divides. The audio frequency, after passing the phones, goes to the detector tap of the "B" battery. Notice that no by-pass condenser is shown around the phones. This is to prevent the high radio frequency waves from using this path back to the filament. Instead they are choked back by the inductance of the phones, and so run from plate to the left and through the honey comb coil and condenser back to the filament. Since they are thus impressed on the primary coil, they act to give regeneration. Of course, if regenerative action happens to be very strong in your set so that reducing the brightness of the filament does not give enough control, then the feedback action can be reduced by putting a small condenser, say .0001, in parallel with the phones. This will allow part of the radio frequency to use this path instead of through the primary coil, and in that

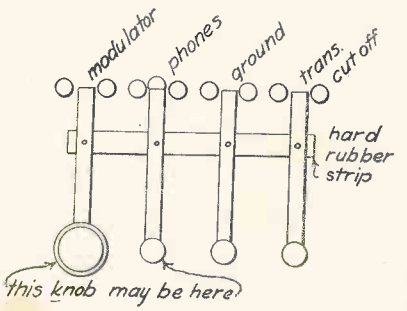


Fig. 2. A Four-Pole Switch Which Controls Sending

way will weaken the feedback action through the primary.

A Bell Ringing Modulator

Now let us throw the switch to the transmitting position. This is labelled "T" in Fig. 1. This cuts out the phones and connects the transmitter. It also completes the circuit to the grid through the secondary of the modulating transformer. This transformer may well be a 110-volt bell ringer. Such a unit takes the place of the expensive devices on the market and seems to work very well indeed. It can be bought for about $1.50. If you do not wish to use a bell ringing transformer, then any other with a ratio of about 10 to 1 will do as well.

The primary is connected in series with the telephone transmitter and three dry cells in series. The secondary runs between the filament and the grid. In this way the audio frequency waves which your voice sets in motion as it vibrates the diaphragm are impressed on the grid and so modulate the amount of energy being fed out to the plate. The output from the plate at a radio frequency of around 1500 kc. is conveyed almost entirely to the aerial, where it is tuned through the honey comb coil by the series condenser. None of this high frequency can get back to the right of the plate through the "B" battery because the radio frequency choke coil will not pass any of this high speed vibration.

Winding the R. F. Choke

This choke coil may be wound of about 250 turns of No. 30 single cotton covered wire on a two-inch tube. These values, however, are not critical, since they do not tune at all, but merely hold up the high speed vibrations while allowing the direct current from the "B" battery to pass to the plate.

This transmitter-receiver makes an ideal portable set, and with 120 volts on the plate as a transmitter, it has worked up to 15 miles on voice. However, between 5 and 10 miles will be the average. It can be constructed in a very small space, and easily carried from one place to another and will function as a transmitter even on a loop. A range of about one mile might be expected in even this case, depending on the size of the loop. That is a very good range, however, for a single bulb transmitter, particularly, one which does not use a power tube.

WHY IS KDKA JUST LIKE HANK

Ever hear the story of Hank O'Day, the big league baseball umpire?

A baseball fan approached Hank one day near the end of the season and asked:

"Would you mind giving me your winter address so I shall be able to write you and have you decide some of the baseball arguments that come up from time to time?"

Hank, whose fame is more than national, pondered a moment and then flashed back,—

"Oh, sure—just address it to Hank O'Day, U. S. A. That'll reach me."

Well, KDKA is something like that. It is synonymous with Pittsburg, and Pennsylvania.

This was proved the other day when a letter reached that broadcasting station without delay although the only address it contained was the letters KDKA, hand-printed, two inches high. It was mailed in Delaware, Ohio, and reached its destination the next day.

A Quick Testing Jack Hook-Up

This is the Best Way to Compare Phones or Horns

HARRY A. NICKERSON, Boston, Mass.

THE purpose of this "hook-up" is to provide a means for connecting phones or loud speaker units so that any or all of two or more phones or loud speakers may be operated at the same time. When two or three are going together they will be connected in series so that the current does not divide, but all pass through each separate unit. This, it may be remarked, is the best way of exciting two phones as it gives greater loudness than the parallel scheme of connection.

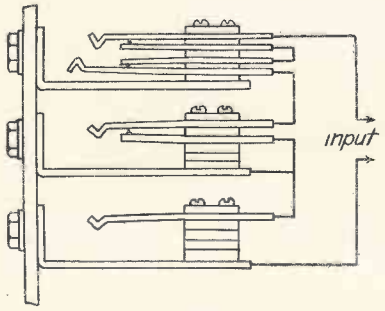


Fig. 1. Any One of These Styles May Be Used

It will be found an excellent method of comparing the relative merits of different phones and speakers, and for making a quick connection of several of these units in series by merely inserting the plugs into phone jacks.

You Must Snap to the Other

It is an advantage to have some such quick change method for switching from one speaker to another when comparing two makes, which are both good. Of course, if one is a great deal better than the other, then you can spend a couple of minutes in making the change and still be able to pick out the better performer. But if they are modern types, which you are comparing, then you will have to snap from one to the other pretty rapidly, to see which is louder and clearer. If you don't, the change in quality and loudness of the singer's voice or of the band music, will vary as much or more than the change in reproducing value, which you are looking for.

The drawing, Fig. 1, shows three jacks hooked up so that any one of three units may be tested. Of course, one of the jacks might be omitted, or additional ones inserted in the same way. As illustrated, there are a four spring, a two spring, and a single spring unit. Naturally, these would ordinarily be all alike of some one of the three styles. The reason for showing the different ones is only to make clear how the individual types are hooked up. But note that only one of the single spring jacks can be used in series unless a speaker unit is kept inserted, as otherwise the circuit will be broken at that point. If one of these single spring devices is used, it should always be the first to receive a phone plug. It will then complete the circuit through the "B" battery, which otherwise is interrupted.

Use a Separate Panel

While the jacks may be thus connected as part of a particular radio set, it is useful to place them on a separate small panel attached to a baseboard or to the radio table top permanently. On this separate small panel may be mounted binding posts or Fahnestock clips to which the output wires of the radio set are connected.

Or better yet, a regular phone cord may be attached with the leads to the beginning and end connection of the jack, while the other end of the cord has a regular phone plug connected to it, as shown in Fig. 2. By plugging this into your present second set jack on your radio set it converts it into a multiple plug set, which may run as many head phones or loud speakers as you wish. Phones or speakers to be tested must of course, be equipped with the regulation phone plugs. The plugs of units not in use may be left pushed only a little way into a jack opening, while the plug of a unit under test is pushed all the way in. It will be apparent that in this way, a rapid insertion and removal of the different plugs is possible,

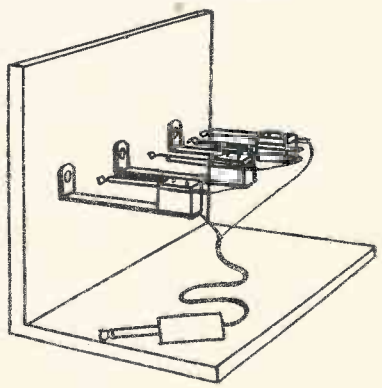


Fig. 2. Loud Speaker and Phones Work Together

so that a convenient and quick comparison of different phone units is readily made.

SWEDEN PICKS THEM UP

The signals of about sixty amateur radio stations in the United States and Canada have been heard recently in Sweden. This was recently announced by the American Radio Relay League, following the receipt of a cablegram from the Radiobladet, a Swedish radio publication. The amateurs of that country are becoming more interested in transatlantic work.

DON'T SEND WITHOUT LICENSE

Under the law, the penalty for operating an unlicensed transmitter is a fine not exceeding $500 and the apparatus is forfeited to the government. The penalty for operating a transmitter without an operator's license is $100 or imprisonment of two months or both. The penalty for malicious interference is a fine of $500 or a sentence of one year or both.

American Radio Relay League

THIS WILL REDUCE CODE TROUBLE

Radio receiving conditions in the United States can be improved through systematic co-operation of the amateurs. At any rate, that is what the American Radio Relay League believes, and so it has arranged for the appointment of "vigilance committees," the object of which will be to relieve trouble from code interference.

The regulations of the Department of Commerce, together with the new assignment of wave speeds for broadcasters and code transmitters have done much to clear up interference; but the A. R. R. L. is determined to improve conditions even further, with the help of amateurs having a knowledge of the code.

The Newspapers Are Represented

These vigilance committees are to be appointed by league traffic officers in all large cities in the country, where they will work in co-operation with radio clubs and newspapers. Organizing the committees will be under the supervision of the assistant division managers of each state. Each committee will consist of five men—three radio fans with a knowledge of code, one broadcast listener, and a newspaper man.

The chairman of each committee will solicit complaints of interference through the local newspapers, and will then assign the cases which are reported to various members for investigation. The results of such inquiries will be submitted to the committee which will then make such recommendations as appear necessary.

How They Will be Punished

This committee will not take any definite action unless it is found that the interference is caused by amateurs. If it is discovered that any members of the A. R. R. L. are violating any of the regulations of the Department of Commerce, then strenuous measures will be taken, and if conditions are not immediately remedied, it will be urged that such members keep off the air until their transmitters have been properly adjusted. If such amateurs refuse to give this co-operation, then the amateur will be reported to the A. R. R. L. Headquarters, which will ask the Department of Commerce to keep the offending station quiet.

But some broadcast listeners do not realize, according to the A. R. R. L., that code interference sometimes comes from ship and commercial stations as well as amateur transmitters. Many fans can not read the code call letters of the station that is causing the interruption of their programs, and so they blame the amateurs in their immediate vicinity, often without the slightest evidence. "In case of doubt, blame the hams" is their motto.

Helping to Trace the Trouble

It is the intention of the league in providing for the appointment of a national system of vigilance committees to give listeners an opportunity to trace the source of code interference, so that the blame in such cases may not be unjustly placed. However, if amateurs are found to be at fault, the committee will suggest adjustments for their stations in order that the trouble may be entirely cured once and for all.

One important advantage of these committees, the league believes, will be the unofficial assistance they will render the Department of Commerce's inspection division. At present the facilities of this division are unable to keep up with the many varieties of complaints made to the department.

The supervisors of radio are known to be heartily in accord with this project, since it will have a tendency to cut the kicks, and so reduce the amount of their correspondence. Through the committees, listeners will be able to have a personal investigation made of interference in their neighborhood, which would be impossible to obtain in any other way.

Committee members will also assist listeners who own single circuit receivers suggesting methods by which the sets may be changed in order to tune out objectionable interruptions.

THE IDEAL RADIO ANNOUNCER

The Radio Voice Technique Committee recently voted as to which station had the best announcer. A series of tests were laid out to help make the decision. Herbert B. Glover won the decision as aproaching nearest to the ideal. He is one of the four who tell us what good things we can expect from WJY.

RADIO A CURE FOR CRIME WAVE

"Two recent fads make for the good of the race in a new way," says Dr. Louisa Burns in an editorial in the March number of the Journal of the American Osteopathic Association. "These are the home manufacture of radio sets, and the cross word puzzles.

"Propaganda during the war had its effect upon developing brain centers. The discharged soldiers have little share in these criminal tendencies.

"Then came radio, and following that the cross word puzzle, each of which had its part in the development of the normal brain.

"The machinery for good judgment is being set up and put into good running order. The unbalanced stimulation of the emotional centers is at last being hushed and these new fads are developing those brain centers which most urgently need it at this special time."

What Works a Radio?

A fan recently remarked that he had to study a lot about electricity to keep up with radio. To this a broadcast listener replied that he didn't see what connection there was between radio and electricity. It seems that a good many who operate radio sets are not entirely familiar with what makes the wheels go round.

You have doubtless seen a wheel or pulley which is spinning around so fast that it looks as if it were standing still. By the same token we have heard some pretty strong arguments by people who insisted that the current in an aerial flowed down through the set to ground. When informed that it was alternating current, they laughed at the idea.

To be sure, it is not alternating current in the ordinary sense of the word—like that which flows in the mains of most electric light wires. Like our wheel mentioned above, it goes so fast that many think it is standing still. That is the principal reason why the laws of radio electricity seem to be different from those of ordinary electric current.

Learning to Spell

Most children going to grammar school find it easy to learn the rules for spelling. The only trouble is that most words seem to be exceptions. That is the way with many of the laws of physics. The speed of oscillation of radio waves is so fast that the exceptions to the ordinary rules stand out bigger than the rules themselves. At such low speeds as 60 cycles per second, which is the commercial frequency of the majority of electric light lines, the exceptions to the simple rules are so small that they can be neglected in almost all problems without getting a wrong answer.

An example of the difficulty of separating the effects of direct current and radio frequency vibrations was seen in a recent article in this magazine on building a tester for vacuum tubes. The diagram showed a milliameter connected to the grid circuit. What could be simpler than hooking up such a direct current meter as there is found in the equipment of many a radio fan?

Why the Meter Won't Read

But the trouble is this. The grid of a vacuum tube is operated by *alternating* current. When run through an ordinary meter it first deflects the needle to the right and then to the left of the zero. If this change of direction occurs slowly, say once or twice a second, you can watch the pointer swing one side and then the other of the off position. If it changes its direction sixty times a second, then the weight of the pointer is great enough so that it cannot pick up very much of the high speed, and so the deflections are quite small. If you look closely at the needle, however, you will see it buzzing back and forth, much too fast to count the vibrations, over a swing of perhaps 1-32 of an inch.

If it is radio frequency that is run through such a meter, then there isn't a chance that the million times which the current reverses in a second will have any effect at all on the needle. It stays put right on the zero mark and you could run enough current through it to burn out the winding without budging the pointer. Such a current requires a special kind of meter, which always shows a deflection in the same direction, no matter which way the electricity flows. A meter of this kind costs a great deal more than an ordinary direct current instrument, particularly in the sizes used to measure such small quantities. That is why it is necessary to get a special measuring device when you attempt to find the value of current or voltage in radio frequency circuits.

Something for Nothing Again.

We all like anything that is free. You can draw a crowd by giving away anything—except advice. It is the lure of something for nothing which makes it easy for slick salesmen to push worthless oil stock with the idea that it is worth a lot.

That is very likely the reason why radio magazines every now and then spring such an idea on an unsuspecting public. For instance, every little while some one recommends using a Ford ignition coil for an audio transformer, or a choke coil, or whatnot. The statement is usually added that one of these coils can often be had for nothing at most any wayside garage.

There are several objections to this advice. In the first place, very few garages are giving much of anything away, even though they may think that the device has little value. Besides that, a *good* Ford coil costs about $1.50, and any which are in the condition to be given away have obviously something wrong with them. The usual thing that goes wrong with an ignition coil is that the secondary winding short circuits, and of course, such a coil is useless for anything except a paper weight. It is easy to test out such a unit, and if it does what it is intended to do, that is, throw a

spark one-quarter inch long, of course you can not expect to get it for less than its regular price. And if it will not give such a spark as just explained, it practically always means that the winding is damaged, and so will be of no use in radio.

Too High a Ratio

But let us assume that you get hold of a good unit, which is undamaged. The secondary, or high tension winding, has about ten thousand turns, while the primary consists of about two hundred. The ratio is therefore 10,000 divided by 200, which is 50 to 1. This is way beyond the highest value which can be used as audio transformer. Probably you will recall that most transformer manufacturers advertise a ratio of 3½ to 1, while some prefer 6 to 1, or even 10 to 1, for special experiments. Any such ratio as a Ford coil possesses would be out of the question.

Another objection to an ignition coil for such use is this: The iron core on which the coils are wound is built of a large number of pieces of small wire, which are about four inches long. These are straight wires and do not bend around to make a complete iron circuit. But if you will examine any audio frequency transformer, you will see that the iron forms a complete loop around the wire. This is necessary in order to prevent serious distortion of the music. An open core requires that the magnetic flux, or lines of force, return from the north pole to the south, through a long path of air. It is this long path which causes the trouble, since air has 500 to 1000 times the resistance (to magnetism) which good soft iron possesses.

It Will Not Choke

Perhaps you may think that such a coil would do for a choke. If it is for an audio frequency choke, it would serve the purpose fairly well, except for the high resistance of the small size and great length of the wire. It is useless, however, on radio frequency. Of course, it is not bank wound, nor does it resemble a honey comb coil, and so the capacity between layers of wire is great. This capacity acts just like a short circuit as far as the high frequency is concerned. That is why it has very little choking action.

In other words, we might say that as a spark coil it is a tremendous success, but as a radio device it is not worth very much.

Twin-station Announcer—Norman E. Brokenshire, who announces at WJZ and WJY, is a Canadian by birth. Prior to entering the radio field he toured the Chautauqua circuit as a public speaker, and his training there has stood him in good stead as an announcer.

LIKE FATHER, LIKE DAUGHTER

Milton J. Cross has long been a favorite announcer. He is the Senior at WJZ. He has just announced the birth of a baby girl, Lillian. Those who have heard the father singing, claim that the daughter has inherited the same talent for broadcasting—and if anything, is even more persistent at it.

RADIO KEEPS UP FLOW OF GAS

Radios, cross word puzzles, and other popular fads are among the important things that the modern gas company has to take into account. These activities really have an effect on gas production and consumption, and consequently on the average gas bill, as has been definitely determined.

"Housewives aren't 'gadding about' as much as they did before radio became the national household pet," said Robert J. Canniff of the American Gas Association before a recent convention of the New Jersey Gas Association. "They can have more fun staying home listening in on grand opera, national conventions and after-dinner speeches. The result is that 'ma' is doing more home cooking and baking than she once did. Gas stoves are burning merrily, ovens heated by gas are turning out crisp loaves of bread, and the gas manufacturers are rubbing their hands with satisfaction."

Europe Pays For Floating Stations

Radio Keeps Steamship Lanes Safe From Dangerous Icebergs

By VANCE

ARE you thinking of taking a trip across the water to Europe this summer? If so you do not want to have an argument with an iceberg. They are so cool and collected that it doesn't pay.

When one of these visitors wanders into the region which is used by trans-Atlantic steamers it is necessary to inform the shipping immediately of their presence. Naturally radio can take care of delivering the messages but some way is required to locate the bergs and do the sending. The United States is of course very much interested to keep traffic flowing across the seas. However, the nations of Europe are just as much concerned, and so the two sides of the Atlantic have got together on the proposition. The various nations involved have united in providing the money and equipment for this service.

Two Cutters Fly American Flag

As a result of the invention of a new high-powered, low-voltage vacuum tube, the Coast Guard cutters, Tampa and Modoc, put to sea recently equipped with the highest powered telephone and telegraph radio transmitters carried by any ship flying the American flag. A photograph of the Tampa is shown in Fig. 1. No sails are carried but the tall mast is used to support the powerful aerial which the boat uses for both sending and receiving. Each ship has a 2 kw telephone and telegraph transmitter and, if the regulations of the Coast Guard Service permitted, they could easily be used as floating broadcasting stations, greater in power than most licensed land stations.

The Tampa and Modoc left the Boston navy yard detailed to patrol the ship lanes of the North Atlantic to protect shipping from the menace of icebergs. These floating radio stations both have the same call letter, NIDK. Notice that the call letters do not start with either a "W" or a "K" as these are used only with broadcasting stations. The "N" means that the ship belongs to the Navy. However, they are in reality international, for the cost of the operation of the patrol is shared by the leading maritime powers of the world, as provided in the London agreement signed January 20, 1914, at the International Conference on the Safety of Life at Sea. This conference was the outcome of the sinking of the Titanic with appalling loss of life after striking an iceberg on the night of April 14, 1912. As a result of this conference the United States was asked to undertake the responsibility of the ice patrol in the North Atlantic.

The success of this service depends vitally upon the quality of the radio facilities and it was for the purpose of providing a dependable, long-range, high-powered transmitter that the Coast Guard headquarters commissioned the General Electric Company to develop a transmitter especially for this work.

Squeezing It In

As you probably know the problem of building a radio set to go on board a ship is quite a lot more difficult than that of designing a good set for land use. Although perhaps you may complain that you have not as much room in your house as you would like to have, just think of the space in a cabin on board a vessel. There every inch has to be used to the best advantage and so a set even though high in power must be compressed into such a compact space that it will fit in the corner which the ship can spare for the purpose.

With this idea of having everything made as small as possible, you can easily see that high voltage must not cause any danger. On land if you have an

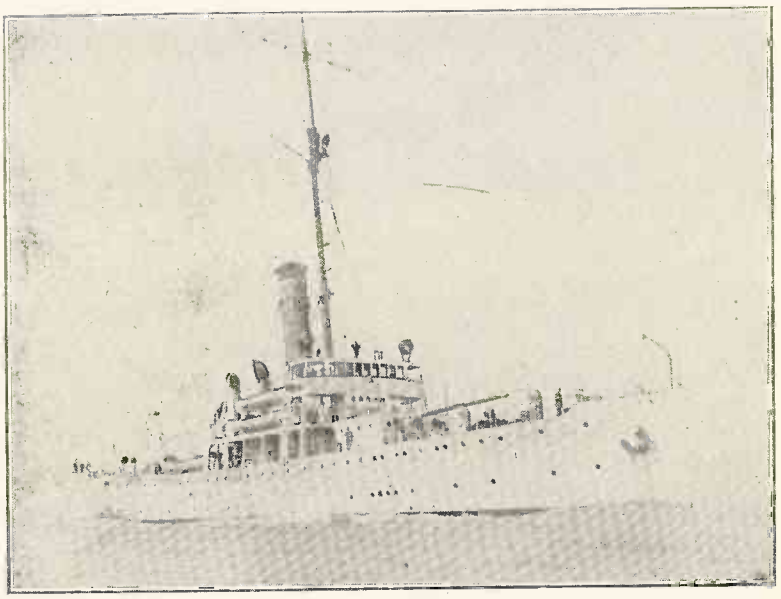


Fig. 1. The "Tampa." Americans May Well be Proud of This Ship

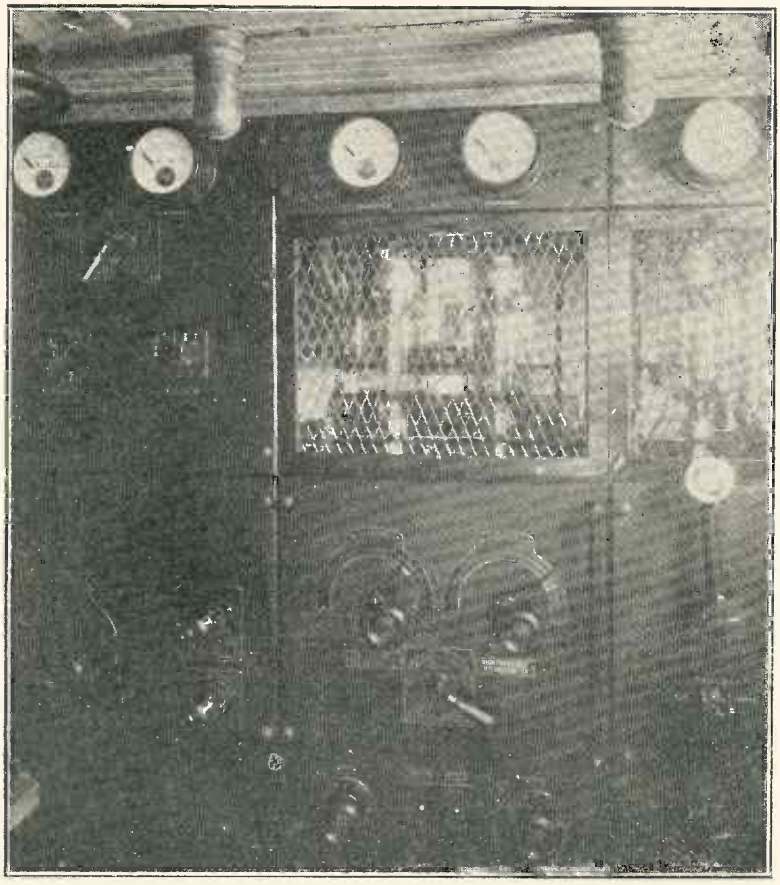


Fig. 2. Control Panel. Notice That High Tension is Confined Behind Grating

unusually high voltage you can avoid trouble by separating the conductors by two or three feet if necessary, but this cannot be done on shipboard. That is why the high voltages used on land stations must be reduced quite a lot for sea operation.

Shocking the Operator

Another thing to consider is this: Have you ever been on the water during a storm? The ship rocks this way and that, and unless a man has on his sea legs, he is very apt to be banged up against a companion way or mast. It would never do for a sudden lurch of the vessel to throw the radio operator ("Sparks," he is called) against any part of the equipment which would cause him a shock. To prevent this all live parts of the set which carry much of any electrical pressure, must be hidden away behind the panel and switch board so that he cannot accidentally touch them as shown in Fig. 2. Factors of strength, reliability and simplicity of tuning must also to be considered. It is further necessary that the emitted wavelength or frequency must be absolutely independent of any variations due to the rolling and pitching of the ship. All these requirements were met in the equipments now aboard the Tampa and the Modoc.

Continued on Page 28

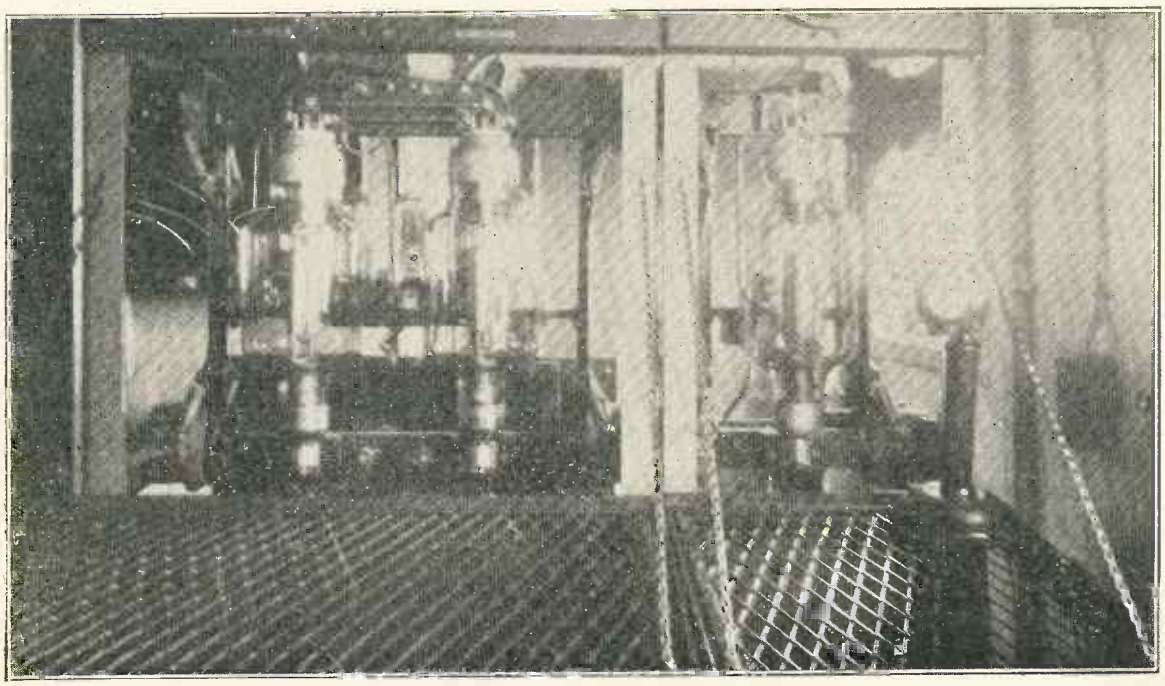


Fig. 3. A Close-up of the New Style High Power Sending Tubes

Results of the Victor Tests

A Report On What Was Accomplished By These Broadcasts

THE Victor presentations have been over long enough for the company to get reports on how listeners like them. They certainly did enjoy these unusual concerts. In fact, they were so popular that it is hard to realize how many people made a date with themselves at home on alternate Thursdays so as not to miss the marvelous music. Here is an idea of the size of the audience.

More than twice the combined population of all the capitals of Europe;

Every single resident of France and Spain.

To help get this in mind, consider that a football contest in the Yale Bowl has usually been cited as the example of a colossal human gathering. And so it was, until these broadcasts made it possible for the first time in history for tens of millions to hear really great music by really great artists at one and the same moment.

If a football game, like that of Fig. 1, were played in the Yale Bowl every Saturday in the year, and each game were played to a capacity crowd, it would be almost a generation before the number of spectators would equal the roster of those who heard these Victor Broadcast Concerts.

Last summer Galli Curci sang to an audience of 27,000 at the Hollywood Bowl. This was the greatest audience that had ever heard a single concert. Yet when John McCormack and Lucrezia Bori on New Year's Night broke the great silence so far as the vast air audience is concerned, they were heard by an audience estimated at 8,000,000 listeners-in.

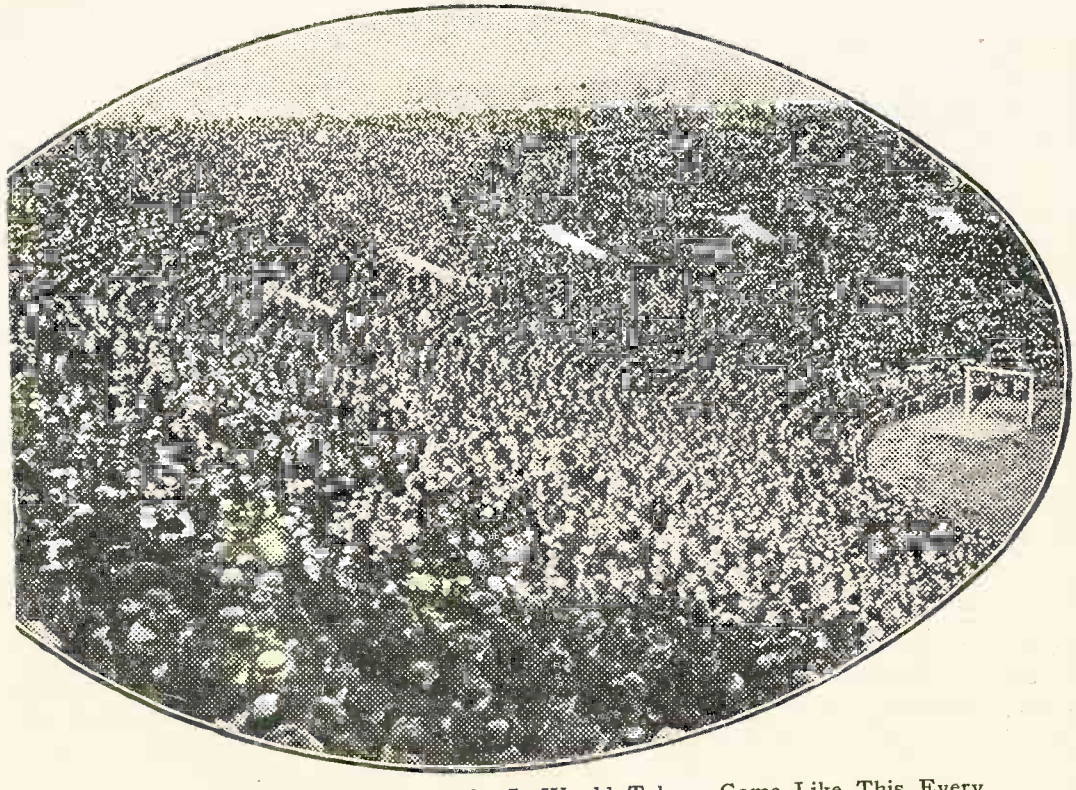


Fig. 1. This is the Yale Bowl. It Would Take a Game Like This Every Week for 15 Years to Equal the Number in the Victor Audience

The seven concerts recently completed reached a total audience of 64,000,000 people. This equals:

The entire population of South America;

All the inhabitants of forty states;

Every man and woman of the United States over 25 years of age;

In fact, while we're dealing in the millions, the audience of some one-eleventh of our countrymen and countrywomen who heard these Victor concerts

Continued on Page 28

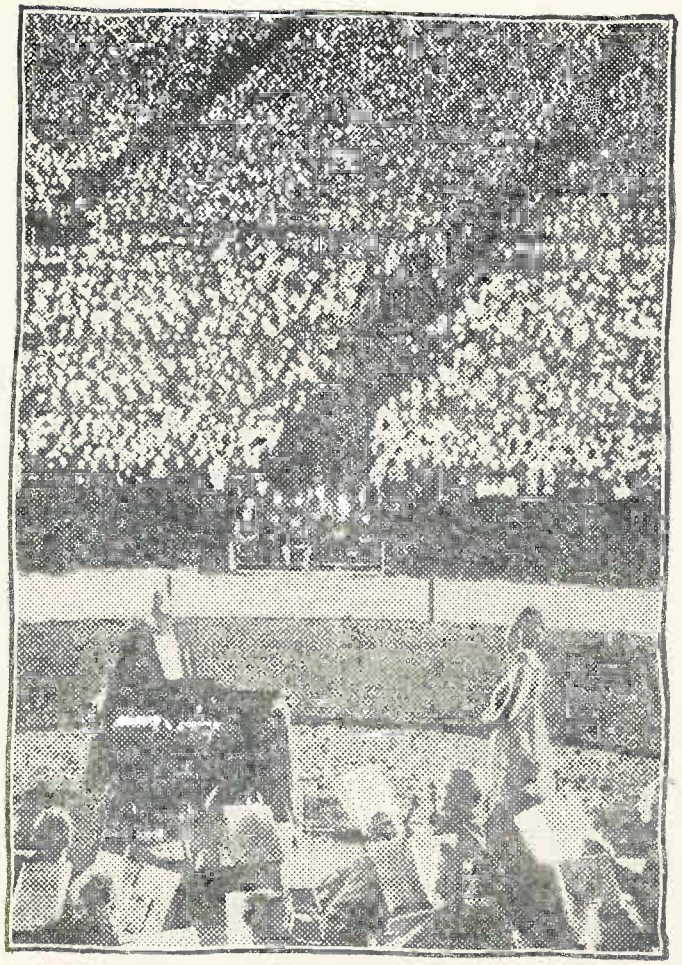


Fig. 2. Mme. Galli-Curci Entranced 27,000 at Hollywood. Could She Do it 337 Times?

RESULTS OF VICTOR TESTS

Continued from Page 27

divided itself, as Julius Caesar put it, into three parts. The first embraced those who had previously known and appreciated good music. The second included those whose idea of good music was that it was a highbrow, "high hat" affair. To them, judging from their letters, the Victor concerts came as an amazing revelation. Like the old gentleman who, on hearing a speech by Daniel Webster, exclaimed, "Why, I understood every word of it," they too discovered that good music can be comparatively simple fare for the soul to digest.

A third great class as revealed by the tide of mail received came from those who had never appreciated that there is a difference in music and the way it is interpreted. It was with wondering delight that these expressed their thanks and interest in the Victor programs, a great group for whom the word "music" will henceforth hold a newer and more exalted meaning.

April marks the waning of the year's musical tide. Then the Metropolitan Opera season ends. Easter is here and gone. And already the ending of the first series of Victor Broadcast Concerts has made the air paths silent for millions who gained from this source new musical inspiration and pleasure. No one knows whether they will be a part of the next musical season which the Metropolitan ushers in next October.

Of course, the expense of such broadcasting was very large, and it is a question with the Victor Company whether the advertising value was enough to make it pay. If the increased sale of records seems to justify it, it is probable that we shall have the pleasure of listening to a second series next season.

EUROPE PAYS FOR FLOATING STATIONS

Continued from Page 26

The first and greatest problem in meeting these needs was the development of a high-powered, low-voltage vacuum tube. At the time there were available low pressure tubes using up to 2500 volts direct current, obtainable directly from a motor generator, and also high pressure tubes operating on 10,000 volts or more, of direct current. To provide this latter pressure on shipboard would have required a motor generator set, a step up transformer, a rectifier with two or more special tubes (kenotrons), and an elaborate filter to smooth out the ripple in the rectified wave. Specialists in the research laboratory of the General Electric Company concentrated on the tube and produced the new and largest medium voltage tube, known as Model UV-851, which is rated at only 2000 volts on the plate and is four times as powerful as the previous low voltage tube. Its output is 1000 watts. By means of this tube, power is supplied from the direct current motor generator set at 2000 volts, eliminating the intervening units heretofore necessary, that is, transformer, kenotron rectifier and filter.

Gratings Protect 2000 Volts

Fig. 3, shows a view of these units. Notice the tremendous size of the bulbs compared with what you are familiar within your receiving set. The filament and grid circuit come in at the top. You will notice what heavy leads are used to carry the big currents. The contact at the bottom is for the plate. Since this runs as explained at 2000 volts, it must be kept as far as possible from the other circuits and that is why it is brought out at the opposite end of the tube. The metal gratings, which cover the openings in front of the tubes, can be swung down as shown, and they are then supported by the long chains which appear at each side.

No doubt you feel angry if by accident you burn out one of your receiving tubes. *They*, however, cost only $3.00. It's no wonder that Uncle Sam does not want to buy new bulbs of this tre-

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A Radio Without a Dial

Tuning Your Set from the Next Room Can be Done

By THOMAS F. MAGER, Bridgeport, Conn.

YOUR aerial is installed in your living room, let us say. Have you ever felt the need of working the loud speaker in the dining room or kitchen? Of course, a long cord attached to your loud speaker will do the trick for a local station, but if you are picking up distance, then it is not so easy to tune in one room while the horn is playing

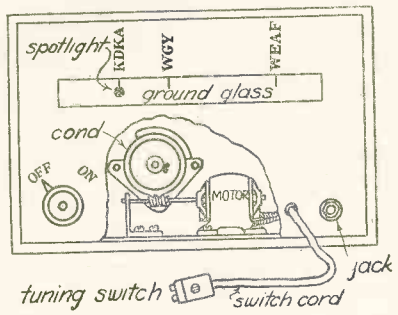


Fig. 1. Operating Parts. Motor Drives Condenser

in another. It means running back to the set every little while to get the exact adjustment.

To get around this trouble Leslie Gould, pioneer radio enthusiast of Bridgeport, Connecticut, has completed construction of a new radio set for which are claimed many unusual features with regard to the task of "tuning in" stations, long regarded as an irksome detail by every inexperienced operator. Gould's set tunes automatically, being controlled entirely by a small switch on the end of a flexible cord running from the set. The switch is held in the operator's hand.

A Three-Volt Toy Motor

The device is simple in idea. There is a small electric motor, such as is used to run toys like Christmas trains, which run on two dry cell batteries. The pulley on this little motor drives a string belt which runs around another pulley connected by gears and a worm to the rotor of the variable part of the tuner in the radio set. This may consist of a condenser, as in the ordinary set, or perhaps a variometer. If a neutrodyne is to be controlled, the three dials are tied together by gears in such a way that the electric motor drives all three simultaneously.

Attached to the apparatus is also a small flash light, which travels back and forth behind a ground glass set in a panel near the top of the receiver. The ground glass is about a foot long and a couple of inches high. Marked on it are vertical lines with the call letters of the various stations, as shown in Fig. 1.

Switching the Light Spot

A switch cord and switch is attached to the set. This cord may be any length necessary to reach around the house. The switch has two buttons, one of which makes the motor run to the right and raises the wave speed (frequency) while the other causes left hand rotation and reduces the kilocycles. Of course, the spot of light travels back and forth in accordance with the setting of the rotor.

When the station desired is reached on the glass the operator releases the switch, which stops the motion, and permanently marks on the ground glass the setting for the station. An aid to this is the pilot light behind the writing. The small motor provides such slow motion that it actually is in itself a vernier action, nothing else being required to clear up reception. When the light has travelled across the dial or if he has kept his button pressed so long that the adjustment has gone through the station setting and off the other side, the operator, by merely pressing the other button reverses the motor action and the spot of light and with it the tuning is brought back again to the proper place.

Acquiring the Knack

With a small amount of practice this action is so easy that the set can be installed in the next room or the next house, as far as that is concerned. Two cords run between the set and the radio fan. One of these carries the output to the loud speaker and the other is the control by which one station after another is brought in. Of course, in such a case the ground glass can not be seen but a little practice gives you the knack of picking up the station you want by knowing about how far it is (in frequency) from some other station which you may recognize. This is illustrated in Fig. 2.

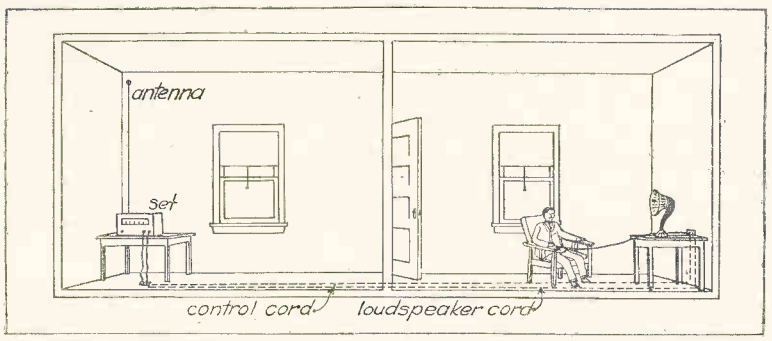


Fig. 2. How Listener Tunes Set in Another Part of House

Continued on Page 30

Fone Fun For Fans

A Chip on His Shoulder

Mike went into a jewelry shop to purchase a gold ring.

"Eighteen carat?" asked the salesman.

"You're a liar," said Mike. "Oi've been aitin' oinion."—Good Hardware.

Statistics

Killed by Gas, 1924:
32 Inhaled It.
140 Lighted Matches in It.
5,000 Stepped on it.
—En-Ar-Co National News.

More Restful

"Is he a go-getter?"

"No, a have-it-brunger."—Pittsburgh Post.

When He Missed It

Professor—I forgot my umbrella this morning, dear.

His Wife—How did you come to remember having lost it?

"Well, I shouldn't have missed it, only I raised my hand to shut it when the rain stopped.—Good Hardware.

Some Fans Must Use Them

"Are you sure these field glasses are high power?" asked the lady potential customer.

"Madam," replied the ambitious salesman, "when you use these glasses anything less than ten miles away looks like it's behind you."—Crosley Radio.

A RADIO WITHOUT A DIAL

Continued from Page 29

In appearance the set is extremely neat as there are no outside connections beyond a switch to light the vacuum tubes.

When these are extinguished no "B" battery current can flow. The same switch puts voltage on the control motor and so makes ready for tuning.

No Knobs at All

In place of the usual control knobs the front glass is graduated with spaced marks giving it a finished effect as just explained. The control switch resembles a button hanging switch for an overhead fixture, except that it comes out of the front panel of the radio.

The new invention, which Gould perfected after three years experiment, has proved highly successful in tests, having tuned in distant stations automatically without the use of head phones. Gould has applied for a patent on the automatic features and will enter his devise in a contest being conducted by a Chicago radio manufacturer for something new in radio this year.

WHAT THE OLD WORLD THINKS OF RADIO

Continued from Page 18

radio is steadily increasing is proved by the fact that the Radio Branch at Ottawa issued 78,057 receiving licenses from April 1, to December 31, 1924, as against 22,648 for the same period of 1923. American manufactures are active in this market, and their complete sets and parts are well represented.

Mexico.

Mexico at present offers a very good market for American radio apparatus. Some American receiving sets were imported into Mexico in 1922, but trade at that time was limited because the Mexican government prohibited the erection of broadcasting stations. This opposition was withdrawn in 1923, and several broadcasting stations were subsequently established.

EUROPE PAYS FOR FLOATING STATIONS

Continued from Page 28

mendous size, and so above each of the tubes is a meter which indicates the amount of voltage on the filament. The plate voltage is also measured as a means of adjusting the output.

Getting Smooth Signals

The 2 KW transmitters of the Tampa and Modoc provide radio communication both on pure continuous wave telegraph and on telephone. The tone modulation is known as "sine wave" modulation, which gives a pleasing, clear musical tone, easily read through static and interference. A sine wave is a smooth one with regular curves at the top and bottom, rather than a pointed or rough one.

IZZY A. NUTT—HE IS TAKEN AT HIS WORD

UNITED STATES BROADCASTING STATIONS ARRANGED ALPHABETICALLY BY CALL LETTERS

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

	K.C.	W.L.	W.P.
KDKA—Westinghouse Elec. & Mfg. Co., E. Pittsburg, Pa.	970-	309-	1000
KDPM—Westinghouse Elec. & Mfg. Co., Cleveland, O.	1200-	250-	500
KDYL—Newhouse Hotel, Salt Lake City, Utah	900-	333-	500
KDZB—Frank E. Siefert, Bakersfield, Cal.	1430-	210-	100
KFAB—Nebraska Buick Auto Co., Lincoln, Neb.	1250-	240-	200
KFAD—McArthur Bros. Mercantile Co., Phoenix, Ariz.	1000-	300-	500
KFAE—State College of Washington	860-	349-	500
KFAF—Western Radio Corp., Denver, Colo.	1080-	278-	500
KFAJ—University of Colorado, Boulder, Colo.	1150-	261-	100
KFAU—Boise High School, Boise, Idaho	1090-	275-	500
KFBK—Kimball Upson Co., Sacramento, Cal.	1210-	248-	100
KFCF—Frank A. Moore, Walla Walla, Wash.	1170-	256-	100
KFCL—Leslie E. Rice, Los Angeles, Cal.	1270-	236-	500
KFDM—Magnolia Petroleum Co., Beaumont, Tex.	950-	316-	500
KFDX—First Baptist Church, Shreveport, La.	1200-	250-	100
KFDY—S. Dak. Ste. Col. Ag. & Mech. Arts, Br'kngs., S. Dak.	1100-	273-	100
KFEQ—Scroggin & Co. Bank, Oak, Nebr.	1120-	268-	100
KFFV—Graceland College, Lamoni, Iowa	1200-	250-	100
KFGC—Louisiana State Univ., Baton Rouge, La.	1120-	268-	100
KFGD—Oklahoma College for Women, Chickasha, Okla.	1190-	252-	100
KFGH—Leland Stanford Junior Univ., Stanford Univ., Cal.	1100-	273-	500
KFGX—First Presbyterian Church, Orange, Tex.	1200-	250-	500
KFHJ—Fallon & Co., Santa Barbara, Cal.	833-	360-	100
KFHR—Star Elec. & Radio Co., Seattle, Wash.	1140-	263-	100
KFI—Earl C. Anthony, Los Angeles, Cal.	640-	469-	1500
KFIF—Benson Polytechnic Institute, Portland, Ore.	1210-	248-	100
KFIQ—First Methodist Church, Yakima, Wash.	1170-	256-	100
KFIZ—Daily Com'lth & Seifert Rad, Corp., Fondulac, Wis.	1100-	273-	100
KFJF—National Radio Mfg. Co., Oklahoma, Okla.	1150-	261-	225
KFJM—University of No. Dak., Grand Forks, No. Dak.	1080-	278-	100
KFKB—Brinkley-Jones Hosp. Assoc., Milford, Kans.	1100-	273-	500
KFKQ—Conway Radio Laboratories, Conway, Ark.	1200-	250-	100
KFKU—University of Kansas, Lawrence, Kas.	1090-	275-	100
KFKX—Westinghouse Elec. & Mfg. Co., Hastings, Neb.	1040-	288-	1500
KFLR—University of New Mexico, Albuquerque, N. Mex.	1180-	254-	100
KFLV—Swedish Evangalical Mission Church, Rockford, Ill.	1310-	229-	100
KFLZ—Atlantic Automobile Co., Atlantic, Iowa	1100-	273-	100
KFMQ—University of Arkansas, Fayetteville, Ark.	1000-	300-	500
KFMT—George W. Young, Minneapolis, Minn.	1140-	263-	100
KFMX—Carleton College, Northfield, Minn.	890-	337-	750
KFNF—Henry Field Seed Co., Shenandoah, Iowa	1130-	266-	500
KFOA—Rhodes Dept. Store, Seattle, Wash.	660-	454-	500
KFOC—First Christian Church, Whittier, Cal.	1270-	236-	100
KFON—Echophone Radio Shop, Long Beach, Cal.	1280-	234-	100
KFOX—Technical High School, Omaha, Nebr.	1210-	248-	100
KFPG—Oliver S. Garretson, Los Angeles, Cal.	1260-	238-	100
KFPR—Los Angeles County Forestry, Los Angeles, Cal.	1300-	231-	500
KFPT—Radio Service Corp. of Utah, Salt Lake City, Utah.	1150-	261-	500
KFPX—First Presbyterian Church, Pine Bluff, Ark.	1240-	242-	100
KFPY—Symons Investment Co., Spokane, Wash.	1130-	266-	100
KFQB—Searchlight Publishing Co., Fort Worth, Tex.	1180-	254-	100
KFQC—Kidd Brothers Radio Shop, Taft, Cal.	1300-	231-	100
KFQM—Texas Highway Bulletin, Austin, Tex.	1120-	268-	100
KFQU—W. E. Riker, Holy City, Calif.	1280-	234-	100
KFQZ—Taft Radio Co., Hollywood, Calif.	1330-	226-	250
KFRB—Hall Bros., Beeville, Texas	1210-	248-	250
KFRU—Etherical Radio Co., Bristow, Okla.	760-	395-	500
KFRW—United Churches of Olympia, Olympia, Wash.	1360-	220-	100
KFSG—Echo Park Evangelistic Asso., Los Angeles, Calif.	1080-	278-	500
KFUM—W. D. Corley, Colorado Springs, Colo	1240-	242-	100
KFUO—Concordia Seminary, St. Louis, Mo.	550-	545-	500
KFUT—University of Utah, Salt Lake City, Utah.	1150-	261-	100
KFUU—Colburn Radio Laboratories, San Leandro, Calif.	1340-	224-	100
KFWA—Browning Bros. Co., Ogden, Utah	1400-	214-	500
KFWB—Warner Bros. Pictures, Inc., Hollywood, Cal.	1190-	252-	500
KGO—General Electric Co., Oakland, Cal.	830-	361-	2000
KGU—Marion A. Mulrony, Honolulu, Hawaii	833-	360-	500
KGW—Portland Morning Oregonian, Portland, Ore.	610-	491-	500
KHJ—Times-Mirror Co., Los Angeles, Cal.	740-	405-	500
KHQ—Excelsior Motorcycle & Bicycle Co., Seattle, Wash.	1100-	273-	100
KJR—Northwest Radio Service Co., Seattle, Wash.	780-	384-	500
*KJS—Bible Institute of Los Angeles, Los Angeles, Cal.	1020-	294-	750
KLDS—Reorg.ChurchofJesusChristofLatterDaySts., Ind.,Mo.	1120-	268-	250
KLS—Warner Bros. Radio Supplies Co., Oakland, Calif.	1240-	242-	250
KLX—Tribune Publishing Co., Oakland, Calif.	590-	509-	500
KLZ—Reynolds Radio Co., Denver, Colo.	1130-	266-	250
KNX—Los Angeles Express, Los Angeles, Cal.	890-	337-	500
KOA—General Electric Co., Denver, Colo.	930-	322-	1000
*KOB—New Mexico Col. of Agriculture, State Col., N. Mex.	860-	349-	750
KOP—Detroit Police Dept., Detroit, Mich.	1090-	278-	500
KPO—Hale Bros., San Francisco, Cal.	700-	428-	500
*KSL—The Radio Service Corp., Salt Lake City, Utah.	1000-	300-	1000
KQV—Doubleday-Hill Electric Co., Pittsburg, Pa.	1090-	275-	500
KSAC—Kansas State Agric. College	880-	341-	500
KSD—Post-Dispatch, St. Louis, Mo.	550-	545-	750
KTHS—New Arlington Hotel Co., Hot Springs, Ark.	800-	375-	500
*KTW—First Presbyterian Church, Seattle, Wash.	660-	454-	750
KUO—Examiner Printing Co., San Francisco, Cal.	1220-	246-	150
KUOM—State Univ. of Montana, Missoula, Mont.	1230-	244-	500
KYQ—The Electric Shop, Honolulu, Hawaii	1110-	270-	100
KYW—Westinghouse Elec. & Mfg. Co., Chicago, Ill.	560-	535-	1500
KZKZ—Electrical Supply Co., Manila, P. I.	1110-	270-	100
KZM—Preston D. Allen, Oakland, Cal.	833-	360-	100
KZRQ—Far Eastern Radio, Manila, P. I.	1350-	222-	500
WAAB—Valdemar Jensen, New Orleans, La.	1100-	273-	100
WAAC—Tulane University, New Orleans, La.	1090-	275-	100
WAAF—Chicago Daily Drovers Journal, Chicago, Ill.	1080-	278-	200
WAAM—I. R. Nelson Co., Newark, N. J.	1140-	263-	250
WAAW—Omaha Grain Exchange, Omaha, Neb.	1080-	278-	500
WABA—Lake Forest University, Lake Forest, Ill.	1320-	227-	100
WABI—Bangor Railway & Electric Co., Bangor, Me.	1250-	240-	100
WABL—Connecticut Agric. College, Storrs, Conn.	1090-	275-	100
WABN—Ott Radio (Inc.) La Crosse, Wis.	1230-	244-	500
WABO—Lake Avenue Baptist Church, Rochester, N. Y.	1080-	278-	100
WABX—Henry B. Joy, Mount Clemens, Mich.	1180-	254-	250
*WADC—Allen T. Simmons, Akron, O.	1160-	258-	100
WAFD—Albert B. Parfet Co., Port Huron, Mich.	1290-	233-	250
WAHG—A. H. Grebe Co., Richmond Hill, N. Y.	950-	316-	500
WAMD—Hubbard & Co., Minneapolis, Minn.	1230-	244-	100
WBAA—Purdue University, West Lafayette, Ind.	1100-	273-	250
WBAN—Wireless Phone Corp., Paterson, N. J.	1230-	244-	100
WBAO—James Millikin University, Decatur, Ill.	1090-	275-	100
WBAP—Wortham-Carter Publishing Co., Fort Worth, Tex.	630-	476-	1000
WBAV—Erner & Hopkins Co., Columbus, Ohio	1020-	293-	500
WBBP—Petoskey High School, Petoskey, Mich.	1400-	214-	100
WBBG—Irving Vermilya, Mattapoisett, Mass.	1210-	248-	500
WBBL—Grace Covenant Church, Richmond, Va.	1310-	229-	100
WBBM—Atlas Investment Co., Chicago, Ill.	1330-	226-	200
WBBR—People's Pulpit Assoc., Rossville, N. Y.	1100-	273-	500
WBES—Bliss Electrical School, Takoma Park, Md.	1350-	222-	100
*WBOO—A. H. Grebe Co., Richmond Hill, N. Y.	1270-	236-	100
WBS—D. W. May, Newark, N. J.	1190-	252-	100
WBT—Southern Radio Corp., Charlotte, N. C.	1090-	275-	250
WBZ—Westinghouse Elec. & Mfg. Co., Springfield, Mass.	900-	331-	1500
WCAD—St. Lawrence University, Canton, N. Y.	1140-	263-	250
WCAE—Kaufmann & Baer Co., Pittsburg, Pa.	650-	461-	500
WCAH—Entrekin Electric Co., Columbus, O.	1130-	266-	200
WCAI—Nebraska Wesleyan Uni., Uni. Place, Nebr.	1190-	275-	500
WCAL—St. Olaf College, Northfield, Minn.	890-	337-	500
WCAP—Cheaspeake & Potomac Tel. Co., Wash., D. C.	640-	469-	500
WCAR—Southern Radio Corp. of Texas, San Antonio, Tex.	1140-	263-	100
WCAU—Durham & Co., Philadelphia, Pa.	1080-	278-	500
WCAX—University of Vermont, Burlington, Vt.	1200-	250-	100
WCAY—Milwaukee Civic Br'dcstng Assoc., Milwaukee, Wis.	1130-	266-	250
WCBC—University of Michigan, Ann Arbor, Mich.	1310-	229-	200
WCBD—Wilbur G. Voliva, Zion, Ill.	870-	345-	500
WCBI—Nicoll, Duncan & Rush, Bemis, Tenn.	1250-	240-	150
WCUW—Clark University, Worcester, Mass.	1260-	238-	250
WCCO—Washburn Crosby Co., Minneapolis, Minn.	720-	416-	500
WCEE—Charles E. Erbstein, Elgin, Ill.	1090-	275-	500
WCK—Stix, Baer & Fuller Dry Goods Co., St. Louis, Mo.	1100-	273-	100
WCM—Texas Markets & Warehouse Dept., Austin, Tex.	1120-	268-	250
WCN—Foster & McDonnell, Chicago, Ill.	1130-	266-	500
WCTS—C. T. Sherer Co., Worcester, Mass.	1120-	268-	100

	K.C.	W.L.	W.P.
WCX—Detroit Free Press, Detroit, Mich		580-	517- 500
WDAE—Tampa Daily News, Tampa, Fla	1100-	273-	250
WDAF—Kansas City Star, Kansas City, Mo		820-	366- 500
WDAG—J. Laurence Martin, Amarillo, Tex	1140-	263-	100
WDBE—Gilham-Schoen Electric Co., Atlanta, Ga	1080-	278-	100
*WDBK—M. F. Broz Radio Store, Cleveland, O	1320-	227-	100
WDBR—Tremont Temple Baptist Church, Boston, Mass.	1170-	256-	100
WDBY—North Shore Congregational Church, Chicago, Ill.	1160-	258-	500
WDWF—Dutee W. Flint, Cranston, R. I.		680-	441- 500
WDZ—James L. Bush, Tuscola, Ill	1080-	278-	100
WEAF—American Tel. & Tel. Co., New York, N. Y.		610-	492-2000
WEAI—Cornell University, Ithaca, N. Y.	1180-	254-	500
WEAJ—University of So. Dakota, Vermilion, So. Dak.	1080-	278-	100
WEAM—Borough of North Plainfield, No. Plainfield, N. J.	1150-	261-	250
WEAN—Shepard Co., Providence, R. I.	1110-	270-	100
WEAO—Ohio State University, Columbus, Ohio	1020-	294-	500
WEAP—Mobile Radio Co., Mobile, Ala	1140-	263-	100
WEAR—Goodyear Tire & Rubber Co., Cleveland, Ohio.	770-	389-1000	
WEAU—Davidson Bros. Co., Sioux City, Iowa	1090-	275-	100
WEAY—Iris Theater, Houston, Tex		833-	360- 500
WEBH—Edgewater Beach Hotel Co., Chicago, Ill.		810-	370-1000
WEBJ—Third Avenue Railway Co., New York, N. Y.	1100-	273-	500
WEBL—Radio Corp. of America, United States (portable)	1330-	226-	100
WEBM—Radio Corp. of America, United States (portable)	1330-	226-	100
WEBW—Beloit College, Beloit, Wis	1120-	268-	500
WEEI—Edison Electric Illuminating Co., Boston, Mass.		630-	476- 500
WEMC—Emmanuel Missionary Col., Berrien Springs, Mich.	1050-	286-	500
WEW—St. Louis University, St. Louis, Mo	1210-	248-	100
WFAA—Dallas News & Dallas Journal, Dallas, Tex		630-	476- 500
WFAV—University of Nebraska, Lincoln, Neb	1090-	275-	500
WFBB—Eureka College, Eureka, Ill	1250-	240-	100
WFBG—William F. Gable Co., Altoona, Pa	1080-	278-	100
WFBH—Concourse Radio Corp., New York, N. Y.	1100-	273-	500
WFBI—Galvin Radio Supply Co	1270-	236-	100
WFBK—Dartmouth College, Hanover, N. H	1170-	256-	100
WFBL—Onondoga Hotel, Syracuse, N. Y	1190-	252-	100
WFBM—Merchant Heat & Light Co., Indianapolis, Ind.	1120-	268-	250
WFBR—Fifth Infantry Maryland N. G., Baltimore, Md.	1180-	254-	100
WFBY—U. S. Army 5th Corps Area, Ft. Benj. Har'sn, Ind.	1160-	258-	100
WFI—Strawbridge & Clothier, Philadelphia, Pa.		760-	395- 500
WGAQ—W. G. Patterson, Shreveport, La	1140-	263-	150
WGAZ—South Bend Tribune, South Bend, Ind	1090-	275-	250
WGBA—Jones Electric & Radio Mfg. Co., Baltimore, Md.	1180-	254-	100
WGBB—Harry H. Carman, Freeport, N. Y	1240-	244-	100
WGBG—Breitenbach's Radio Shop, Thrifton, Va	1330-	226-	100
WGBS—Gimbel Bros., New York		950-	316-1000
WARC—Am. Rad. & Research Corp., Medf'd H'lsde, Mass.	1150-	261-	100
WGN—The Tribune, Chicago, Ill		810-	370-1000
WGR—Federal Telephone Mfg. Corp., Buffalo, N. Y.		940-	319- 750
WGST—Georgia School of Technology, Atlanta, Ga.	1110-	270-	500
WGY—General Electric Co., Schenectady, N. Y.		790-	380-1500
WHA—University of Wisconsin, Madison, Wis		560-	535- 500
WHAD—Marquette University, Milwaukee, Wis	1000-	275-	500
WHAG—University of Cincinnati, Cincinnati, O	1290-	233-	100
WHAM—University of Rochester, Rochester, N. Y.	1080-	278-	100
WHAR—Seaside Hotel, Atlantic City, N. J	1090-	275-	100
WHAS—Courier Journal & Louisville Times		750-	400- 500
WHAV—Wilmington Electric Specity Co., Wilmington, Del	1130-	266-	100
WHAZ—Rensselaer Polytechnic Institute, Troy, N. Y.		790-	380- 500
WHB—Sweeney School Co., Kansas City, Mo		820-	366- 500
WHBF—Beardsley Specialty Co., Rock Island, Ill.	1350-	222-	100
WHBH—Culver Military Academy, Culver, Ind	1350-	222-	100
*WHBW—D. R. Kienzle, Philadelphia, Pa	1390-	216-	100
WHDI—Wm. Hood Dunwoody Ind. Inst., Minneapls, Minn.	1080-	278-	100
WHEC—Hickson Electric Co., Inc., Rochester, N. Y.	1160-	258-	100
WHK—Radiovox Co., Cleveland, O	1100-	273-	100
WHN—George Schubel, New York, N. Y		830-	361- 500
WHO—Bankers Life Co., Des Moines, Iowa		570-	526- 500
WIAD—Howard R. Miller, Philadelphia, Pa	1200-	250-	100
WIAK—Journal-Stockman Co., Omaha, Nebr	1080-	278-	250
WIAS—Home Electric Co., Burlington, Iowa	1180-	254-	100
*WIBA—The Capital Times Studio, Madison, Wisc	1270-	236-	100
*WIBC—L. M. Tate Post No 39, V. F. W. St Petersburg, Fla	1350-	222-	100
WIK—K. & L. Electric Co., McKeesport, Pa	1280-	234-	100
WIL—St. Louis Star, Benson Radio Co., St. Louis, Mo.	1100-	273-	250
WIP—Gimbel Bros., Philadelphia, Pa		590-	508- 500
WJAD—Jackson's Radio Eng. Laboratories, Waco, Texas.		850-	353- 500
WJAG—Norfolk Daily News, Norfolk, Nebr	1110-	270-	250
WJAR—The Outlet Co., Providence, R. I		980-	306- 500
WJAS—Pittsburgh Radio Supply House, Pittsburgh, Pa.	1090-	275-	500
WJAZ—Zenith Radio Corp., Chicago, Ill. (portable)	1120-	268-	100
WJJD—Supreme Lodge, L. O. Moose, Mooseheart, Ill.		990-	303- 500
WJY—Radio Corporation of America, New York, N. Y.		740-	405-1000
WJZ—Radio Corporation of America, New York, N. Y.		660-	454-1000
WKAQ—Radio Corporation of Porto Rico, San Juan, P. R.	880-	341-	500
WKAR—Michigan Agric. Col., E. Lansing, Mich	1050-	286-	500
WKY—WKY Radio Shop, Oklahoma, Okla	1090-	275-	100
WLAL—First Christian Church, Tulsa, Okla	1200-	250-	150
WLBL—Wisconsin Dept. of Markets, Stevens Point, Wis.	1080-	278-	500
WLIT—Lit Bros., Philadelphia, Pa		760-	395- 500
WLS—Sears, Roebuck Co., Chicago, Ill		870-	345- 500
WLW—Crosley Radio Corporation, Harrison, O		710-	422-1500
WMAC—Clive B. Meredith, Cazenovia, N. Y	1090-	275-	100
WMAF—Round Hills Radio Corp., Dartmouth, Mass.		833-	360- 500
WMAF—Round Hills Radio Corp., Dartmouth, Mass.		833-	360- 100
WMAK—Norton Laboratories, Lockport, N. Y.	1130-	466-	500
WMAQ—Chicago Daily News, Chicago, Ill		670-	448- 500
WMAY—Kingshighway Presbyterian Church, St. Louis, Mo.	1210-	248-	100
WMAZ—Mercer University, Macon, Ga	1150-	261-	100
WMBF—Fleetwood Hotel, Miami Beach, Fla		780-	384- 500
WMC—Commercial Appeal, Memphis, Tenn		600-	500- 500
*WMCA—Greeley Square Hotel Co., New York N. Y.		880-	341- 500
WMH—Ainsworth-Gates Radio Co., Cincinnati, O		710-	422- 750
WMH—Ainsworth-Gates Radio Co., Cincinnati, O		920-	326- 750
WMU—Doubleday Hull Electric Co., Washington, D. C.	1150-	261-	100
WNAC—Shepard Stores, Boston, Mass	1070-	280-	500
WNAD—University of Oklahoma, Norman, Okla	1180-	254-	250
WNAP—Wittenberg College, Springfield, Ohio	1210-	248-	100
WNAT—Lennig Bros. Co., Philadelphia, Pa	1200-	250-	100
WNAX—Dakota Radio Apparatus Co., Yankton, S. Dak.	1230-	244-	100
WNJ—Radio Shop of Newark, Newark, N. J	1290-	233-	150
WNYC—City of New York, New York, N. Y.		570-	526-1000
WOAI—Southern Equipment Co., San Antonio, Texas.		760-	395- 500
WOAN—James D. Vaughn, Lawrenceburg, Tenn	1060-	283-	500
WOAW—Woodmen of the World, Omaha, Nebr		570-	526-1000
WOC—Palmer School of Chiropractic, Davenport, Iowa.	620-	484-	1500
WOI—Iowa State College, Ames, Iowa	1110-	270-	500
WOO—John Wanamaker, Philadelphia, Pa		590-	508- 500
WOQ—Unity School of Christianity, Kansas City, Mo.	1080-	278-	500
WOR—L. Bamberger & Co., Newark, N. J		740-	405- 500
WORD—People's Pulpit Association, Batavia, Ill	1080-	278-	500
WOS—Missouri State Marketing Bureau, Jefferson City, Mo.	680-	441-	500
WPAJ—Doolittle Radio Corporation, New Haven, Conn.	1120-	268-	100
WPG—Municipality of Atlantic City, Atlantic City, N. J.	1000-	300-	500
WPSC—Pennsylvania State College, State College, Pa.	1150-	261-	500
WQAA—Horace A. Beale, Jr., Parkesburg, Pa	1360-	220-	500
WQAC—Gish Radio Service, Amarillo, Tex	1280-	234-	100
WQAM—Electrical Equipment Co., Miami, Fla	1120-	268-	100
WQAN—Scranton Times, Scranton, Pa	1200-	250-	100
WQAO—Calvary Baptist Church, New York, N. Y.		833-	360- 100
WQAS—Prince-Walter Co., Lowell, Mass	1190-	252-	100
WQJ—Calumet Rainbow Broadcasting Co., Chicago, Ill.		670-	448- 500
WRAA—Rice Institute, Houston, Tex	1170-	256-	100
WRAK—Economy Light Co., Escanaba, Mich	1170-	256-	100
WRAL—Northern States Power Co., St. Croix Falls, Wis.	1210-	248-	100
WRAM—Lombard College, Galesburg, Ill	1230-	244-	100
WRAV—Antioch College, Yellow Springs, Ohio	1140-	263-	100
WRAX—Flexon's Garage, Gloucester City, N. J.	1120-	268-	100
WRBC—Immanuel Lutheran Church, Valparaiso, Ind.	1080-	278-	500
WRC—Radio Corporation of America, Washington, D. C.		640-	469- 500
WREO—Reo Motor Car Co., Lansing, Mich	1050-	286-	500
WRK—Doron Bros. Electrical Co., Hamilton, O	1110-	270-	200
WRM—University of Illinois, Urbana, Ill	1100-	273-	500
WRR—Dallas Police & Fire Dept., Dallas, Tex	1150-	261-	200
WRW—Tarrytown Radio Research Laboratories	1100-	273-	500
WSAB—S. E. Missouri State Tech's Col., Cape Gir'du Mo.	1090-	275-	100
WSAC—Clemson Agric. Col., Clemson College, S. C.		890-	337- 500
WSAD—J. A. Foster Co., Providence, R. I	1170-	256-	100
WSAG—Gospel Tabernacle, St. Petersburg, Fla	1130-	266-	500
WSAI—United States Playing Card Co., Cincinnati, O.		920-	326- 500
WSAJ—Grove City College, Grove City, Pa	1310-	229-	250
WSAP—The City Temple, New York, N. Y.	1140-	263-	250
WSAR—Doughty & Welch Electric Co., Fall River, Mass.	1180-	254-	100
WSAV—Clifford W. Vick Radio Const. Co., Houston, Tex.		833-	360- 100
WSB—Atlantic Journal, Atlantic, Ga		700-	428- 750
WSL—J. & M. Electric Co., Utica, N. Y	1100-	273-	100
WSOE—School of Engi'rng of Milwaukee, Milwaukee, Wis.	1220-	246-	100
WSUI—State University of Iowa, Iowa City, Iowa		620-	484- 500
WSY—Alabama Polytechnic Institute, Auburn, Ala	1200-	250-	500
WTAB—Fall River Daily Herald Pub. Co., Fall R'vr, Mass.	1130-	266-	100
WTAC—Penn. Traffic Co., Johnstown, Pa	1430-	210-	100
WTAM—Willard Storage Battery Co., Cleveland, O		770-	389-1500
WTAQ—S. H. Van Gorden & Son, Osseo, Wis	1180-	254-	200
WTAR—Reliance Electric Co., Norfolk, Va	1150-	261-	100
WTAS—Charles E. Erbstein, Elgin, Ill		990-	302-1000
WTAT—Edison Illum'ting Co., Boston, Mass., (portable)	1230-	302-	100
WTAW—Agric. & Mech. Col. of Texas, Col. Station, Tex.	1110-	270-	250
WTAY—Oak Leaves Broadcasting Station, Oak Park, Ill.	1200-	250-	500
*WTHS—Flint Senior High School, Flint, Mich	1370-	219-	250
WTIC—Travelers Insurance Co., Hartford, Conn		860-	349- 500
WWAD—Wright & Wright, Philadelphia, Pa	1200-	250-	100
WWAE—Lawrence J. Crowley, Joliet, Ill	1240-	242-	500
WWAO—Michigan College of Mines, Houghton, Mich	1230-	244-	250
WWI—Ford Motor Co., Dearborn, Mich	1130-	266-	250
WWJ—Detroit News, Detroit, Mich		850-	353- 500

*Additions and corrections.

I'll Let You Smoke 5 DAYTONETTES to Prove that I'm Giving

10c QUALITY CIGARS for 3c

Smoke a DAYTONETTE Panatella and taste a cigar as mild and mellow as old wine, as fragrant as incense.—Such a blend of fine tobaccos you have never tasted. But don't think there is a joker when I tell you that I am actually selling this cigar for 3c. I have a good reason.

Actual Size
Daytonette
Panatella

Special Low Introductory Price

DIRECT FROM FACTORY

Only to acquaint smokers of the marvellous flavor of DAYTONETTES, can I make this unheard of, ridiculously low offer. I know from the thousands of men who are smoking DAYTONETTES, that when YOU get started to smoking them, you will always regardless of the price.

But even for the advertising value of this offer, I never could afford to make it if I did not give them to you direct from the factory. This way I eliminate big slices of profits jobbers and dealers make, credit losses and extra handling and transportation expenses. I cut out at least 100% needless profits.

Mild, Mellow, Fragrant Panatellas

Choicest Tobacco—No Scrap

I want you to smoke the best 10c cigar you can buy—then smoke a DAYTONETTE. If you don't say I'm giving a better cigar you will be the first one that hasn't.

Every leaf that goes into DAYTONETTES is carefully selected from the choicest tobacco that grows. My reputation is at stake. I will make no money unless you continue to smoke my cigars.

ONE OF THOUSANDS
12-31-24.
Dayton Cigar Co.,
Dayton, Ohio.
Messrs:—
Received the "Daytonettes" few days ago and will say, have enjoyed every one of them and have liked them so well have given my friends most of them. I have been smoking for 20 years and mostly two for 25c but like these better.
So please send two more boxes like these C. O. D.
Yours very truly,
J. H. SHEPPERD.

My blend is a secret that no other manufacturer has ever been able to copy. It has taken me nine years to perfect it. Now I want you to try it.

Daytonettes are *hand-made*. Every one draws well and gives you the fullest benefit of the wonderfully blended tobaccos. And my cigars are the most sanitarily made of any that we have a record of.

Smoke Five at My Risk---And See If I Am Not Right

If you do not believe all I have said about my cigars, I am willing to prove it. Let me send you a box of 100 DAYTONETTES. Smoke five out of the box, and if you are not more than delighted, return the rest. Fill out the coupon and mail with a deposit of $3 for the box or give the postman a deposit of $3.25 including C. O. D. expense. If you decide to return the box, the money will cheerfully be refunded. Postal authorities see that we make our word good. You have nothing to loose and $7 to save. Fill out and mail the coupon now.

H. A. JACQUES,
Director of Sales.

TEAR OUT AND MAIL

DAYTON CIGAR CO.,
Factory 111,
Dayton, Ohio.

I'll let you prove to me that you are actually giving 10c quality cigars for 3c. Send me one box of 100. I will smoke five and if not satisfactory, I may return the rest. If I do not enclose the deposit of $3, I will pay the postman $3.25 as deposit including C. O. D. charges.

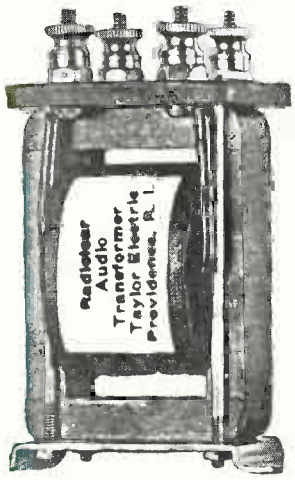
NAME. . . . . .

ADDRESS. . . . . .

She Cut The Last Dance

It was the last regular dance of the season, too. At first he was desolated, but the thought then occurred to him that by adding a couple of steps of amplification to his single tube set he could get fox-trot music on his loud speaker. So he purchased two RADICLEAR kits, and although he was no expert, he hooked them up.

Presto! The music was so loud and clear that she consented to come to an informal dance and all was happy again.



Many transformers, while giving music almost as sweet as the RADICLEAR, are still not loud enough to permit dancing. It requires a large amount of engineering skill to combine sweetness of tone and loud volume in the same unit.

One of the things which helps accomplish this result is the kind of insulation used between layers in winding the secondary. This insulation has been especially developed for just such a purpose. So many transformer builders use ordinary insulation and so get very ordinary results.

The transformer alone sells for $3.95, or the kit, which includes everything needed for a complete step of audio amplification, is $6.00. This includes RADICLEAR transformer, rheostat, socket, (state kind of tube used), phone jack, amplifier terminal, and wiring. Use the coupon for easy ordering.

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

Please send me the following by parcel post. (Mark which one you want.)
Radiclear Audio Transformer @ $3.95
Amplifier set complete @.....$6.00
(Socket to fit.....tube)
Audion Crystal @ 25c.
Gold Plated Cat Whisker @ 15c.

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

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

Name.....

Address.....

TAYLOR ELECTRIC CO.

1206 Broad Street

Providence, R. I.