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RADIO PROGRESS

"Always Abreast of the Times"

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Why is a Lightning Arrester?

Special Article by Horace V. S. Taylor

Building a Five-Tube Neutrodyne

Non-Squealing Regenerative Radio

The Popular Loop Aerial

Winner of Prize Liar Contest

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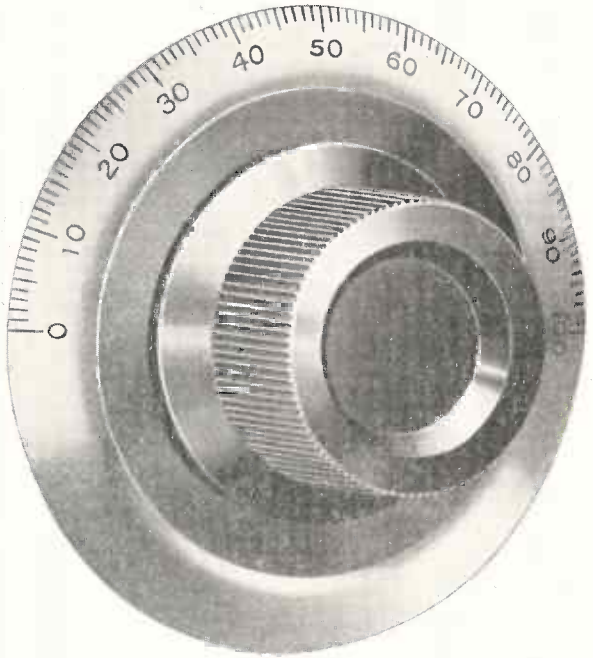

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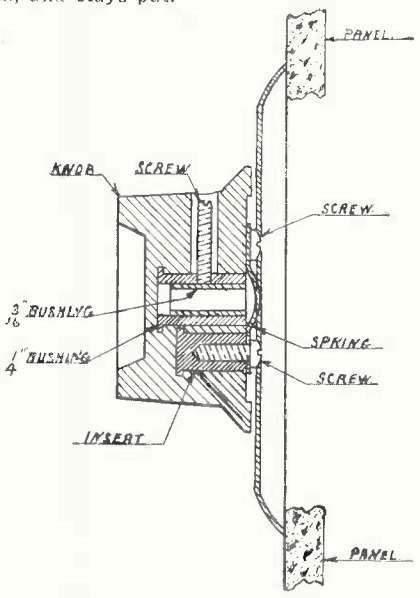

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RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 1 Number 3

Contents for

APRIL 15, 1924

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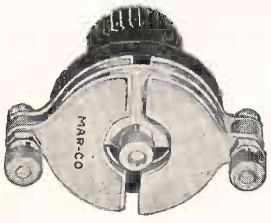

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RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. I, No. 3 APRIL 15, 1924 15c. PER COPY, $3 PER YEAR

Why is a Lightning Arrester?

If Yours is Wrong Perhaps the Fire Engine Will Call at Your House

By HORACE V. S. TAYLOR

THE most abused part of the usual radio installation is the lightning arrester. Most radio fans do not know what the arrester is and are rather hazy about what it does. Some think it necessary and some omit it. This article is intended to clear up some of the questions which are being asked about this subject.

The theory of a lightning arrester is quite simple. We have an aerial extending up into the air like a lightning rod. This aerial gathers the electrical energy of a radio message out of the air, and conducts it down through the set to the ground. But the aerial can hardly be called intelligent. It will not pick up the electricity of a radio concert and the next day refuse to pick up the lightning stroke, which is perhaps several million times more powerful. In fact, it can not pick and chose at all, but sends all the electricity it can gather down the lead-in wire. So, if a thunder cloud, in a playful mood, hands a bolt of lightning to your aerial, it is a sign that some one will pull the fire alarm box in your neighborhood. That is, unless you have an efficient lightning arrester connected to your aerial. In this event the arrester will conduct the bolt of lightning directly and harmlessly to the ground and your house will be protected from fire.

What the Arrester Does

From this you will see that a lightning arrester is a piece of electrical apparatus which does not disturb the small voltages caused by the radio waves (if it did, it would disturb the broadcasting), but which will short circuit large voltages direct to ground. Refer to Figure 1 to see how this result is accomplished.

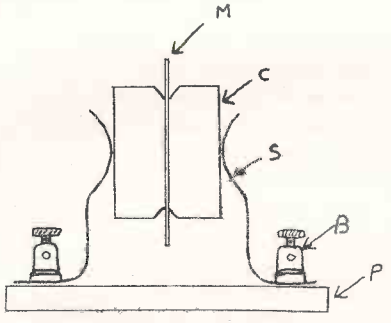


Fig. 1. X-Ray View of Your Lightning Arrester

M is a thin mica disk. On each side of this disk are blocks of carbon C. These two blocks of carbon are pressed up tight against the mica by the two springs S. The springs are fastened at he lower end by the binding posts B. The whole apparatus is mounted on a porcelain base P. The mica diaphragm M has one or more small holes cut right through it. Remember now that mica is a very good insulator, but that the holes in the mica will allow electricity to pass from one carbon block C to its mate. The blocks do not quite touch each other; as a matter of fact, they are held a small distance apart—just equal to the thickness of the mica diaphragm. This completes the description of the arrester itself.

Connecting the Arrester

To connect this apparatus either binding post is attached to the aerial and the other one to the ground wire. When a radio wave comes along it runs direct to its carbon block, but it cannot get across to the other block because of the mica and air space, so nothing happens—it cannot get through and the wave goes direct to your radio set and makes music. From this you will see that the arrester does absolutely nothing whatever to the broadcasting which you receive. But now suppose a thunder storm comes up. The lightning comes nearer and nearer and finally a direct stroke or a secondary stroke of lightning hits the aerial. This will give a pressure of several thousand up to several million volts on the wire. Immediately the little film of air in the hole through the mica diaphragm breaks down and the bolt of lightning jumps across from one carbon block to the other, and so goes down the ground wire direct to earth. The house is saved and the fire bell does not ring.

Most types of lightning arresters on the market are built on this principle. There is one other scheme also used which is quite similar, except that the two disks C are placed inside a glass tube and then the air is pumped out, leaving a partial vacuum. Lightning can jump through such a partial vacuum quicker than through the air and so the arrester will work at a somewhat lower voltage. The advantage of such an arrester is that it offers protection at a little less electrical pressure. The dis-

advantage is that if the glass tube gets cracked and so lets in the air, thus killing the vacuum, the efficiency of operation is much reduced and you do not know about it until the next lightning stroke sets the house on fire.

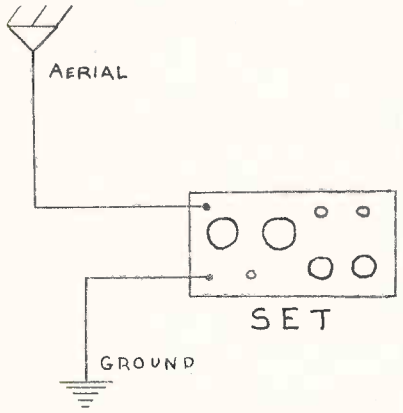


Fig. 2. Puzzle—Find the Lightning Arrester

Errors in Installing

Figure 2 shows the commonest lightning arrester error. Or, perhaps, we should say, doesn't show it, because the lightning arrester isn't there. This applies only to an outside aerial where there is danger of a lightning stroke. An inside aerial is just as safe as any other part of your house, and so no arrester is required by the Underwriters.

Your Insurance Won't be Paid

If you have an outside aerial and you do not install a lightning arrester, then you might just as well stop paying your insurance premiums. The fire insurance people won't pay your insurance when your house burns down if you haven't an arrester. But perhaps you can prove that the fire started from lighting the kitchen stove with kerosene. That will not help you a bit. Your insurance policy demands that you use approved electrical fittings as required by the Underwriters, or else you don't get your money. So by all means make sure that you have a lightning arrester.

Figure 3 shows another form of lightning protection. Here we have a single pole double throw switch. (This means that there is only a single bar in the switch, but that you can throw it either up or down.) When the switch is thrown up, you will see it connects the aerial to the set. This is the position for receiving the music. At eleven o'clock (or maybe one or two o'clock) when you get through listening you throw the switch to the down position. This you will notice disconnects the set from the aerial, but connects the aerial direct to ground. Such a system affords very good lightning protection, except that one night you were so sleepy you forgot to throw the switch down, and unfortunately a thunder shower came up, and so set the house on fire. It happens that the fire insurance companies do not like to pay fire losses very well and so they are very explicit in requiring you to put on a lightning arrester anyway, even if you are also using a grounding switch as shown. This arrester must be so good that it will protect against thunder storms even when you do forget to throw the switch. Since it is as good as that and will work when you forget the switch, why use the switch at all? As a matter of fact, the Underwriters do not require the switch, but recommend it if you want to use it.

Another common mistake is shown in Figure 4. This shows the aerial lead-in coming through the top of the window. From there the wire runs down to the bottom of the window where the lightning arrester is installed. This is contrary to the rules of the Underwriters. They say, "each lead-in wire shall be provided with an approved protective device located as near as practicable to the point where

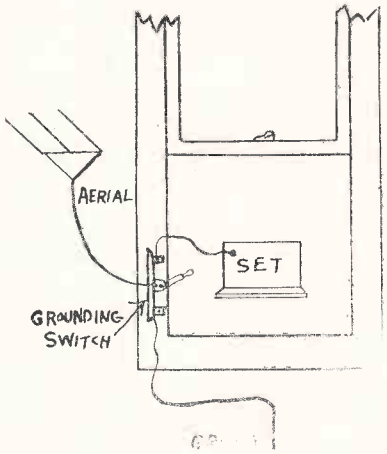


Fig. 3. Grounding Switch is Not Enough Protection

the wire enters the building." They do not interpret it as being close enough to the entrance, if the arrester is several feet away. In this picture the arrester should be up at the top of the window, within a foot or so of the entrance. The idea is that when the lightning enters through the building it should be conducted to ground just as soon as possible, in order to give the least chance of causing any damage.

On the other hand, don't make the mistake shown in Figure 5. Here we have an arrester installed up at the top of the window, but unfortunately the curtains cover it. This is dangerous, as the Underwriters state "the protector shall not be placed in the immediate vicinity of easily ignitible stuff, or

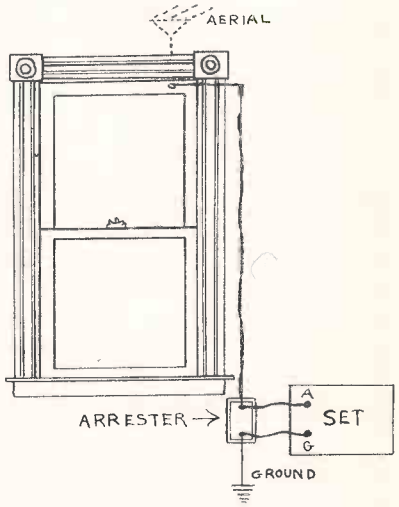


Fig. 4. This Location of Arrester is Not Allowed

where exposed to inflammable gases or dust or combustible materials." When a lightning stroke does occur it sometimes happens that a flash of fire will be thrown out from the arrester itself, and naturally if ignitible curtains are in its vicinity, there is a pretty good chance that they may catch fire, and so the arrester would be a source of danger, rather than safety. In such a location, two possible ways of remedying the trouble are open. Either the arrester can be mounted directly above the curtain and six inches away from it, or else it can be moved out to the side of the window and installed on a board fastened to the wall.

If either of these plans are objectionable, then it is allowable to take a piece of heavy asbestos board and fasten it between the arrester and the curtain.

Outside Installations

Of course, another way out of this difficulty is to put the arrester outside the window as shown in Figure 6. Here

it is located a foot above the entrance through the window. This is allowed by the Underwriters. However, it is not usually done for the following reasons: An arrester suited for outside installation has to be made waterproof and so usually it costs considerably more than one which is satisfactory for inside work. Another trouble is that, whereas, when in your rooms it will be kept reasonably clean, if left outside it is likely to get covered with dirt and grime. In such a case perhaps it will not work as

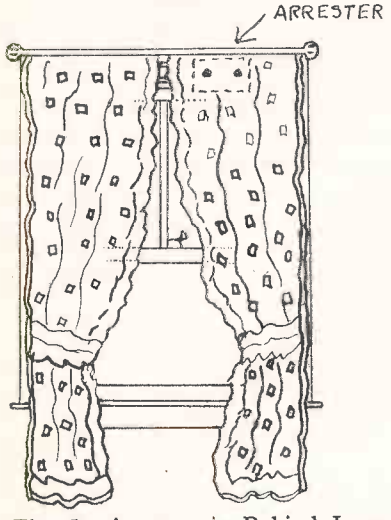


Fig. 5. Arrester is Behind Lace Curtain

well as it otherwise might when lightning strikes the aerial. Besides this it will never get any inspection if you cannot see it from the window, and if the ground wire should drop off you probably would not know about it. Of course, such an occurrence would be seen right away if it were inside. For these reasons, we recommend the inside installation, if it is possible.

What Kind of a Ground?

In grounding an arrester you must be careful to follow the Underwriters' rule. They recommend grounding on a water-pipe, but if that cannot be done ground on a pipe driven into the earth, but do not do it like Figure 7. The pipe is shown entering the ground only a couple of feet. This is not enough to make good contact. As explained in the last issue of RADIO PROGRESS the pipe should enter permanently moist ground to a depth of at least four feet. Since the permanent moisture is usually two or three feet down, it means that some six or eight feet of pipe should be used to get good results. Other grounds allowed by the Underwriters are grounded steel frames of buildings, or other grounded metallic work in the building, and artificial grounds, such as buried plates, cones, etc.

Two Grounds Unnecessary

We have two separate grounds shown in Figure 8, one for the arrester and one for the radio set. While this is quite legal it is an unnecessary waste of time and money. Unless the ground for the arrester is good enough to be passed by the Underwriters, it will not make a satisfactory connection for the radio set. And once you put in a first-class ground for the arrester, why not use it for the set? This is particularly mentioned in the fire insurance rules and is allowed by them. So the best method is to connect up your arrester first, and after complying with the requirements of the Underwriters, run the ground wire from the arrester over to the radio and you will cut the work of installing a ground in two.

A Very Common Mistake

Another mistake made very often is that of using a protective device which is not approved by the Underwriters. All the approved arresters carry the notice of approval either on the device itself, or else on the container. The label will usually give the serial number of the approval and the date. When you see such a notice you will know that it is safe to use the apparatus and if it is missing you are running a serious risk if you depend upon it. As

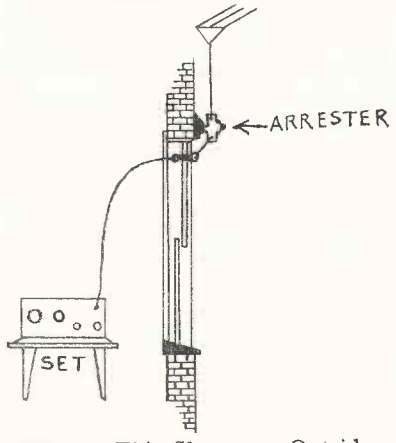


Fig. 6. This Shows an Outside Installation

pointed out above, this risk is not so much that your house may be set on fire as that the fire insurance company will not pay the policy if the house burns down from any cause at all. You cannot blame the fire insurance people for not holding up their end of the contract if you yourself break the contract at first by using apparatus that you have promised not to.

What Kind of Wire?

The kind of wire to use on your lightning arrester has been the subject of

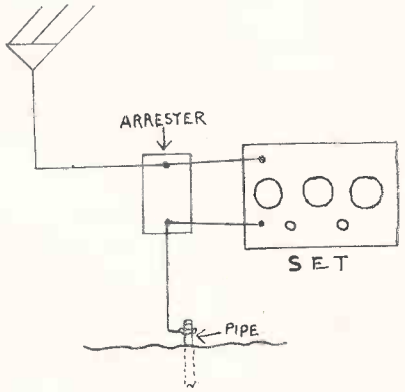


Fig. 7. The Ground on This Arrester Not Approved

considerable discussion and argument. Up to about a year or two ago it was required that you use No. 10 insulated wire for grounding the arrester, but in May, 1922, this was changed. Since that

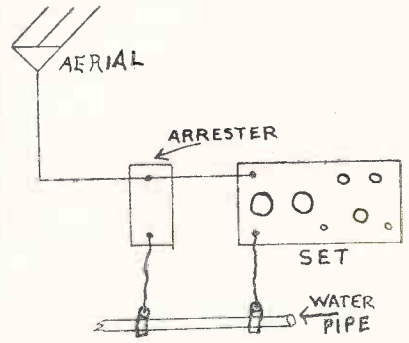


Fig. 8. Too Much of a Good Thing One Ground Enough

time you must use either copper or copper-covered steel wire at least as big as No. 14 if the former, or No. 17 if the latter. It need not be insulated. As a matter of fact, there is no advantage at all in insulating the ground wire, as it adds considerably to the expense and nothing at all to the safety. Since your aerial will be constructed of No. 14 bare copper wire, you might just as well use the same kind for a ground for arrester and set.

Continued on Page 8

American Radio Relay League

Unusual Boomerang Prize Contest is Offered

You often speak about something you have done being a boomerang when it comes back and hits you. Here is a chance to get a real boomerang imported direct from Australia. This is the native weapon used by the aborigines, and when thrown into the air it will perform the most astounding tricks. It can be made to rise to a surprising height, then suddenly swerve and come back to the feet of the thrower.

Must Get Answer Back

Such a boomerang is offered as a prize by the American Radio Relay League of Hartford, Conn. It will be presented to the first radio amateur in this country or Canada who establishes two-way communication with an amateur in Australia or New Zealand. This is, the winner must talk back and forth with one of the countries named. Already one-way messages have been received, but so far no one has been able to get back an answer.

A number of foreign countries, regarded heretofore as backward in the development of radio communication, are now showing an increasing interest in amateur transmission. New Zealand fans have been for some time a highly appreciative and little known audience of American broadcast stations. While listening to transmissions from this country they have heard amateurs in the various districts talking with one another by radio telegraph and many have learned the code so that they are able to understand some of these communications.

As Far as Kansas

They desire now to make themselves heard in the States and several have installed code transmitters for that purpose. Already amateurs in Eureka, Kansas, and Bridgewater, Mass., have reported hearing a New Zealand transmitting station. Rev. Chapman, a missionary at Anvik, Alaska, claims to have heard a New Zealand call.

As New Zealand and the Philippines are about equally distant from the center of the United States, it is expected that communication with the islands will be possible in the near future. However, the local receiving conditions are by no means as good as they are in New Zealand, where atmospherics are at a minimum. Fred Elser, operator of the Philippine station IZA, is making an effort to communicate with the United States with two 50-watt tubes.

RELAY LEAGUE ANNOUNCES A NOVEL DOUBLE COUNTERPOISE

An unusual form of counterpoise has been announced by the American Radio League. This has been designed by Adriano Ducati of Italy. An ordinary aerial is used, but no ground. Instead the ground connection of the sending set is hooked up to a counterpoise about eight feet above the ground level. So far this is standard practice, but in addition to this counterpoise there is a second series of wires spaced just as far above the aerial as *it* is above the lower counterpoise. You might almost call it an aerial sandwich; that is, an aerial for the meat and a counterpoise above and below like slices of bread.

It Sounds Like a Sandwich, but in Spite of That—it Works

This sounds like a rather peculiar arrangement, but the proof of the pudding, etc., and with it Signor Ducati has communicated very successfully with amateurs in this country. He is easily the foremost amateur in Italy, inasmuch as he was the first to establish two-way connection with this country. Being unfamiliar with all of the methods employed by American radio men, he did not place any special stress on his novel aerial. The technical department of the A. R. R. L., however, is interested in the use of an additional counterpoise over the antenna, and experiments will be made shortly to determine its special advantages.

In other respects Signor Ducati's equipment is similar to the better class of amateur stations in this country, and the results are regarded as remarkable considering that an interest in amateur radio is just beginning in Italy. He states that the broadcast bug is biting and conditions as regards reception of programs are about the same as they were in the United States two years ago.

Europe Squeals, Too

Every one wants radio sets, but the ready-made apparatus is far from being standardized. The fan who is starting in radio is in doubt as to what kind of a set he should get, and interference conditions are likely to be troublesome for some time to come. Strange to say, most of the interference on short waves come from stations in Holland, France, England, Switzerland, Belgium and other places.

WHY IS A LIGHTNING ARRESTER?

Continued from Page 7

Some people have taken great pains to run the ground wire out through a convenient window and along the outside wall of the house down to the cellar, then into the cellar window to ground on the waterpipe. Such a rambling route is undesirable. It is not required that the ground wire be run outside of the house. It is preferable indeed, since the arrester and the waterpipe are both indoors, to have the wire connecting them inside the building. Nor is it demanded that this wire must be carried on porcelain insulators. It must, however, be protected from mechanical injury.

After you have looked over your arrester and made sure you have not made any mistakes mentioned above, then the best thing to do is to tell your fire insurance agent that everything is O. K. and get him to issue to you a policy rider to be pasted on your fire insurance policy. He will be glad to do this without making any charge for it. This is not required, but it is a good thing to do because then there will be no controversy at all about paying your fire insurance if you have the bad luck of having your house burn.

Constructing a Five-Tube Neutrodyne

Construction, Assembly, Wiring and Tuning Information for Home Building

By KIMBALL HOUTON STARK

Chief Engineer F. A. D. Andrea, Inc.

EDITOR'S NOTE: Of all the different radio sets which lately come on the market, probably the most popular is the Neutrodyne. The reason is found in the fact that it combines exceptional sharpness of tuning with remarkable ease of operation. The dial positions for any given station can be logged, that is, recorded in permanent form at any time that the station can be brought in again by setting the dials to the same position. Mr. K. H. Stark is the Chief Engineer of the F. A. D. Andrea Co., Incorporated, who manufacture the FADA line of radio material.

This article appears in two parts. The first installment below describes the theory of a neutrodyne and the details of construction. The second half outlines the hook-up and gives the methods of operating the set. We can recommend this as being one of the best radios we have ever tested.

BREATHES there a man with soul so dead that he has not enthusiastically told his neighbors with ready speech and beaming eye of his marvelous DX (distance) records the night before?

A rather funny statement was made to me the other day. The thought was presented that radio is certainly making us a nation of liars. A couple of rabid radio hounds meet at any radio store and immediately begin the discussion, infinite in detail and yet always ending with that universal topic of, "How far did you get last night?" One man hears signals, 1,500 miles on a two-tube super; another chap gets Los Angeles on a one-tube set; somebody else happens to think of the old days when someone told him about hearing a commercial ship station three thousand miles west of San Francisco, from New York City, using a crystal detector—and so it goes.

Romantic Radio

It seems to me the craze for distance will never die out. I don't want it to. Of all the romance, mystery and myths that we encounter in this life and that we are told about, where can we get romance that will compare with listening-in to concerts and music and speeches from stations hundreds of miles away, from invisible cities, as it were, from an empire not of radio receivers, or equipment, not of listeners or radio fans or experimenters, but a vast empire of pleasure and entertainment, of music and of all the good things that this world has in store for us.

There are thousands and thousands of radio fans that struggle along with their one-tube sets, or their two-tube sets, who are just wishing night and day they could add a fourth tube or a fifth tube in order to hear that station a few hundred miles beyond the limit of their receivers today. Some of these radio fans can afford to buy complete receivers, but the majority must build, or would rather build, their own.

Sled or Radio?

In past years, before radio came into people's homes, a man would build a mission table, a sled for the kiddies, or possibly a model engine; and, after planning for days, what a thrill he would get when the thing was actually finished and made to "work" or serve some useful purpose! Where in the world is there anything that can compare in giving to such people more thrills and pleasures, with the everyday use of radio receiver, built by their own hands, that works?

To give radio experimenters dependable, authorized constructional information concerning the neutrodyne circuit receiver is the purpose of this article.

In March of 1923, Professor L. A. Hazeltine revealed his developed work and introduced the neutrodyne circuit radio receiver. About July of 1923, a limited number of companies licensed under Professor Hazeltine's patents were building completed receivers, utilizing the neutrodyne principle and in addition were supplying complete sets of parts, suitable for neutrodyne-receiver construction.

Painstaking Care Necessary

Being in intimate touch with many people who have built neutrodyne-circuit receivers using such parts, I can assure you that to build such a receiver calls for reasonable care in construction in order to obtain maximum broadcast signal reception, but for thousands who would be painstaking, the results in the end certainly justify the expense and the pains necessary.

List of Materials Necessary to Construct a Five-Tube Neutrodyne

The five-tube neutrodyne-circuit receiver to be described gives two stages of tuned radio-frequency amplification, a vacuum-tube detector and two stages of audio-frequency amplification. Such a receiver will cost approximately $65.00 for parts, and if one purchases all the additional equipment, the total cost will be approximately $150.00, including the five vacuum tubes, storage battery, "B" battery, phones and antenna material.

The following list of materials for receiver construction must be acquired:

		Approximate Prices
1	Panel, bakelite, 26″ x 7″ x 3/16″, drilled, machined and engraved	$ 8.00
1	Base board, oak, 26″ x 6″ x ¾″	1.00
1	Triple socket	2.70
2	Single sockets	2.00
3	Neutroformers (tuned secondary R. F. transformers)	22.50
2	Neutrodons (neutralizing condensers)	2.50
2	Audio transformers	12.00

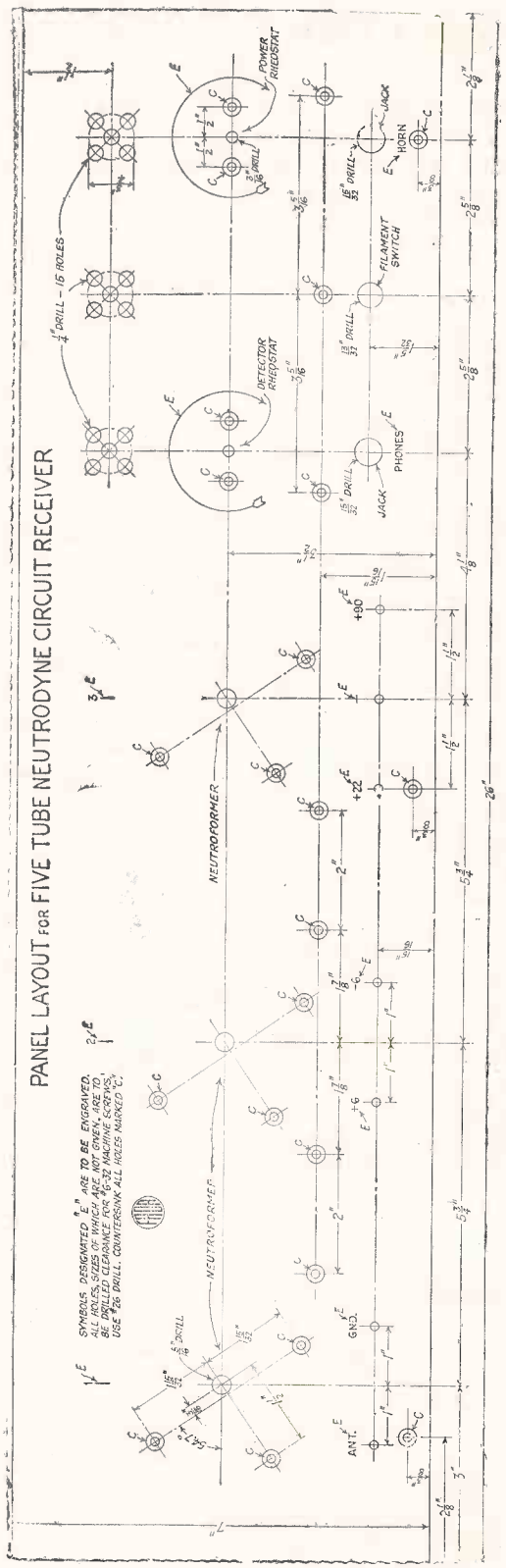


Fig. 1. This Shows Drilling Plan for Panel, Size 26" x 7" x 3/16"

1	A battery switch	.75
3	Dials (verniers are unnecessary)	3.60
1	Power rheotsat (2 ohms)	1.20
1	Detector tube rheostat (6 ohms)	1.25
7	Binding posts	.84
1	Radio jack, closed circuit	.75
1	Radio jack, three spring automatic	1.00
27 ft.	Insulated tubing	2.26
27 ft.	Wire No. 14, tinned copper	.25
2	Condensers, .006 mfd.	1.50
1	Grid leak, 2 megohms	.75
1	Grid leak, condenser, .00025 mfd.	.65
	screws, nuts, terminals, etc.	
	Total	$65.00

Great care should be taken in purchasing these parts and one should obtain only the special neutrodyne parts made by authorized licensees under Professor Hazeltine's patents.

Drilling Your Panel

For the panel, either bakelite, formica, condensite or radion may be used. A detailed panel drilling layout is shown in Figure 1, all dimensions being given.

If you do not purchase the complete set of parts but only the necessary special neutrodyne parts, you will need to lay out your own panel for drilling. In doing this it will be found convenient to use dividers and a combination square in order to get all dimensions, etc., accurately. It is suggested that you purchase the complete set of parts, which includes the panel with all holes drilled and the proper engraving done. By using such a finished panel in constructing your receiver, it presents a mighty good appearance when finished. However, if you do drill your own panel, very great care must be taken in laying out the position of the Neutroformer mounting holes as the relationship of the Neutroformers to one another is very important.

As shown on the drawing, Figure 1, the Neutroformers are mounted at an angle of 54.7 degrees from the horizontal and should this vary even one or two degrees, trouble will be experienced in properly balancing out the receiver. On the diagram, the marking is also shown for the binding posts and telephone jacks. All holes not marked with special dimensions are to be drilled clear-

ance for 6-32 machine screws. This requires the use of a No. 26 drill.

Assembling the Parts on the Panel

With our panel drilled and engraved, the next step is to assemble the various units on the panel. The rear view of the completed five-tube neutrodyne receiver is shown in Figure 2, and from this pic-

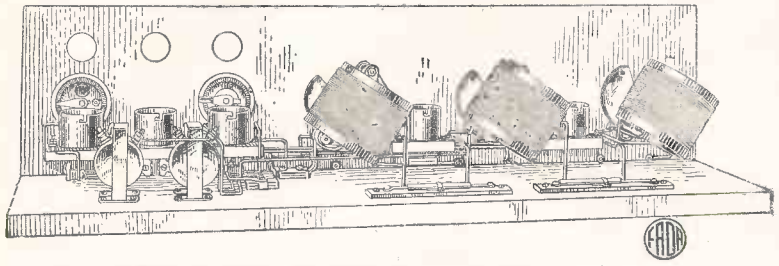


Fig. 2. Rear View of Completed Neutrodyne

ture one can get an idea of the general arrangement of the parts on the panel.

It will be noted that two of the sockets are placed between the Neutroformers, and that the triple-tube socket is placed on the left-hand end of the panel looking from the back. The rheostat at the extreme left end is a power rheostat controlling the filament current of the amplifier tubes and the rheostat closest to the left-hand Neutroformer controls the filament current of the detector tube. In the hole on the panel drilling layout marked "phones" is mounted a two spring closed-circuit telephone jack. This is directly under the knob of the vernier rheostat. In the other or "horn" jack is mounted a three-spring automatic filament-control jack. The filament switch, binding posts and sockets are easily assembled in their proper position. The Neutroformers should be very securely screwed to the panel in their proper position as the operation of the set would be affected if they were even slightly moved out of position during assembly and wiring.

Wiring Up the Five-Tube Neutrodyne Set

The wiring of a receiver is usually the stumbling block for most of the experimenters. I have seen some of the most horrible looking jobs on neutrodyne receivers, yet when the job was properly balanced out, it worked O. K. This should not be taken as a criterion, however, and the experimenter is advised to take particular pains in wiring up his set.

Study the wiring diagram in Fig. 3 very carefully. Note in particular the polarity of the Neutroformer windings, audio-frequency transformers, and especially the connections of the Neutrodons and telephone jacks. All high-potential plate and grid leads should be kept as widely separated as possible and all wiring separated at least one-half inch with as few leads running parallel to one another as possible.

In assembling the receiver, it is usually best to fasten the base board to the panel, and to fasten the audio-frequency transformers and Neutrodons to the base board. Before wiring up the receiver, however, one should unfasten the base board from the panel, as this makes it much easier to wire all the parts mounted on the panel. Then fasten the base board with its Neutrodons and audio-frequency transformers again into place to complete the wiring of these units.

It is usually best to begin wiring by connecting all the negative vacuum-tube socket terminals and then extending this same wire to the ground binding posts. In like manner, the positive filament connections can be made and the wiring of the detector tube rheostat, power rheostat, battery switch and battery binding posts completed.

Connections to the Neutroformers come next. It will be noted that all the Neutroformer secondary windings have a small loop or tap. On the wiring diagram no connection is made to the tap of the first or left hand Neutroformer looking from the panel front. A lead is connected, however, from the tap of the second and third Neutroformers going directly to one terminal respectively of the second and third Neutrodon condenser.

The fixed condensers with capacities as shown on the wiring diagram are wired into position and need not be fastened either to the panel or base board, as the stiff No. 14 copper wire will hold them in position. After you have completed wiring up your receiver or preferably step by step as you fasten each wire in position check off with a heavy pencil on the wiring diagram the connection that you have just made. When the wiring is completed, all wires will have been checked and in addition by doing the job this way, you are doubly checking yourself for mistakes.

On the wiring diagram, no wire is

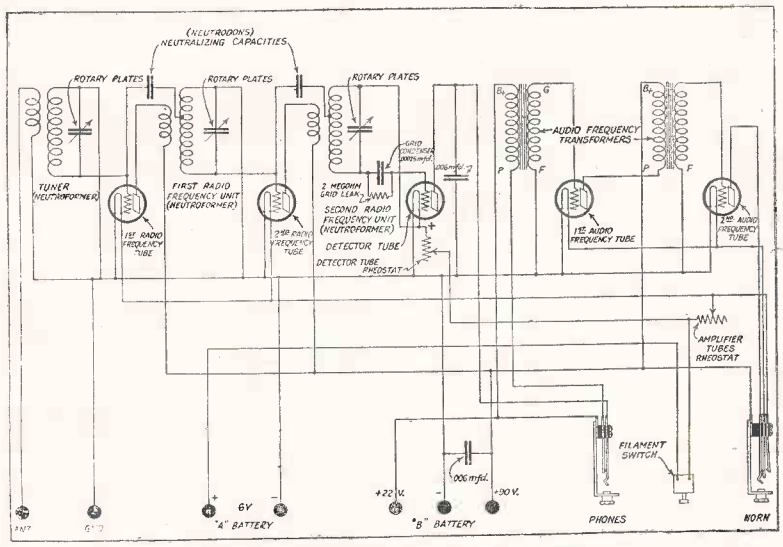


Fig. 3. Hook-up for Five-tube Set

shown jumping another one with a loop symbol. The plan shows each wire passing across the others and only connecting to cross wires when represented by a solid black dot. Check this carefully with your own wiring.

In the last article of this series, de-

A Good Prize Contest

Results of Our Liars' Contest Show a Plentiful Crop

WE certainly got some pretty tall stories entered in the competition for the biggest lie. After reading them, we came to the conclusion that by comparison we must be pretty truthful. It was hard to select a winner. But after carefully considering all the manuscripts, the judges unanimously decided on a single one as showing the greatest originality. We take pleasure in awarding a year's subscription to RADIO PROGRESS to Mr. William J. Cummings, 42 Glenwood Avenue, Eden Park, R. I. We also wish to thank all our contributors for the interest they displayed in the contest. Mr. Cummings' story is as follows:

THE WAVE TRAP

By WM. J. CUMMINGS

A wave trap, as most of us know, is a device for eliminating local interference and enabling one to get that elusive distant station. After having read a series of articles on wave traps I finally decided to build one.

The trap I decided to build was one of the ordinary non-degenerative type, with a Continental motor, Fisher body, Timpkin axles, Apco shock absorbers, four wheel brakes, balloon cords, self-starter and stopper, and a number of other extras.

The wave trap when finished worked fine. WJAR, WEAN, and WSAD (all three local stations), were trapped again and again. In fact everything worked perfectly, but the strange, weird, hair-raising, soul-stirring and dramatic part of it I have yet to narrate.

One evening I came home and somehow or other mixed the A and B batteries. The three tubes in the set of course—need I repeat the sad story? Well there I was without a set and broke, so I turned back to the "moss covered" crystal. Now it happened to be rather dark when I started to hook up the crystal set and again I made an error. Mistaking the wave trap for the crystal set I hooked it up to air, ground, and phones.

Then as I slowly turned the dial, a great shout greeted my ears. My palpitating heart stood still and quavered. What great invention had I stumbled on? I listened to an entire program of one of the local stations I had trapped a few days before. By turning the dial back a bit I could get the program of the previous day. I turned the dial around about an inch or so and all was silent, but on rotating it a little more I tuned in another local trapped station playing a program a week old and succeeded by rotating the dial of the trap to bring the program up to that of the previous evening.

Realizing that I had really found something of real value, I looked the trap over carefully and proceeded to take notes, while the trap percolated with the volume of the three tube set that it had been used on. The antenna and ground were connected on one side of the trap and the phones on the other, one tip in one post and one in the other, or the reverse, as I found it made no difference.

Since making that first test and having bought new tubes for my set I have experimented a great deal with the trap and have stored up programs up to two weeks old. The programs will keep indefinitely if the trap dial is kept at zero. On account of the small dimensions of the trap programs for over two weeks could not be stored but this could easily be remedied by making a larger trap.

As mentioned before, the programs can be kept indefinitely if the dial is kept at zero, but if on rotating the dial you tune in a trapped station, then like the art of Chiropractic you adjust the vertebrae of the trap and release the imprisoned impulse.

That is all there is to it. If there are any who doubt the truth of this article let them make a wave trap and be convinced. Any type of trap may be used and all I have found give the same wonderful results.

5-TUBE NEUTRODYNE

Continued from Page 11

tailed instructions will be given for balancing out the inherent capacity of the vacuum tubes as well as the stray-circuit capacities, thereby eliminating parasitic and distorting oscillations and regeneration.

The Need for Balancing-Out or Neutralizing the Circuit

Many people who have constructed neutrodyne receivers have possibly found the adjusting or "balancing out" of the set before it is ready for use, a difficult task. In most cases, it has been difficult, not because the process itself is complicated but because of a misunderstanding of the results to be obtained and the methods of obtaining them.

It may be well at this time to consider the function of the neutrodyne circuit in order to understand just what is accomplished when we balance out or adjust it for capacity neutralization.

Professor Hazeltine devised a method of neutralizing both the stray circuit capacities and the inherent capacity of the vacuum tube, i.e., the capacity existing between the filament or cathode and plate or anode of the tube. It is the presence of these coupling capacities in an ordinary tuned radio-frequency amplifier circuit that causes the circuit to regenerate and oscillate when the tuned amplifier circuits are in resonance, unless some means is provided for controlling the grid potential of the tubes, which usually results in a loss of efficiency.

Kill the Parasites

Such parasitic oscillations make it impossible to secure pure radio-frequency amplification and in addition cause very decided signal and speech distortion. Every listener-in knows the disadvantages of tuning-in to a local concert and hearing all sorts of "birdies."

Concluded in Next Issue

Tube Popularity Causes Shortage

Harder to Get 201-A Tubes Than to Pick Up the Coast

IN some parts of the country the builders of amateur sets have found a great deal of difficulty in completing their radios because of the scarcity of 201-A tubes. This style is one of the most popular ones made for several reasons. In the first place, it will amplify for a loud speaker more than any other tube on the market. In this respect it is in a class by itself. It also consumes a small current, only a quarter of an ampere, from the "A" battery, so that on a pinch it can be run by an ordinary hot-shot battery, such as is used by the old style ignition of a Ford automobile.

Another decided advantage of the 201-A tube is that it "has nine lives." By this is meant that if the tube is accidentally burned at too high a brilliancy it is not necessarily entirely wrecked. Such high operation might be caused, for instance, by accidentally dropping the "B" battery wire on the "A" terminal, and so putting 22½ volts or more on the filament designed for five volts. Naturally, if this high voltage lasts very long the filament will actually burn in two, and then it is too late to repair it. Another cause of excessive brilliance is an improper adjustment of the rheostat. Some fans turn the rheostat way on to the "full-on" position, thinking that by so doing they can get music in louder. This is a mistake. The music will not be any louder, but the life of the tube will be very much shorter.

Turning on Another Life

If the 201-A tube has been operated at such a high voltage that it no longer works, its life may be restored again by special treatment. The way to do it is this: Light the filament by turning the rheostat around to the normal position to give about five volts at the socket. Then disconnect the "B" battery entirely. This will naturally kill the music. Burn the tube this way with the "A" battery on and the "B" battery disconnected for about one-half an hour. At the end of this time reconnect the "B" battery, and if the filament has not been damaged too much you will find it will be restored so that the music will sound as good as it did when the tube was new. The action can not be repeated indefinitely, so that it is better to see to it that the tubes are not burned too brightly in the first place.

Rumors About 201-A Tube

There have been persisent rumors in the last month or so that the shortage of 201-A tubes was artificially caused by the Radio Corporation in order to push the sale of their other tubes. This is a mistake. The only way the Radio Corporation makes its money is by selling supplies, and since the tubes are all the same price ($5.00) and cost approximately the same to build, there is no reason why they should want to sell any type to the exclusion of the other.

Radio Corp. Explains

This matter was taken up with the Radio Corporation of America, and Mr. E. B. Bucher, manager of the sales department, released the following statement:

"Rumors to the effect that we have been holding back on our tube sales are absolutely false, and I wish to deny that this is the case. Only 10 to 15 per cent. of our total monthly tube production is required for our merchandise, the remainder going to purchasers using sets and parts manufactured by others.

"There are general facts in the vacuum tube situation which we are glad to give and which, no doubt, will tend to curb any feeling that the Radio Corporation of America is not giving this subject the close attention that it deserves.

"(1) We maintained a day-by-day inventory of from 450,000 to 600,000 tubes of five different types (UV-199, UV-200, UV-201A, WD11 and WD12) up to January 1 of this year, and steps were taken many weeks past with the endeavor to build this inventory to still larger figures.

"(2) 768,816 Radiotrons were delivered to the trade in January this year; 825,636 in February, and March deliveries exceeded 900,000.

"(3) *Seventy per cent. of our monthly production schedule is composed of Radiotrons UV-200 and 201-A.*

"(4) Stocks of dry battery tubes have been in excess of the trade demands from May, 1923, to date, and current production is keeping apace of the demand.

"(5) Current production on the storage battery types of tubes is actually in excess of new orders booked for these particular types, but present production schedules should produce an excess by the first week in April.

"There is no desire on the part of the Radio Corporation to do anything other than produce tubes in sufficient quantities to meet every possible requirement of the trade. We are in the business to *sell* and not to *withhold*. However, the circumstances under which the manufacturer works in meeting the requirements of the market must be given due consideration.

"Briefly, the industry is too young to enable either the dealer or the distributor to place orders with the manufacturer sufficiently in advance to meet the fluctuating demands for the specific types of tubes. As the factories, on the other hand, must prepare their production and procure new material from 90 to 120 days in advance of actual deliveries, it becomes necessary for us to endeavor to predict at least four months in advance what the trade requirements may possibly be. To this end the Radio Corporation maintains a staff of expert statisticians whose time and energies are devoted solely to a study of this situation. Frequent conferences are held with the manufacturers and production schedules are revamped to meet the fluctuating demands of the market.

Are Not Mind Readers

"During the latter part of November, 1923, a largely increased demand for the storage battery types of tubes became evident, but no prior notification of this possible increase was given to the Radio

Continued on Page 14

Letters from Our Readers

One of the Aces is One of the Graces

In the article appearing in the March 15 issue, entitled "Three of a Kind, All Aces," we inadvertently interchanged the names of two of the "Aces." As a result we got a very bright letter from Mr. Thomas A. McNally of Station WBZ, which we are reproducing. We might say that Mr. McNally's letters are as interesting and as snappy as his voice over the radio, and that is saying a good deal. Here is his letter:

The Editor—

Dear Sir:

I have at hand your young publication, Vol. 1, No. 1. It immediately attracted my attention. After turning over a few pages, I came upon the picture of "The Three Graces," Faith, Hope, and Charity.

There was a slight error in the initials of the announcers. I am "Hope"—but I could stand a lot of charity. You had "MCN" under Bill Tilton and "WST" under me.

My hosts of friends in Providence and surrounding cities would recognize the "Irish map" as soon as they saw the mistake. There is no mistaking me for anybody else. I am individual! distinctive! This is not egotism, just the bare, cruel truth. That is one of the reasons why I need charity as a substitution for sympathy. I was born in Central Falls many years ago and migrated from said village at a very tender age. Like the wandering troubador, I flitted here and there, gathering no moss, until the cruel fates sat me down in this city of queer traffic regulations and the home of Republicans.

Perhaps you are wondering why or how come all this disconnected chatter. I want to thank you, on behalf of Mr. Tilton, Mr. Bach and myself for the write-up in your first edition. I can readily understand why you chose our picture for your "premier." Good stuff! Your magazine should increase to about 120,000 on the next edition.

I have so many relatives in Providence I would like them all to have a copy of your Radio Progress, but I have only been able to secure two copies.

Best of success to you and your publication. It made me feel great to think that the face of one of Little Rhody's "clam diggers" graced the first pages of your endeavors.

Respectfully,
Thomas H. McNally,
MCN of WBZ.

Crosley Radio Predicts Success for Radio Progress

We felt rather flattered to receive the following congratulatory letter from the Crosley Radio Corporation of Cincinnati. As our readers are aware, this company manufactures radio sets which show an unusual amount of engineering ability, and whatever they say about radio is pretty apt to be right. The idea of devoting a page or two to the new things in radio is a good one. With Mr. Plough's permission we are reproducing his letter:

March 24, 1924.

Mr. Horace V. S. Taylor,
Editor Radio Progress,
Providence, Rhode Island.

Dear Sir:—

You are to be complimented on selecting an attractive color for your cover. The design of the cover is excellent. The title of your magazine, Radio Progress, always abreast of the times, is very good, but I would like to suggest, inasmuch as you have asked me for my criticism, that you devote the first few pages of your book, or at least one page, to a tabulation of the radio progress since the last issue of your publication. In other words, for your copy for May tell what progress has been made up to the time of publication. This would bear out the title of your magazine.

I fully realize that a new magazine is a problem. It is hard to find out just what the public wants and yet be different from the other publications, but you are solving this, and as your magazine progresses you will find it much easier to supply this want. The idea of making every reader a contributing editor is an excellent one, and as a reader I shall feel privileged in the future to send you material.

With all the success that is due you for your efforts in bringing radio to the attention of the public, I am

Most sincerely,
The Crosley Radio Corporation.
A. R. Plough,
Publicity Director.

TUBE POPULARITY

Continued from Page 13

Corporation by the trade channels. Major steps were then taken in our factories to increase production on that type, such as the building of additional plant facilities, the installation of new machinery, the training of additional personnel, etc., etc. Between the first week of December and February, production on the storage battery types of tubes was actually doubled and still further increases are obtained week by week.

"Production schedules have been laid down in the factories for the remainder of this year, which it is confidently believed will be largely in excess of the trade requirements, for it is the avowed policy of this company to keep its production ahead of the demand.

"A temporary tube shortage may develop in any particular locality not by reason of insufficient factory production, but because of the difficulties of obtaining uniform distribution. The Radio Corporation sells its tubes to distributors; from that point on it has no control over distribution to the dealers. We are aware, however, that distributors are making every effort to serve dealers in all localities, but the actual quantities distributed in any particular territory are also governed by the amount of dealers' orders, dealers' credits, inability of some dealers to sense the public demand sufficiently in advance to enable them to serve customers promptly, and numerous other factors, all of which have bearing on the situation.

"As further evidence of our desire to meet all possible trade demands, it is important to point out that only 10 to 15 per cent. of our total tube production is required for our own merchandise, and all that we need is more concise advance notification of what the trade wants, thus enabling us to prevent shortages."

Taking the Cap Off Capacity

Inductance and Capacity Sound Hard, but Are Easy to Understand

By VANCE

YOU cannot go very far in radio without running across the terms inductance and capacity. They seem like rather mysterious qualities, but are not so difficult when you get to know what they really mean. Take the word inductance. Inductance means weight. When you speak about the inductance of a coil, you mean the weight of a coil. This refers to the electrical weight and not avoirdupois. When you want to send a coil through the mail by parcel post, you put it on a pair of scales and get the weight in pounds.

Electrical Weight is Meant

But when you want to weigh the coil electrically to get the inductance, you do not use scales. The laboratory in measuring a coil puts it in an electric circuit and uses a couple of meters to see how heavy it is, ordinarily a volt meter and an ammeter. The answer does not come out in pounds, but in millihenries. This term, by the way, is derived from the famous electrician, Henry, who discovered many of the properties of electrical circuits. When the readings of the meters have been obtained, by substituting in the proper formula the electrical weight of the coil in millihenries can readily be found. If you have two coils, and one is long and narrow and the other is short and fat, they can still be used interchangeably, provided they have the same inductance. In reading the diagrams of radio circuits you will notice that the coils are frequently specified as having so many millihenries. It is better to call them by their inductance than by any other way. This is because if they were specified as so many turns of such a size of wire, wound on a given diameter of tube, it would take a little longer to say it, and then, besides, if you happened to have a coil of different size of wire wound on a different diameter, you would not know whether you could use it or not. By giving the proper value of the inductance it enables you to pick out your own coil.

How Many Henries Per Pound?

It has been stated that when you weigh the coil electrically the answer is the inductance in millihenries, and when you weigh it mechanically you get the result in pounds. It is logical to ask, How many millihenries to the pound? Unfortunately you cannot get the answer in any such way. One pound equals sixteen ounces, to be sure, and if we weigh the coil in ounces we can convert that to pounds by simple division. But the electrical weight of a coil depends on other things besides mechanical weight.

For one thing, it is very greatly affected by the number of turns wound around the tube. If you have two coils each weighing five pounds, one a fine wire with a lot of turns, and the other a few turns of coarse wire, then the inductance of the first, with the large number of turns, will be very much greater than that of the second. Another thing that affects the electrical weight is the spacing of the wire. If you have a lot of turns wound close together, the coil will have greater electrical weight or inductance than if the same coil is pulled out so that the turns lie far apart. Other things that affect the number of millihenries are the size of the wire and the dimensions of the spool or tube on which the coil is wound.

How Many Nuts to the Pound?

Since all these factors enter into the electrical weight of the coil, it is impracticable to put it on ordinary scales to get its inductance. You have to use some kind of an electrical measuring instrument instead, as described above. But do not think it is peculiar that these factors all affect electrical weight. A similar thing happens in avoirdupois weight. For instance, suppose you have a quart of nuts. How much do they weigh? Well, in the first place, it depends on what kind of nuts they are. Another thing is, Are they thick shelled or thin shelled? Another factor is the way they are compressed into the quart measure. If they are packed down tight they naturally weigh a lot more than if they are thrown in loosely. But all these variations do not bother us at all because we are used to putting them on the scales and getting the exact weight. What we can say is that the bigger the quantity of anything we have, the tighter packed it is, and the denser the material, the heavier it will be, and in the same way the more wire we have, the closer it is spaced, and the greater the number of turns, the more the inductance or electrical weight expressed in millhenries will be.

Effects of Two Coils

When we get two coils close together the effect is different from anything we have in ordinary weight. If each of two coils weigh five pounds, then the two coils will weigh 10 pounds, no matter how they are spaced. But notice this: The electrical weight of the two coils connected together will depend a great deal on how they are placed relative to each other. If each coil is five millihenries, then the two will be 10 millihenries, provided one does not affect the other. They will not affect each other if they are spaced very far apart. Also, if they are placed close together, exactly at right angles, they will not affect each other. Either way the two together will weigh 10 millihenries. But now suppose you bring the coils closer together or else turn them so they are not any longer at right angles, and immediately the electrical weight changes from 10 millihenries. It may go up and it may go down, depending on the direction of the windings of the coil. Suppose you look at both windings endwise. If the wire in both of them goes around in the same direction, that is, both right hand or both left hand, then the inductance will be increased by bringing them close together. On the other hand, if the wire in one goes around right hand while the other is left hand, then the two will oppose each other and you will get less than 10 millihenries.

Like Playing Baseball

Does this idea seem hard to grasp? It is just exactly like playing baseball. Here we have a team of nine men. Each man is a star. If they play entirely independently, then the team is nine times as good as each individual man. But suppose now they all pull together with wonderful team work, then the result will be a lot better than nine times as good as a single man. But, on the other hand, suppose they are each jealous of the other, and instead of pulling together they pull apart and each one blocks the action of his teammates. Then the whole team will not be worth more than two or three individual players. The same things happen with the coil. When they act individually (a long distance apart or at right angles) then the two add up as you would expect. But when near together, if they use team work, the total weight of the two coils may be as much as four times the weight of each individual coil. Turn one of the coils around so they are jealous of each other (wound in opposite directions), and they get in each other's way, so that the weight may be reduced nearly to zero.

Team Work in a Variometer

This is just what happens in a variometer. Here we have two coils wound up with the same number of turns and arranged so that one can turn inside the other. Suppose each coil taken alone weighs five millihenries; then when you turn the variometer so that the two coils are at right angles the combined weight will be 10 millihenries. Turn them so they are both wound alike and the inductance jumps to 20 millihenries. Now turn the rotating coil or roter right upside down, so they are bucking each other, and the inductance drops nearly to zero.

You will notice it is *nearly* to zero. It does not go quite down to nothing because the two coils are not quite alike. Since the roter has to turn inside the stator (the stationary part), of course it has to be wound on a smaller form or else it would interfere. This makes the two coils of slightly unequal strength, and so when you subtract the smaller from the larger, the stronger one has a little bit of inductance left over. That is why you cannot get a zero inductance with a variometer.

Variocoupler Has Taps

When we come to a variocoupler we change its weight not by adding or subtracting another coil, but by varying the connection from one tap to another. In winding up the variocoupler a lead or tap is brought out every six or eight turns. An ordinary variocoupler will have about 60 turns. When you want a large inductance you use all 60. But if you want a smaller inductance to make this connection to one of the taps you use, say, 15 or 20 turns. If you want a very small inductance, connect to the first tap, and only six turns will be in use. This makes a very convenient method of varying the electrical weight in your circuit, but, of course, there is the disadvantage of being adjustable only in big steps instead of smoothly and continuously, as you do in turning a variometer.

Consider a Variable Condenser

We come now to condensers. These are of two kinds, the fixed and the variable. The fixed condensers are made of alternating layers of tin foil or copper foil, which is separated from each other by layers of treated paper or mica. Once the condenser is built its capacity cannot be changed. So it is called a fixed condenser. The variable condensers, on the other hand, are made of two sets of plates. One set can be turned so that it meshes or dove-tails into the other set. The two are insulated from each other by the small air spaces left between the leaves. When the rotor (movable plates) is turned so that they mesh completely with the stator, the condenser action is greatest, and when the rotor is turned half way around, so that it does not mesh at all, then the condenser action is least.

Just Like a Spiral Spring

This condenser action that we speak about really means the springiness of the circuit. A big condenser is just exactly like a big spring. If you have a weight attached to a spring you know how easily it will vibrate up and down. The same thing applies to an electrical circuit with an inductance (weight) connected to a condenser (spring). If you want to slow up the vibration of the weight and spring you can do it by making the spring quite long. Conversely a short stiff spring speeds up the vibration. This is what happens in your radio. A large condenser, since it is a large electrical spring, causes a slow vibration. As the variable condenser is adjusted by turning the rotor so that the plates do not mesh so deeply, this cuts down the electrical spring to a short length, and that speeds up the frequence of vibration. That is the way you tune your radio. If you want to get a short wave length, which means a fast speed of vibration, like KDKA (East Pittsburg), which runs at 326 meters, you use a small capacity to give the high speed of vibration. When you want to pull in WGY (Schenectady), you have to turn in a lot more capacity, because, since it is a longer wave length, 380 meters, and a slower vibration, you have to have a longer spring. But suppose you decide to tune to WEAF, New York. You have to use practically all your condenser because the long wave length, 492 meters, means a very slow oscillation, and this requires a very long spring to cut the speed down.

TAKING MOVIE PICTURES BY RADIO

The wonders of radio are increasing at such great rate that it is hard to tell how much we can believe of the wonderful stories we hear. A recent illustration of this was furnished by Station WJAZ, the Edgewater Beach Hotel, Chicago. A short time ago they announced over the air that they were going to try to take motion pictures of their listening audience through the microphone, and if radio fans would listen closely they would hear the click of the motion picture camera. Of course, this was a joke, and it was supposed by the hotel that it would be understood as such. The movie-man put a camera up close to the microphone and gave the crank a few turns, and sure enough, the clicking of the camera was heard life-size away across the continent.

That was all there was to it as far as WJAZ was concerned. Imagine their surprise when letters began coming in the next day, and continuing for a week, from listeners all over the country, asking whether the group picture they had taken turned out well, and whether it would be shown in their local moving-picture theatres. "Did I take a good picture?" was the usual question.

Non-Squealing Regenerative Radio

"Teledyne" Circuit is One of the Recent Developments in the Non-radiating Sets

H. S. WILLIAMS, Radio Engineer

Editor's Note—This is the second of a series of articles by H. S. Williams, radio engineer, on operation and features of the Cutting & Washington "Teledyne," the new non-reradiating circuit. To-day's article deals with antenna and ground construction and the best ways of tuning. The first article appeared in the April 1 issue.

UP through the various stages of rapid progress in the science of radio reception, from the early commercial application by Marconi to present-day "radio in the home," the importance of the aerial, as a collector of feeble radio impulses has been of supreme importance to the results obtained.

Too often the radio fan depends on an antenna that he thinks is "good enough." There is the "freak" aerial. A freak aerial is a thing in the category of everything else notional and freakish. It soon passes.

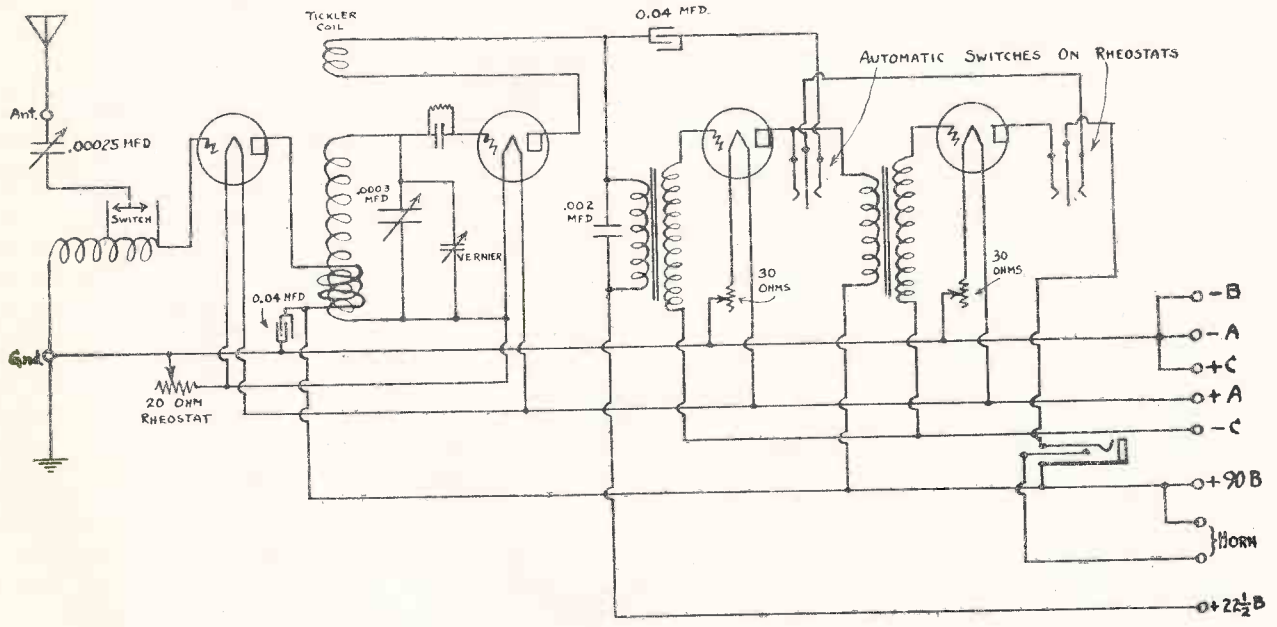
Granted, that there is a certain thrill in "getting so and so" with a wire out the window, across the room or under the carpet, the results are always greater if the antenna is carefully built. The most authoritative radio engineers agree that there is no substitute for a good antenna and ground. For this reason the Teledyne is designed to operate on an aerial in conjunction with a good ground instead of many of the more or less inferior devices put forth as substitutes. Although it will operate surprisingly well on small and poor antennas, the Teledyne's sensitivity increases enormously when connected with the average good antenna.

An analysis of the radio wave easily explains this. The energy emitted from a transmitting station, as is commonly known, is radiated in ever widening circles, becoming weaker and weaker as the distances it travels increases. The impulses picked up by the distant receiving station are so very minute that the most efficient collective device should be utilized if the maximum amount of energy is to be brought into the receiving set.

The ideal antenna is one well out in the open having a minimum of resistance and the best of insulation. The lead-in should be short and direct, well insulated, and clear of the sides of buildings. Space and convenience considerations are very important limiting factors in the erection of a suitable antenna. Thus, since we can only approach the ideal the greatest care should be exercised in planning and constructing.

The average antenna has an effective height of about twenty feet, although its actual height may be somewhat greater. The effective height may be called its electrical height, and it is this that largely determines the antenna's efficiency as a collector of radio energy. The greater the effective height, the better the signal strength.

In contrast with the ordinary antenna, the average loop has an effective height



This Shows the Hook-up of the 4-Tube Teledyne

of about *three inches.* Thus the usual antenna compared with the average loop collects, roughly, about eighty times as much energy. Obviously, such an initial advantage is not one to be ignored.

For the best results under ordinary metropolitan conditions, an aerial with between 60 and 100 feet between the set and the far end should be used. The antenna may be longer if there are no stations within 50 miles.

The receiving set is ordinarily connected to water pipes, radiators, rods driven in the ground, pumps, or gas pipes. The greater the resistance of the radio "ground," the less the signal strength, hence the importance of securing a low-resistance ground connection.

Hooking Up the Set

The diagram shows the method of hooking up the various parts described in the last issue of Radio Progress. The first tube is a radio frequency amplifier. Control is obtained in coarse steps by the switch, while fine tuning is accomplished by the eleven plate (.00025 mfd) condenser. The output from the plate of this tube goes to the primary of the air cored radio frequency transformer, which you have already wound. You will notice a condenser, .04 mfd, which connects across the 90 volt "B" battery. This may be omitted or a smaller condenser, say .002, substituted. The reason for its use is to allow the radio frequency to avoid the necessity of going through the "B" battery.

The Tickler is Important

The tickler coil running from the plate of the second tube or detector is coupled to this same air cored transformer. After the audio frequency waves leave the tickler coil they go either direct to the phones or to the first or second audio amplifier, depending on the position of the automatic switches on the rheostat. For these switches may be substituted ordinary filament control jacks, or, if desired, regular four contact jacks may be used and the tubes turned on and off by the rheostat. As a matter of fact, everything in the hook-up diagram to the right of the tickler coil is just like any ordinary two-tube amplifier.

The rheostats shown are of 20 and 30 ohms for use with the UV 199 tube. If storage battery tubes or WD11 or 12 tubes are to be used, then six ohm rheostats should be substituted. The two terminals for the horn are to be used if the loud speaker cord has no plug attached, but if a plug is used these terminals may be omitted, and the loud speaker plugged into the telephone jack in the usual manner.

Ready to Tune In

There are two general methods of tuning the Teledyne. Both are extremely simple and therefore quite rapid. Each method has its advantages, and every user of the Teledyne probably swears by his favorite method. The important feature of the Teledyne receiver, however, is the fact that, regardless of the method of tuning employed, or of the degree of skill or lack of it in the operator, the Teledyne will not emit the howls and squeals peculiar to other regenerative receivers, and thus cannot possibly annoy or interefere with neighboring reception.

The Teledyne receiver has thus at one stroke eliminated the only objectionable feature of regenerative receivers, and has at the same time achieved a remarkable sensitivity.

The first way of tuning is the familiar beat method. This consists in causing the detector tube to oscillate by increasing the regeneration, and then slowly varying the secondary condenser control. As this control is moved over the scale, innumerable beat notes, known variously as "chirps," "squeals," "valleys," etc., are heard.

The second step is to bring the primary into tune with the secondary. One of the beat-notes heard while moving the secondary control should be tuned to the "valley" or zero-beat position as is customary in single circuit tuners. The primary control is then slowly varied over its range. One position will be found where the beat-note is made very much louder, thus indicating that this is the tune position. Leaving the primary at this adjustment, the regeneration is then decreased until the beat-note disappears and the signals are clear and distinct. Re-adjustments of primary and secondary controls will often help in bringing the signals in much louder, as in any other receiver. The chief advantage of the beat method of tuning is its rapidity, and the ease with which weak or new stations may be picked up and tuned in. Its chief disadvantage lies in the presence of the beat-note squeal while engaged in the tuning-in process. For those who object to this latter feature, the second method of tuning will probably offer greater appeal.

The second method of tuning the Teledyne may be called the Hunt method. It is characteristic of the Neutrodyne, and similar receivers, but in the Teledyne, only two controls are used, one for each hand, thus greatly simplifying the tuning process.

The regeneration control is set at a low value, well below the oscillating point. With the primary control in one hand, and the secondary control in the other, the entire range is slowly and carefully covered, maintaining the primary in tune with the secondary. The in-tune position may be readily determined by the sudden increase in atmospheric and extraneous noises as the primary is slowly varied. A little practice makes this process quite easy and rapid. Any stations operating and within range of the set will be heard as the receiver comes into tune with them. Once a station is heard, the regeneration may be increased, and minor readjustments made until the intensity is a maximum.

This method may be satisfactorily used on the louder stations, but for tuning in the weaker and extremely distant stations, the beat method is preferable.

The dial scale readings on the Teledyne may be recorded on a chart after they are once found, and thus a station once heard, may be immediately tuned in again at any time by setting the dials in accordance with the charted scale readings. It is only necessary to record the primary and secondary readings, as the regeneration control serves only to adjust the intensity of the signals.

$350,000,000 FOR RADIO IS THE PREDICTION OF MR. BABSON

According to Mr. Roger W. Babson, the eminent statistician and business authority, America will spend $350,000,000 for radio this year. Vacuum tubes alone will take $50,000.000. This is a third as much as the entire furniture business of the United States, and twice as great as the carpet and rug business. Be careful not to let any of your money go to the replacing of carelessly burnt out tubes.

Broadcasting Has Its Dangers

Falling Radio Tower Nearly Wrecks the Montreal Express

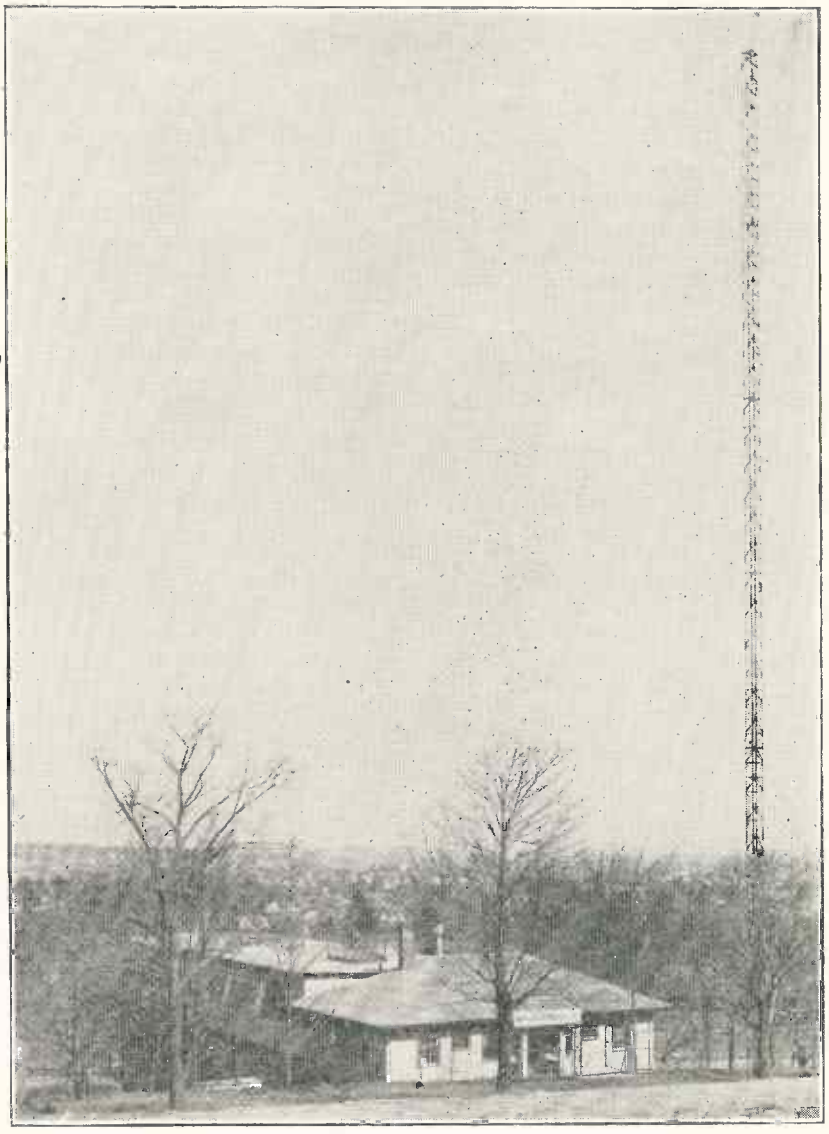
ONE of the popular stations which is heard in Eastern United States is Amrad, with the call letters WGI, located at Medford Hillside, a little way out from Boston. To listen to its programs as given out to-day, no one would imagine that it was once a struggling station and was having its troubles in getting started.

From its lofty tower close by the route of Paul Revere's historic ride, the Amrad Corporation was one of the first to broadcast speech and music across the land. "Sowing seeds in the air" seemed in those early days of radio but the odd dreams of a fanciful visionary. How well these "seeds" took root is evidenced by the remarkable growth of the radio industry.

It was in the summer of 1915 that WGI was first erected, due to the persistence and foresight of Harold J. Power, one of the leaders in the Radio Art. These were the days before present-day broadcasting licenses were issued by the Government. Amrad WGI was then designated as IXE, an experimental station call letters. It was during 1916 and 1917 that the newspapers of New England frequently printed stories about radio music and speech, being heard in isolated communities and by ships at sea —stories which seemed almost incredible to the reading public.

Express Train Rushes On

In connection with the erection of the tower over eight years ago, there is an interesting story: On a Saturday noon, the workmen erecting the tower, the first and highest of its kind, had almost finished their job. However, the supporting guide wires were not in place. This almost criminal negligence on the part of the workmen nearly resulted in a serious fatality. A gentle breeze sprang up, rocking from side to side the 320-foot perpendicular structure which was entirely unsupported. An extra draft, and over the tower toppled, falling across the trolley wires of an adjacent thoroughfare, and also across the tracks of the Boston & Maine Railroad. The Montreal Express was approaching at 60 miles an hour, but fortunately, the engineer saw the tower falling, and was able to bring the train to a standstill by applying the emergency without crashing into the debris.



This Tower Measured Its Length

At once work was started to re-erect the tower, but this was delayed due to protests from the trolley company, railroad and nearby residents, who feared the tower a mysterious menace to public safety. The proposition even went before the State Commissioners, who fortunately were broad-gauged enough to appreciate the far-reaching possibilities of radio broadcasting and to recognize that the engineering construction of the tower was basically sound. Their judgment has been adequately justified by the intervening years.

The picture shows the rather unusual construction of the broadcasting tower. While most structures are rigid at the base, and depend on the foundations for holding some of the side pressure, this tower is quite different. No reliance at all is placed on the masonry base to prevent the tower tipping over. Instead, an elaborate series of guy wires is used. The tower is divided into four parts and at the top of each section the guy wires are attached. This large number must be used to prevent the tower buckling under a heavy wind storm. Although the steel work looks rather frail, it has stood the test of nearly ten years' storms.

Started Once in Two Months

Of course, the early broadcasting efforts were periodic, first bi-monthly and then weekly, and then twice a week. Over two years ago, May 20, 1921, regular daily and nightly broadcasting was scheduled, and has continued without intermission ever since. The first Director of Broadcasting was H. M. Taylor. The first studio was a comparatively primitive affair in marked contrast to the

Harold J. Power

richly furnished and conveniently arranged studios of to-day. Three times has the studio been entirely remodeled to keep pace with the increasing improvements of the broadcasting art—in order to keep this oldest broadcasting station on a par with the best of the recent stations.

While using comparatively low power, 100 watts, the station has been heard from coast to coast, in Canada, and the West Indies. Noted persons of this country and Europe have been attracted to the station. The present Director of Broadcasting is H. D. Miller.

The First Radio School

The executive head of this station is Harold J. Power. His story is as romantic as the industry he has helped to shape. He started in radio as a young grammar school boy and became so enthusiastic that he got permission to be let out of school in Everett early each day so he could run home and get the Navy Yard time signals at noon. He used at this time a home-made set with which he had experimented for a year, first in his mother's kitchen, then in a shack called the "Laboratory," before he received his initial message. In 1910 he conducted what is believed to have been the first radio school in the East—a night class at the Everett High School.

J. P. Morgan Interested

After he finished school Mr. Power, as a result of his unremitting work with radio, was able to get a wireless operator's berth on a Boston-New York passenger steamer. Later he was operator on the late John Jacob Astor's yacht. His next move was to the "Corsair," the famous yacht of Pierpont Morgan. While operator on the "Corsair," Mr. Power, though even then hardly more than a lad, interested Mr. Morgan in the possibilities, then little recognized, of radio as a commercial proposition. The result was the establishment in 1915 of the first Amrad plant at Medford Hillside, with Morgan financial backing. After several years of struggle and persistent research work, the concern was placed on its present sound basis.

Invents the "S" Tube

In its model manufacturing plant, the American Radio and Research Corporation, the largest among the independents, produces the highest class type of modern radio equipment. Production facilities are 1,000 sets per day under normal conditions. Research, so important in the development of any art, has not been neglected. One of the startling scientific achievements of the research end of the business—one that has attracted considerable attention—is the "S" Tube—a Rectifier without a filament.

ODDS AND ENDS TRAY

Harry A. Nickerson

All the 6-32 and 8-32 screws, nuts and bolts and all the thousand and one small parts that seem indispensable for building a radio set have to go somewhere. The slack worker puts them all in one tin can. But the methodical one who saves time in the end provides separate trays for the principal items. If time is no object, a tray about 12 inches square divided into six or more compartments can be made. But an equally desirable tray already divided into compartments is found in the shallow tin muffin pans used in every kitchen. These can be purchased for 10 cents or a little more, all shiny and new, and will save many times their cost in conveniently holding small bolts and the like.

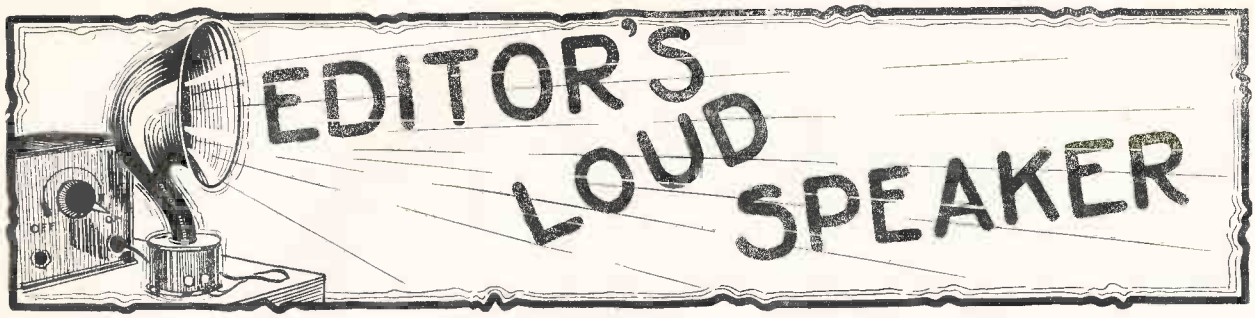
"MAHOGANITE" IS COPYRIGHTED

Perhaps you are using a radio panel which is grained like mahogany wood with streaks of red and black in it. Such an appearance is very attractive on a set and adds considerably to the neatness of the design. But it may or not be mahoganized. This name can be used only if the product is manufactured by the American Hard Rubber Company as they were the first to use this name and have copyrighted it as applying only to their own product.

A good many people in the past have used "mahoganite" as the name for this kind of material, although made by competing companies, and while by law the American Hard Rubber Company has the legal right to sue for copyright infringement, they have taken the broad stand that it is undoubtedly inadvertance that has caused this theft of name. However, they have served notice that in the future any one infringing will be prosecuted.

RADIO VOTE AGAINST CAPITAL PUNISHMENT

An analysis of several thousand of the letters received from WEAF's audience as a result of the debate held before its microphone at the Hotel Astor between Warden Lewis E. Lawes of Sing Sing and Senator William Love of Brooklyn on March 25, showed that 48 per cent. of the audience favored capital punishment and 52 per cent. were against it.



HISSES AND CLAPS

WHEN you tune in to-night and you hear a soprano singing some wonderful solo, like "At Dawning," for instance, what will you do? Undoubtedly you will be thrilled and perhaps remark, "What a wonderful voice she has." But do you let the matter drop there? If you do, you will not have done your duty.

You will often hear that courtesy requires that you send applause cards to the broadcasting stations when you are particularly pleased with some program, and no doubt most people agree that this is the polite thing to do; but have you ever acted on this prompting and expressed your appreciation by filling out and mailing an applause card? Perhaps it is not generally known that most of the talent gives its service free to the broadcasting station. Even such a big company as the General Electric Company does not pay its artists anything for their performances before the microphone at WGY, Schenectady. All their services are donated free of charge. And what do they get out of it? Only two things. First, the advertisement of themselves, and, second, the mental satisfaction which they get from knowing that they are helping to make the world a pleasanter place in which to live. But how can they know they are succeeding in this laudable purpose if no one tells them about it?

Like Talking to Yourself

Did you ever talk into a telephone and find that it was out of order? Would you be so foolish as to continue to speak your message into it when you got no response from the party who was cut off at the other end? Probably any remarks you did make were of rather a choice nature. Well, when a person talks into a microphone in broadcasting it seems just like talking into a dead telephone. Absolutely nothing happens. Perhaps the instrument is even out of order; you do not know. You talk for perhaps five minutes, maybe for an hour, and nothing but silence reaches your ear in reply. And if that silence is repeated when the mail comes in the next day and on succeeding days, nothing is heard from your audience, you naturally are discouraged from ever repeating the performance.

Two Dollars or One Cent

Another point to consider is the effect on the broadcasting director at the studio. The only way he knows what the public wants is by reading over the applause cards coming in. And so if you do like a certain piece of music or a certain singer, the only way you can be sure that you can get an encore is by letting the director know about it. Then, too, you sometimes hear something that is very disagreeable. Perhaps the soprano flats badly and it grates on your ears. This may happen every night if you do not send in a few hisses. You spend two dollars to see a show and then "give a hand" to the performers besides. By all means to-night, after you have heard the concert, spend a cent for a postal card and write a few hisses or claps and send it in.

THE BROADCASTING BATTLE

At the present time the newspapers are full of the fight between the Radio Corporation of America and its allied organizations, the Westinghouse Electric Co., the General Electric Company, the Western Electric, on one hand, and the Government on the other. The claim is made by the latter that an attempt is being made to monopolize broadcasting. This is denied by the corporation.

This situation was brought about by the recent action of the Western Electric Company in bringing suit against several broadcasting stations for infringement of their patents. A word here might be said as to how the various patent rights were acquired. As we all know, radio is a very new science, and it undoubtedly has the great popular appeal of any science. There are multitudes of people working on its improvement all the time. Quite possibly you, yourself, have been experimenting somewhat in the last month, using one hook-up and then another, which you may have read of, then combining them with your own ideas to see if you cannot get even better results; and if you are successful you very likely take out a patent. When you multiply your efforts along these lines by the hundreds of thousands of other experimenters you will realize that the rapid growth of the industry must have resulted from the large number of patents covering the entire field.

Beating the Patent Game

According to patent law, if you make an improvement on somebody's invention which he has patented, you can make and use the improvement, but not the underlying patent which you have improved. On the other hand, the original patentee can not use your improvement.

So you each block the other. Neither one can make or use the improved article. Owing to the operation of this law, no company could make a good radio set.

One could make some parts and another other parts. But complete sets were out of the question. What was more natural, under the circumstances, than that the big companies should get together and agree to pool their patents? As a matter of fact, the same thing happened a good many years ago in the automobile industry. Before that combination one company could make an engine, another a steering gear, and a third a transmission. But no one company could make a complete automobile.

Uncle Sam Takes a Hand

During the war the Government asked the three biggest electrical manufacturing companies in the United States to get together and pool their patents. This they did by a cross licensing agreement, under which each company could use the other companies patents. Since that time they have been able to make complete sets without infringement. They also granted licenses for use of their patents to several independent companies, who are now making complete sets.

The position of the Radio Corporation in the discussion is that they have spent millions of dollars in all in developing radio to its present success. The only way they can get a return on the money invested is by selling their apparatus. If *anyone* can manufacture and sell the patented articles without giving any return to the patentee, then what use is the patent? To quote from Mr. H. B. Thayer, President of the Radio Corporation:

"Broadcasting is made possible by inventions that have cost their owners large sums not only in acquiring patents, but also in experimental and development expense. We have recognized the fact that many broadcasters, in making wrongful use of our inventions, have been ignorant of their infringement. We have, therefore, established reasonable license fees, the payment of which, coupled with an agreement to refrain from further infringement, would liquidate any claims for infringement and would give the broadcaster a legal right to the use of the patent during their life. The fees are so moderate as to represent a return far below the customary profits on unpatented electrical apparatus.

"With approximately 400 stations in the United States using our inventions without a license from us, it became a matter of ordinary prudence for use to institute legal proceedings that would establish our ownership of patents and our rights as owners. Not to protect them would be sheer neglect of duty."

This gives the position of the Corporation. On the other hand, the Government thinks that there is danger of a monopoly being created in radio, which will be very detrimental to the art. If one company is able to dictate at will who shall do broadcasting and who shall not, there is considerable danger that an attempt will sooner or later be made to put out propaganda of one kind or another. Just imagine at election time if one company can dictate the sort of political speeches which are allowed to go on the air, what a tremendous power this would be. Or even, in the matter of religion, suppose notice were served on the broadcasting stations that hereafter only church services of certain denominations should be broadcast. Granting a complete legal monopoly, there is no limit to the censorship which the one company might not be able to establish.

Secretary Hoover Speaks

Mr. Herbert C. Hoover, Secretary of Commerce, is the champion of the people's rights in the matter. He says:

"I am in receipt of many requests for my views as to issues now before the courts bearing on the control of radio broadcasting. * * * I can state emphatically that it would be most unfortunate for the people of this country to whom broadcasting has become an important incident of life if its control should come into the hands of any single corporation, individual, or combination. It would be in principle the same as though the entire press of the country was so controlled. * * *

"In the licensing system put in force by this Department the life of broadcasting licenses is limited to three months, so that no vested right can be obtained either in a wave length or a license. I believe it is safe to say irrespective of claims under patent rights on apparatus that broadcasting will not cease and neither will our public policy allow it to become monopolized."

We Become a Prophet

If we may assume the role of a prophet we predict the following outcome of the controversy: The case will be carried eventually to the Supreme Court and will be dragged out over a long period of time. Eventually it will simmer down to this situation: The Radio Corporation, which is the legal owner of the patents (and quite properly—it has paid vast sums of money for them—), will allow any responsible organization to broadcast. This will remove the muzzle from the air. But they will charge license fees for the use of their patents, and will fix these fees at an amount which give them an adequate return on the time and money which they have invested.

SO DOES THE SODA CLERK

In previous issues of this magazine, we have invited *you,* who are now reading this article, to send in comments and criticisms, and if you are one of the large number who have done so, we want to thank you for your interest.

The attempt is being made to conduct RADIO PROGRESS a little differently from the way other papers are run. Of course, each publication tries to please you, but we are making an unusual effort to give you what you want. It is like a drug store. A man walks in and tells the soda jerker what he will have. He does not expect the man behind the counter to serve what *he* wants, and he knows he is not gifted as a mind reader, so he condescends to tell the soda server that he will take coffee ice cream with hot nut fudge poured over it.

So once more we ask you to let us know what kind of ice cream you prefer we should serve you in this magazine.

Lines for Lady Listeners

Edited by Miss Opal A. Mowry

Contributions for This Department Will be Accepted if They Are of Special Interest to Women

First Music Then Looks

NOW that the first thrill of listening to entertainments from the air by merely turning a few dials has worn off, people are beginning to give more thought to the selectivity of the radio set, and also to distances which the set will receive. The day is past when we shall be satisfied with just being able to receive music, lectures, etc., with no thought to clearness. We have to hear every word of the lecture and every note of the music or we immediately know that our set is not what it ought to be. We now realize that radio is not only a luxury, but it is becoming more and more educational and important, and we will not be satisfied until we have the most *selective* receiver which we can get, as well as one that will bring in the distances in our home. The programs from local stations may be just as good as those from distant stations, but because we know that we are receiving from many miles away it makes it seem all the more wonderful and entertaining. It is remarkable to listen to local stations, but the greater the distance received the more thrilling it is.

When buying or building a radio set, then, we must give more thought to the selectivity and distance which it will receive than to the appearance. Of course we all like to have a nice looking set in our home, but which is more important, the way it looks or the way it works? After we have procured a set which receives great distances and is also selective it is then time to give thought to appearance, and this will be done.

Then What?

Mother: "Jessie, the next time you hurt that kitty, I am going to do the same thing to you. If you slap it, I'll slap you. If you pull its ears, I'll pull yours. If you pinch it, I'll pinch you. There now."

Jessie (after a moment's thought): "Mamma, what'll you do if I pull its tail?"—Crosley Radio Weekly.

WHICH ONE DO YOU LIKE?

In this store it is not only possible for the customer to see the loud speaker he wants, but also to hear it by plugging in on the one which best suits his taste. The horns do not have to be removed from the shelf, but are kept in place, which keeps them in better condition, as it is not necessary for them to be handled so much. This is the very newest and practical method adopted for demonstrating loud speakers, since it is possible to listen to the one of your choice by merely plugging in. A pilot light placed at the base of each horn indicates the loud speaker in operation. The originator of this novel idea is Harold Herbert.

THIS IS W-E-E-P

The shades of night were falling fast,
When through the air we heard at last,
My Radio.

Then Pa begins to try and tune
And gets as crazy as a loon
On Radio.

We dare not speak nor dare to think
When Pa is on the ragged brink
Of Radio.

If papers rustle he gets mad,
"Shut up!" he cries in tones not glad,
"Oh—Radio!"

Then music sweet it fills the air
And things come in from everywhere
By Radio.

Pa raves and swears and tears his hair—
Mixed organ peals and squeals are there—
Bum Radio.

Was ever such a craze as this,
That takes the joys from wedded bliss
Like Radio.

—*W. W. Harris, in Universal Windings.*

Top Shelf is for Horns and Belles

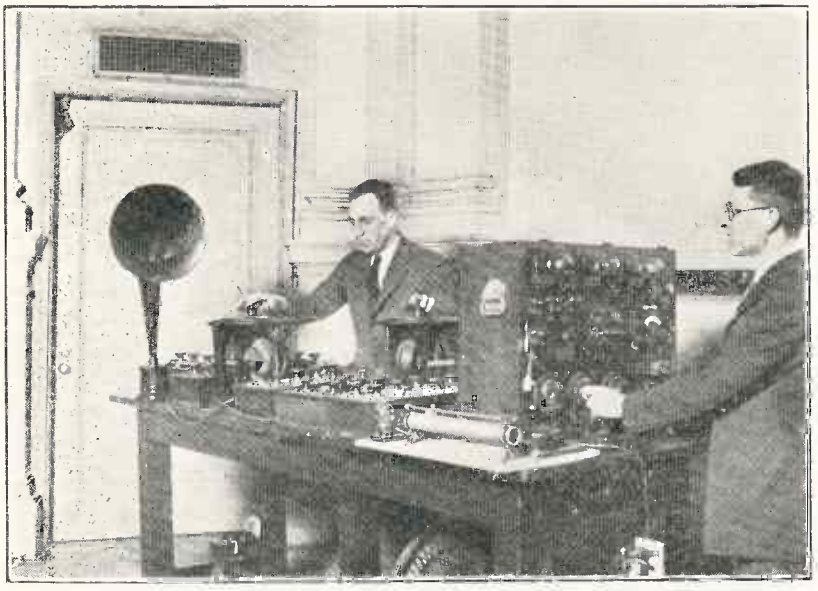
TIMING THE CURFEW BELL

In some cities it is customary to ring the fire bell at 9 o'clock every evening for the double purpose of testing the electrical system of the fire alarm and also for giving the correct time to the citizens. Nowadays the hour has been changed until 10 o'clock in the evening. This insures getting the correct time exact to the second. The radio receiver is either tuned direct to Arlington, which gives the standard time for the whole United States, or if found desirable one of the relaying stations, like KDKA (East Pittsburg), is tuned in. By this means the radio fans who may be listening to a concert from some other station can still get the correct time from the booming of the fire bell.

Radio Doing Its Own Broadcasting

New Sending Station Does Without Singers and Speakers and Talks Itself

IN these days you frequently hear of trouble as to what should be broadcast, and there is discussion as to what talent to employ. The performers are beginning to think they should get paid for singing. But the latest in the art is to do away with the performer and let the radio do its own broadcasting. Dr. Harvey Fletcher, of the Western Electric Company, is the inventor of a new type of apparatus which can be made to talk itself, not merely reproducing what someone else has said.



Dr. Fletcher, who received his degree from the University of Chicago, uses a vacuum tube oscillator and amplifier and with his special tube circuits he can make a loud speaker say A, E, I, O, U. The vacuum tube oscillator is connected up to an overloaded amplifier which causes bad distortion. It is this distortion which produces the harmonics, which distinguishes a spoken word from a mere tone. Two separate circuits are used, which allow two groups of harmonics to be controlled. It is these that determine the character of the sound, instead of just the pitch.

Will be in Big Demand

When this invention is perfected so that any one's voice can be duplicated at will, the imagination hesitates as to how far it may be used. Maybe the business man will have one set up in his office and tuned so that when an undesirable visitor steps in the office boy by pressing a button can make a voice bellow "Throw him out," in a tone that will strike fear in the visitor, or, again, the love-sick youth will send an instrument to his sweetie to put on her dresser beside his photograph, which will continually remind her in his own tone of voice how much he loves her.

They Tune the Tone

Our picture shows Mr. John C. Steinberg at the left helping Mr. Harvey Fletcher to get just the tone of voice which they are aiming for.

TESTING THE "KICK" OF TRANSFORMERS

HARRY A. NICKERSON

It is always advisable before placing a transformer in a radio set to test the primary and secondary windings for continuity. This may be done in the more usual way by placing a small battery and pair of phones in series with each winding to be tested. Each time the circuit is completed, there should be a click registered by the phones.

Here's a very simple but effective method of testing both primary and secondary with one test. Touch the terminals of a three to six-volt battery source to the primary terminals and at the same time touch a moistened finger to each of the secondary terminals. A small electric "shock" is a sure index of proper winding. In the case of audio transformers, the strength of the shock received is to a considerable extent an index of the voltage step-up caused by the transformer.

RADIO THE RULING RAGE

An inventory of the radio craze was recently compiled by an interested authority. This is what he found:

Twenty-five thousand retail dealers.

One hundred and seventy-five million dollars estimated expenditure by the American public during 1923 for radio material.

Two hundred and fifty books on radio.

Seven radio trade papers.

Fifty magazines carrying radio sections.

Thirty radio periodicals.

Three thousand weeklies with radio sections.

One thousand newspapers which carry radio news.

One thousand wholesale distributers and jobbers.

Three thousand manufacturers of radio supplies.

Two hundred and fifty thousand persons connected with the industry.

The Popular Loop Aerial

Many Fans Are Discarding Their Outside Aerial for a Loop Antenna

An Interview with R. H. Langley, Radio Engineer, General Electric Company

MANY of the modern sets have one or two novel appliances. Some have a big wooden cross built into the cover of the radio and on this cross is wound ten to fifty turns of wire, thus forming a loop aerial. In other sets is found a jack labelled "loop" and a loop aerial, as just described is plugged into this jack by means of a flexible coil. What are the advantages of such a piece of apparatus over the usually used outdoor aerial?

The loop antenna is a very interesting device. It is quite different in its method of operation from the outdoor aerial. The outdoor antenna is in effect nothing more nor less than a condenser. It is a very large condenser to be sure so far as its physical dimensions are concerned, but electrically it is a relatively small one. The loop, on the other hand, is an inductance. This fundamental difference between the two is the reason why it is necessary to use different methods of tuning in the two cases.

Like Automobile Generator

There is a very close parallel between the ordinary direct current generator or dynamo and the loop antenna exposed to passing radio waves. In the generator a number of coils corresponding to the loop aerial are rotated in front of the poles of a powerful magnet. The purpose of rotating them is in order that they may move with respect to the magnetism, and thus have a voltage or electrical pressure generated in them. The amount of this voltage depends of course, upon the strength of the field and the speed at which the wires are swept through it.

In the radio case, the coil stands still, but the field moves swiftly past the coil, thus accomplishing the same result. The speed at which the field moves naturally cannot be varied and is always the speed of light, that is 186,000 miles per second.

Let us see now what form of loop would have the greatest voltage generated in it by a passing radio wave. Let us think of this radio wave as very much like great smooth waves on the ocean, which of course, also move forward with a very definite speed. The turns of wire on our loop antenna are necessarily in series with each other, that is to say, they form a continuous winding. See Figure 1. If the maximum voltage is to be generated in the

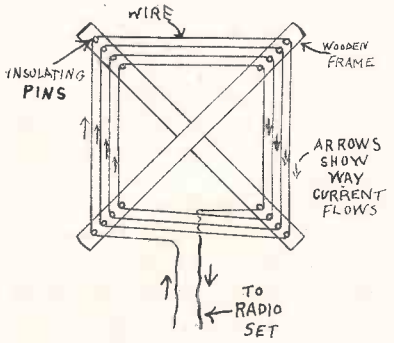


Fig. 1. Layout of Loop

loop, then the voltage induced in the two sides of each turn must be in the direction so that they may add and not oppose each other. If the voltage generated in both sides of the loop were in the upward direction at any one instant, then these two voltages would cancel each other, but if the voltage on one side of the turn were up and on the other side of turn it were down, then they would add. When such a loop is connected to your set, a current will flow around the turns of the loop. This is exactly what we wish to have happen.

Up and Downs of Loop

Now in order to have the voltage generated *up* on one side of the loop while it is *down* on the other side, the loop would have to be one-half a wave length long, that is to say it would have to be long enough in the horizontal direction so that one side was in the crest of the wave when the other side was in the trough of the wave as shown in Figure 2. Since the distance between the crests is called the wave length, then the distance from the crest to the trough is one-half the wave length.

The higher the sides of the loop are, that is, the longer the vertical wires are, the greater will be the voltage generated, and of course the voltage generated in each turn is added to all the others.

As Big as a Battleship

But a loop one-half a wave length long is quite out of the question. The most popular wave length is 360 meters, and you remember that a meter is a little over a yard. Some of the popular stations, like KYW in Chicago, radiate at 536 meters, which is nearly three-eights of a mile. A loop of this length would be nearly as long as a steamship, and almost as difficult to handle.

The loops which we are using every day are of quite reasonable dimensions. say, two to four feet long. This is only a few thousandths of a wave length long. How do they work? In order to answer this question let us see how we would build a coil of wire in order that absolutely no voltage should be generated in it by the passing wave. The only way in which this could be accomplished would be so to build the coil that the same voltage would be generated in both sides of it and that the voltages generated in the two sides would be opposed to each other. This would give a complete cancellation and no voltage at all at the terminals of the loop or coil. It is obvious that the only way in which this could be done would be by so arranging the loop that it had no length at all. That is to say, arranging it so that the two sides were exactly in the same place. This would mean that the horizontal wires across the top and bottom of the loop would cease to exist and the loop would become nothing but a wire laced up and down between pegs on the plain surface of a board.

If there is any distance at all between the two sides of the loop, then there will be some difference not in the amount of voltage generated in the two sides, but in the time at which this voltage is generated and there will conse-

quently be some voltage at the terminals of the loop since complete cancellation of voltages cannot occur.

Another way of putting this would be that while the pressure in the left hand end of the coil is the same as in the right hand end, the fluctuations up and down in the two ends do not keep step and so do not exactly cancel each other. If two men are walking along, one directly behind the other, and they keep exactly in step, they do not interfere with each other, but when the man behind gets a little out of step with the man in front, then the man in front knows about it.

Suppresses Signal

If the loop is rotated so that its horizontal wires are at right angles to the direction in which the signal is coming, then the loop has no length so far as those signals are concerned. The passing wave strikes both sides of each turn in the loop at exactly the same instance, and the voltages generated are therefore, equal and opposed, and there is no terminal voltage, as Figure 3 shows. This is of course the fact which gives the loop antenna its very useful directional property. It is to be noted, however, that if the loop is turned ever so slightly from this zero position, then the voltages no longer cancel, and there is a voltage at the terminal. This means that the zero position of the loop is very sharp, but the maximum position is not.

To get Chicago

In applying the loop antenna to an actual radio receiver, it is necessary that provision be made to tune it to resonance with the desired signal. This is accomplished by means of a variable air condenser. The coil aerial must be large

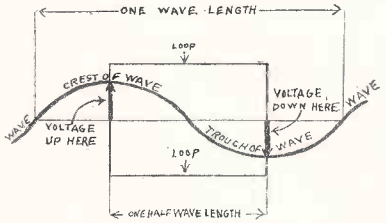


Fig. 2. Effect of Loop Aerial One Half Wave Length Long

enough so that when the variable condenser is turned to give the greatest capacity the combination of coil and condenser will pick up the longest wave length that you want to receive. This will be probably around 536 meters, KYW Chicago. The specification for the best loop antenna therefore, is that it shall have just as many turns as possible, each turn being just as long as possible and just as high as possible, and still have no more than the required maximum inductance. The higher the

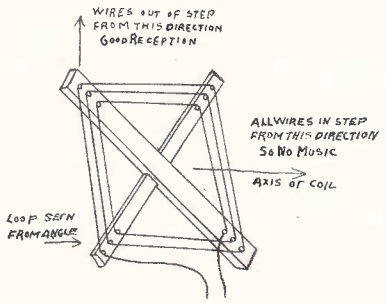


Fig. 3. Directional Effect

loop is, the greater will be the voltage generated in each side of each turn, and the longer it is the greater will be the difference in time at which these voltages are generated in the two sides of the loop and consequently the greater will be the voltage at the terminals, but it must not have an inductance value greater than that required for tuning.

Wind Coil on Cylinder

Now the inductance of a coil of wire increases very rapidly as the turns are wound closer together. The maximum inductance is obtained with the minimum number of turns when they are wound close together. In order to get the maximum number of turns for a given inductance, which is what our loop requires, the turns should be wound just as far apart as possible. It is found that this spacing is best accomplished by winding the loop on a frame which has the form of a vertical cylinder. The wire goes up one side of the cylinder across the top and down the other side and across the bottom, and the turns are spaced around the circumference of the cylinder so that the complete winding covers an arc of about 120 degrees on each side of the cylinder.

As a loop aerial of this form is rather more difficult to build and operate, the more usual construction is that shown in our diagram. It sacrifices something in efficiency, but is easier to construct. It also takes up less room and is more portable. But for those that want the ultimate volume and selectivity, the cylindrical form is the one to adopt.

LEARNING TO DANCE

It is easy to dance if your set can pick music from WJY and WJZ in New York. Just recently these two stations, which together make up Broadcast Central in New York City, have completed arrangements so they can transmit twelve different orchestras. These include some of the best known in the district. To mention a few of them, there are the orchestras of Hotel Commodore, The Waldorf-Astoria, Hotel Alamac, Trocadero Club, Moulin Rouge, Hotel Ambassador and Hotel McAlpin.

Direct wires are run to each of these stations. That is because it is impractical to transport entire orchestras to the broadcasting studio. The scheme also enables the radio audiences to hear these famous dance orchestras just as they play in their respective accustomed surroundings, with the inspiration of atmosphere and the dancers right before them. Many of the orchestras could not leave to reach a broadcasting station studio during the most popular radio dance hour, ten-thirty to eleven-thirty, and without the direct-wire system such a succession of leading orchestras would be impossible.

HEAVENLY MUSIC

Music, which is literally heavenly, has recently been dropped from the clouds. This remarkable occurrence has come about in this way: Some enterprising airplane men have equipped their planes with powerful radio receiving sets and installed loud speakers with the horn pointing straight down. As they flit from city to city, the whole countryside as they pass is delighted with the strains of jazz music coming from one of the popular broadcasting stations. As a matter of fact, one old farmer recently heard "It Ain't Gonna Rain No Mo," coming apparently from the depths of a bad thunder cloud, and he concluded it must be some new form of weather report sent out by the Weather Bureau.

In receiving broadcasting from an airplane a long wire with a weight attached is dropped from the machine, and, of course, the rush of the wind as the plane goes at a speed of 100 miles an hour causes this wire to trail away out behind. This forms an aerial. The ground is connected to the metallic framework of the airplane itself.

NOVEL LOUD SPEAKERS

Most loud speakers may be called glorified telephones with a horn. Naturally a factory designed and built loud speaker will be better than a home-made one, but if you are interested in novelties it will be possible to get pretty good results with some everyday apparatus. The most important part is a good telephone unit. There are several good ones on the market. Perhaps the most popular is the type using a mica or aluminum diaphram instead of the usual steel disk.

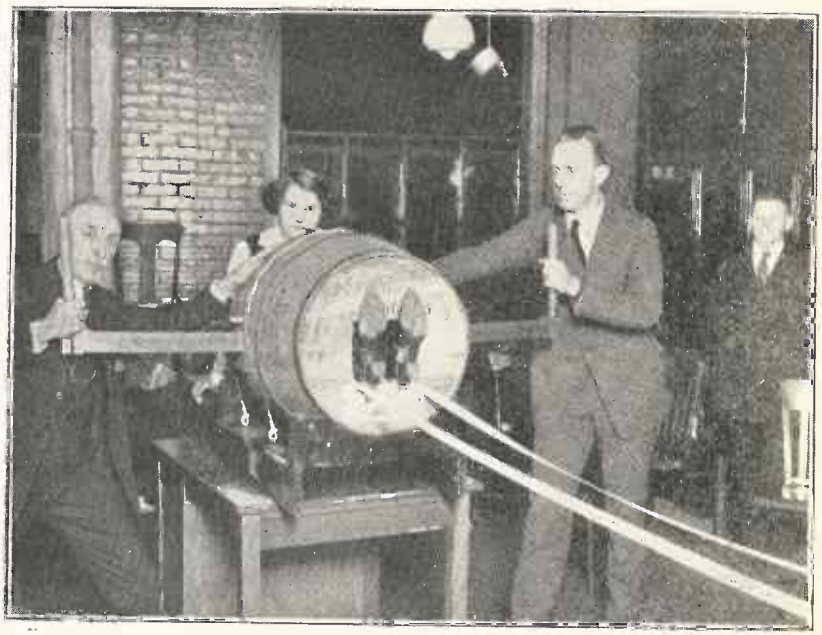
With this loud-speaking ear phone it is possible to build a large variety of horns. One of the attractive ones is made by taking a rather large vase and mounting the phone in the bottom. This is rather surprising to your visitors who hear the music, but are unable to find where it is coming from. Another type of horn which works pretty well is that made from a good size flower pot. One correspondent reports the use of a large goldfish bowl for the horn. He hastens to add that you must first remove the goldfish. The largest horn that has been reported is one moulded out of reinforced concrete.

ARE YOU OUT OF WORK?

If you have a radio set and are out of work, then be sure you tune in to Station NAA, Arlington, 435 meters, next Wednesday night at 7:30. The government is giving a regular broadcasting service every Wednesday from this station. They are sending out the news of various governmental positions which are open in Washington and elsewhere with the expectation of reaching interested persons very much quicker than through the ordinary department bureaus. These positions range all the way from laborers to linemen and from clerks to chiefs. You may land just the job you may have been looking for.

HEARD AND SAW BY RADIO

The chap that said he saw by radio was perhaps not lying, for he undoubtedly referred to the saw he heard cutting a girl in two, as broadcast by Station WLW, Cincinnati, last week. It was carried out by Mr. George Stark, the well-known magician. A young and (needless to say) pretty girl is tied down on a wooden platform by a number of ropes. Men are selected from the audience to hold the ends of the rope while a barrel is slipped over her feet and up to her waist. You can still see her feet projecting through a hole in the other end of the barrel. Then a heavy cross-cut saw, such as is used for felling trees, is brought out, and right before the eyes of the audience is used to cut the barrel with the girl inside in two. After both her legs have been amputated, the halves of the barrel are removed and there she appears still tied up as before.



This Looks Like Quite a "Feet"

Unfortunately, all this could not be seen over the radio, but Mr. Stark in a preliminary speech described what was going to happen, and then you could hear the various sounds broadcast from the Crosley Station. The noise of the saw hacking into the barrel was quite plainly heard. Our picture shows Mr. Stark, the magician, assisted by Mr. Powell Crosley, Jr., of Station WLW.

Rx DR RADIO PRESCRIBES.

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

Question. What is meant by a D. L. 75 coil?

Answer. This is the standard abbreviation for a duo-laterial coil with 75 turns in it. This is one of the popular honeycomb coils. In general there are two styles of honeycomb, and they look alike except on close inspection. In one style the wires of each layer cross each other every eighth of an inch or so, but the wires of one layer lie directly over the wires of the layer underneath. Looking at the coil from the side, you can see small diamond-shaped holes running way in to the tube on which the coil is wound.

The duo-laterial coil, on the other hand, is wound so that each layer is staggered, compared to the layer below, so the diamond-shaped holes mentioned above cannot be seen. As a matter of fact, the inductance of the two forms of coil is almost exactly the same if they are wound with the same number of turns.

Question. Why is an indoor aerial not so good as an outdoor one?

Answer. The indoor aerial is usually but not necessarily inferior to the outdoor aerial. There are two reasons for this. The first is a matter of size. You think nothing of using an aerial 30 or 40 feet high and 100 feet long, but where will you find a dwelling of this tremendous size to cover such an aerial? The ordinary house is only 30 or 40 feet long, and to get a hundred foot aerial inside it requires that the wire be doubled back on itself two or three times. This necessarily sacrifices efficiency. The second objection to the inside aerial is that it is usually shielded by various pipes and wires in the walls and ceilings of the house. You must remember that any piece of metal which is connected to the ground thinks that it is an aerial and takes out of the air all the radio energy it can get. So you will see that if you have around your aerial a network of hot and cold water pipes, steam pipes, electric light wire, telephone wire, gas pipes, bell and enunciator wires, they will rob the air of nine-tenths of all the radio energy coming into the room where your aerial is installed. These are the reasons why the outdoor aerial is usually to be preferred, and not the fact that your wire is covered by a roof.

Question. How can the squeal be eliminated from an amplifier?

Answer. Most squeals these days are caused by regenerative receivers in the neighborhood being improperly operated. If this is your trouble, there is nothing you can do to cure it. If, however, the squeal does not appear in the phones when using the detector only, it cannot be from this cause. If the latter case, the most likely reason is that there is some feedback of energy from one step to another. Such feedback is the result of too close spacing of either the transformer or the tubes. If your transformers are shielded, it is well to ground the metal covering, and, in that case two or three transformers can be installed, even touching each other without bad effects; but if you have ordinary audio transformers, it is well to space them at least two or three inches apart. As a further precaution it is sometimes desirable to turn them at right angles to each other. This will prevent feeding back of energy. Another point to be looked after is to make the grid leads just as short as possible and keep them away from the vicinity of the plate.

Question. I have a single tube regenerative set and wish to add one or two amplifiers. Is it better to use audio or radio amplification?

Answer. Audio amplification is what you will need. A single audio amplifier added to your set will enable you to get loud-speaker operation on local stations and head-set operation on stations 1000 to 1500 miles away. A second audio amplifier will extend the range of your loud speaker to 1000 or more miles. The advantages of the audio amplifier are that the parts are relatively cheap and easily hooked up. No controls are used at all except a rheostat for the filament. Even this may be omitted and the filament connected directly in parallel with the detector tube. As a matter of fact, such a modification is usually recommended at the present time. On the other hand, the radio amplifier is rather difficult to adjust properly and requires further controls which are hard to regulate. The average amateur makes a failure of radio amplification.

Question. What causes a blue glow in a vacuum tube?

Answer. A blue glow will be seen in a vacuum tube when it is improperly operated by putting too much "B" battery voltage on it. It will occur only in a soft tube, such as the UV 200. These tubes in general are used only in detectors and not in amplifiers. Such tubes are called soft when they contain a small amount of air, but if the vacuum is pumped as perfectly as possible the amplifier is called hard. When a soft detector tube is worked with 18 to 22 volts "B" battery the little particles of negative electricity (electrons) shot off from the white hot filament are attracted across to the plate and cause a current in the telephone. They encounter numerous

Continued on Page 32

CABINET USEFUL AS WELL AS ORNAMENTAL

In building a set many an amateur who wants to save money does so by omitting the cabinet. This in general is a mistake. Of course, if it is a choice between having a cabinet or a tube, you *can* do without the former; but it is the experience of radio repair men that the omission of the cabinet has a rather bad effect on the finished set. This is because it is difficult to hook up the parts when assembled on an open board and keep the wires short and direct.

To get efficient operation it is very desirable that the leads, particularly the grid and plate leads, be run as short and direct as possible. The "A" battery wires are not important and may be fastened to the back and sides of the cabinet to get them out of the way. By disposing of them in this manner the undersirable capacity action between wires is avoided. A further advantage of properly housing a set lies in the mental attitude of the builder. If he knows he is working on a good looking job, he usually takes a good deal more pains in laying out the parts, than if he throws them together on a board.

One thing further—in picking out a cabinet remember that a radio is a rather mysterious piece of apparatus to most people and they can not judge how good it will be except by its appearance. A good looking cabinet will about double the saleability of any radio set.

PRIZES FOR SUBSCRIPTIONS

Head Phones or Transformers FREE if you secure two subscriptions for RADIO PROGRESS for one year—your own and that of a friend. See announcement on Page Four of this issue.

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IN THE NEXT ISSUE (MAY 1) OF RADIO PROGRESS

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Here's an opportunity to build a set that you can take with you when you go camping. The directions will be so clear that anyone with the least ingenuity can build the set. It is a two-tube set,—panel dimensions 5" by 10". Can be operated on nearby stations with a loud speaker. Range under normal conditions, 1000 miles. We will give complete wiring diagrams, showing every detail.

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DR. RADIO PRESCRIBES

Continued from Page 29

molecules of air on the way across, but do not affect them, as the speed at which they travel is relatively low owing to the low attraction of the "B" battery voltage. But suppose now that a 45 volts or more "B" battery is used on the detector plate. This high voltage causes such a powerful attraction that the electrons are speeded up to a very high velocity. As they rush across from the filaments to the plate they encounter the little particles of air left in the tube and literally knock the stuffing out of them. That is, in colliding with a molecule of air the electron actually breaks it up and releases one or more other electrons out of the air molecule. This causes a fearful shock in the ether, which is manifested to the eye by a bluish haze or glow. As might naturally be expected, such a condition of irregularity is bad for the radio set. When listening in on a detector adjusted in this way a constant wheezing will be heard, which breaks up the music. As there is no advantage at all in such operation, the remedy is to reduce the "B" battery voltage until the blue haze disappears.

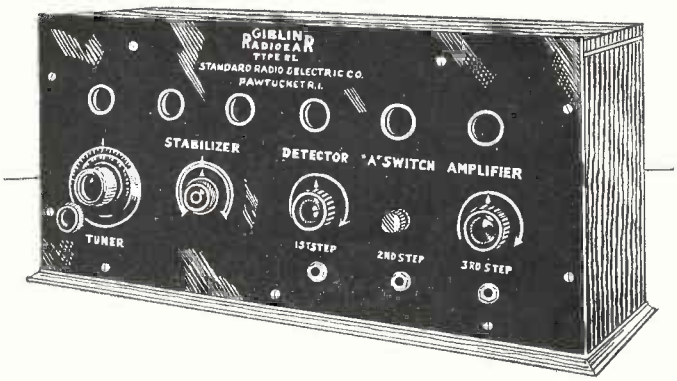
Question. Which is better for a "B" battery, two 22½ volt blocks or one 45 volt block?

Answer. Each has its advantages. If you use a 45 volt block you do not have to make any connections across, and so this bother is saved. There is less chance of interchanging the "A" and "B" battery leaves and so burning out your tubes. Sometimes the price of the 45 volts is slightly less, if it is obtained in one block, rather than in two. On the other hand, a 45 volt block is used as a unit and when part of it wears out the whole block must be scrapped. For this reason most people prefer the smaller units. Suppose, for instance, you bought a set of automobile tires and the tire dealer stipulated that when one tire wore out the other three must be thrown away at once. This would seem like a rather foolish contract to make. But that is what you do when you buy a 45 volt "B" battery. The detector takes a small voltage and so uses only a part of the 45 volt "B" battery. The amplifiers take the full 45 to 90 volts. So you see that part of the battery is working harder than the rest of it, and when this wears out it means scrapping the whole thing.

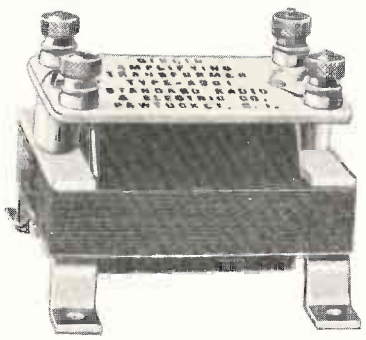
GIBLIN
RADIO APPARATUS

The Giblin Broadcast Receiver

THE Giblin Radio Frequency Broadcast Receiver makes it possible to obtain radio entertainment without the necessity of erecting outside antenna wires or using a troublesome ground wire. A small, loop aerial placed near the set will pick up signals, which, though they have come long distances, and are weakened by hills, valleys, trees and buildings, will be clear and of great volume. Many families, living in apartments where it is undesirable or impossible to erect antenna wires, can now hear enjoyable, ever-changing programs through the day and evening by "listening-in" with a Giblin Radio Frequency Broadcast Receiver.



The set comprises two stages of radio frequency amplification, a detector and three stages of audio frequency amplification. The parts are mounted on a sub-base to which a Bakelite panel is attached. It is enclosed in a handsome solid mahogany cabinet.



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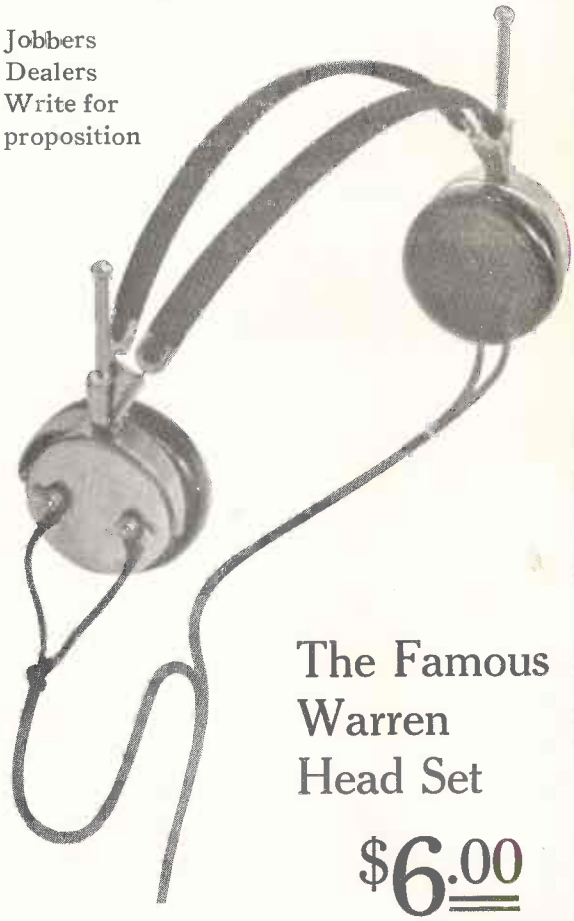

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