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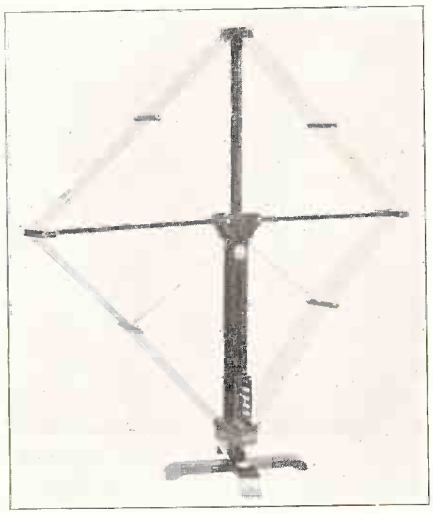

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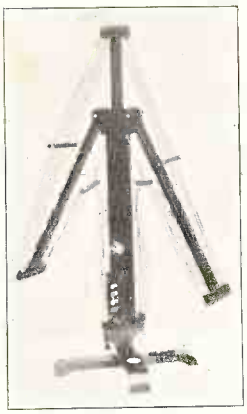

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RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 1 Number 5

Contents for

MAY 15, 1924

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RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. I, No. 5 MAY 15, 1924 15c. PER COPY, $3 PER YEAR

A Real Explanation of the Carrier Wave

Why Cannot Broadcasting be Done by Audio Instead of Radio Frequency?

By HORACE V. S. TAYLOR

ONE of the most puzzling terms to the radio novice is the phrase, "carrier wave." It is generally understood that this refers to some sort of method of transporting the music from the broadcasting station to the radio set, but just why any such special means are required, is not so generally known. Here is an explanation of the process.

You Talk at Audio Frequency

To understand this matter, it is first necessary to grasp the idea of radio and audio frequency. The word "frequency" means the speed at which the alternating current changes its direction or flow, back and forth. As an illustration, suppose we have a small salt water lake by the seashore lying a few hundred yards back from the coast line. It is connected to the waters of the ocean by a narrow inlet. When the tide starts rising, you will notice that the water flows through the inlet toward the lake. As the tide nears flood, the current slackens off and flows slower and slower, until at exact high tide it is no longer running at all. Then, as the tide in the ocean ebbs, the water in the inlet reverses, and we have a current flowing away from the lake. This action is repeated indefinitely twice a day. The frequency then of such a current in the inlet is two cycles per day.

When we come to electricity the same action occurs, but it reverses much faster than does the tide. Most commercial alternating currents in the United States have a frequency of 60 cycles a second. Each cycle consists of a change in the direction of flow from one way to the opposite, and then back again. Since this double reversal happens sixty times every second, it is called a 60-cycle current. Another popular frequency, especially for street railway and power work, is 25 cycles per second, while on the Pacific Coast, some cities have a standard of 50 cycles.

Voice Frequency Much Higher

When we get to music the speed of vibration is considerably faster. When middle C is struck on a piano the oscil-

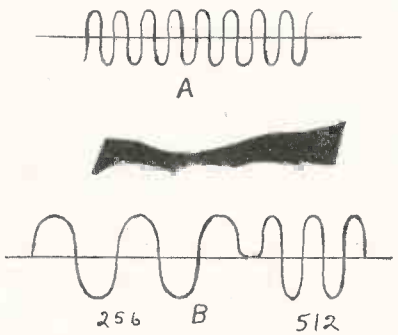


Fig. 1. Radio and Audio Waves

lations occur 256 times every second. This may be illustrated by a phonograph record. If you will adjust your talking machine so that the disk turns around exactly once every second, you can measure the speed of vibration or frequency by counting the number of hills and valleys in one revolution of the spiral needle track on the disk. Wait until the orchestra plays the note C as sounded on your piano. Then you will find that there are exactly 256 little hills and valleys in each revolution of the disk as long as this one note is being sustained.

Octaves Double the Speed

Now strike the next C an octave higher on your piano. The difference in the tone is caused by the fact that the vibrations now number 512 per second, which is just twice as fast. In the same way, high C is double that again, or 1,024 cycles. Each time you increase the speed of vibration it raises the pitch of the tone. That is why, when you change the regulator on your talking machine and speed up the disk, it plays the music in a higher key.

While the human ear can hear sound up to about 10,000 or perhaps 15,000 vibrations per second, such notes do not sound like musical tones at all, but are felt as a very disagreeable and piercing sensation in the ear. Ordinary music seldom goes above two or three thousand cycles. The low speed of vibration, that is, the bass notes run around 150 or 200 oscillations per second. This, then, is the audio frequency range—from 150 to 3,000. This represents the range from the low notes on a bass horn up to the high notes on a piccolo, or violin.

Radio Frequency Higher Again

Radio frequency is so much faster than this that it is in a class by itself. Ordinary broadcasting oscillates back and forth about one million times a second. This is called a million cycles, or 1,000 kilocycles (abbreviated kc.). A broadcasting station radiates waves at this high radio frequency. The exact speed depends on government regulations, as the chief radio inspector assigns a definite frequency to each station. The difference in the shape of the

waves is illustrated in Figure 1. At A is shown a radio frequency wave which oscillates a million times a second. This corresponds to a wave length of just 300 meters. This speed of vibration is maintained by the particular sending station all the time, day in and day out. At B is shown an audio frequency wave. The scale is much smaller, for instead of going a million times a second, the wave first oscillates at a frequency of 256, since the artist is singing middle C and then changes to 512 as he sings an octave higher. This audio frequency, of course, is changing all the time. Every note is a different frequency from the one before it.

Cannot Broadcast Audio Frequency

There are three good reasons why broadcasting is done at the high radio frequency. The first is that if any attempt were to be made to use audio frequency, the apparatus would have to be changed continuously, since the coils and condensers in sending are adjusted to one particular frequency. This would do very well while a singer carries one note, but as soon as the next one was sounded coils and condensers would have to be changed to suit. The second objection is that no tuning to that particular station could be carried out. If the radio were tuned to any particular vibration, say 256, it would receive the note C and that note only from any broadcaster who happened to be playing C at the time. This would be tuning to a note and not to a station.

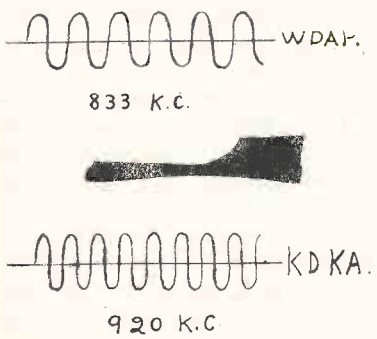


Fig. 2. KDKA or WDAP

The third objection to broadcasting audio frequency is that the amount of energy radiated from an aerial depends directly on the frequency, and at the low number of oscillations corresponding to audio frequency, the amount of power radiated from a sending aerial would be very small.

Carrier Wave Invented

The invention of the carrier wave answered all three objections. It is a continuous oscillation, sent out from the transmitter at a perfectly definite frequency and is changed in its force or modulated in such a way that it will reproduce the music when run through a detector in the radio. Since it has always the same speed of oscillation, there is no need of changing coils or condensers during the operation of the set. In fact, the greatest care is taken to prevent any change in the set which might influence the speed of oscillation. This answers the third objection mentioned above. In the second place, since each station has its own particular frequency or wave length, it is possible to tune a radio to get one vibration and not another. This was explained in the article, "What Happens When Tuning In," in the May 1 issue of RADIO PROGRESS. In this way, if you wish to hear WDAP in Chicago, you adjust your dials so that the set will pick up vibrations at 833 KC, whereas, to hear KDKA, East Pittsburg, the set must be tuned to 920 KC. This difference is shown in Figure 2.

The important thing about these waves, as shown in the cuts, is the spacing. This spacing is intended to represent the interval of time between the waves. Where they are spaced close together as KDKA, it represents waves which are close together in time. When they are spaced farther apart like WDAP, it means that it takes longer for the voltage to rise and fall. The same thing applies on audio frequency. Referring to Figure 1 again, it is the spacing between the hills and valleys which counts. When they are close together, it shows the waves are coming in right on each others' heels and a high pitched note is heard, while if they are separated some distance apart, the tone is a bass note.

How Does a Loud Note Look?

If we draw a picture of a loud tone as compared to a soft one, it will look like Figure 3. This may be the picture of either a radio frequency or an audio frequency wave, depending on how much time elapses between one peak and the next. If this time is about a millionth of a second, then it is a radio wave. If the time is a few hundredths of a second, or a few thousandths of a second, then an audio wave is shown. But in either case, the first wave is loud and the second soft. When we talk about a *radio* wave being loud, it must be realized that it is not the sensation or loudness to our ears that is meant. The human ear never hears a radio wave. It goes too fast to be recorded by our slow moving ear drums. But any electrical instrument, which is able to measure loudness, will show that the upper one has a lot more energy in it than the lower one.

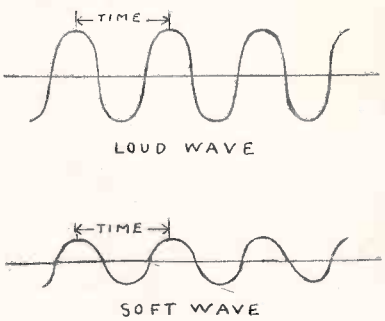


Fig. 3. Loud and Soft Music

Again we can see the same effect if we look at a phonograph record. First, observe a band piece, which is made for dancing, and you will notice that the hills and valleys are easily seen with the naked eye. Then pick out some sort of an orchestra selection and at some spots it will be difficult to see the peaks unless you look through a magnifying glass. And yet, if the same note is being played, you will find that the spacing from peak to peak is just the same whether the note be loud or soft.

Shape of a Wave

All the waves shown so far have had a perfectly smooth, regular shape. Radio frequency waves are always of this character. They are generated by the vacuum tubes in the broadcasting station. They always rise and fall so smoothly that any one wave is just exactly like its neighbor, except for height. If the music is being played loudly, then each mountain will be high and each valley deep. Whereas, with soft music, it will be as shown in the lower part of Figure 3.

Audio frequency waves are not smooth, however. Different instruments

have different shaped waves. Figure 4 brings out this point. A tuning fork sends out a perfectly regular smooth wave, and the pitch of the tuning fork depends only on the frequency or number of vibrations per second. If the distance between peaks represents 1/256 of a second then, the note will be C. When the same note is played on another musical instrument, instead of a smooth, regular mountain and valley, we have a condition as shown in the lower part of Figure 4, which represents a violin. It is the ripples on top of the main wave, which cause the distinctive tone or timbre of a violin, piano, or flute. A trombone, for instance, will have considerable more ripples on it than a violin. These ripples are called harmonics.

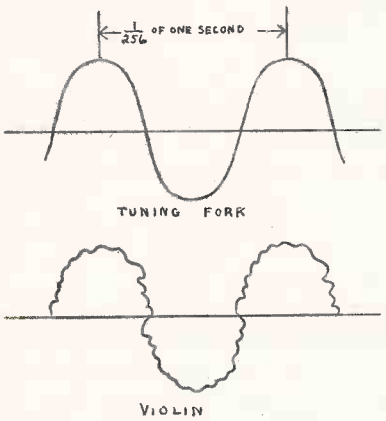


Fig. 4. Difference in Timbre

Making a Rich Tone

For some reason we are built so that our ears prefer a wave with ripples on it. That is, we like harmonics mixed in with the main wave or fundamental. When you listen to a tuning fork the tone seems quite flat and dull. It is because the harmonics are absent. But the violin has a pleasing tone. The same thing is true of singing. You say that one soprano has a rich voice, while another one has not. The difference is entirely in the number and loudness of the harmonic in her voice.

What the Carrier Wave is

Now that it is understood what the radio and audio frequency waves look like, let us see how the carrier wave combines them both. It is called a carrier wave, because while it is sent out at radio frequency, it carries with it the audio frequency music, which we wish to hear. The shape of such a wave appears in Figure 5. It will be seen that the radio frequency oscillates up and down continuously at a fixed speed. If the space between successive beats represents 1/1,000,000. of a second, then we shall have a frequence of 1,000,000 cycles per second, or 1,000 KC which is the equivalent of a 300 meter wave. This is the radio frequency of the carrier wave.

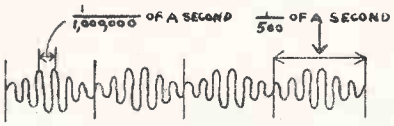


Fig. 5. Carrier Wave

It will be observed that the carrier wave is divided off into groups being alternately loud and soft. If each group is repeated 500 times a second, then the audio frequency will be 500 which corresponds to the note B on the piano.

Diagram is Inaccurate

Figure 5 is quite inaccurate in one respect. You will see one distance labeled 1/1,000,000 and another 1/500 of a second. Since the ratio between these two lengths of time is 2000 to 1, the diagram ought to be nearly 2M times as long as it is. That is, instead of showing half a dozen radio frequency waves to each audio frequency, it should be 2,000 ripples to every main wave. Naturally this would take up too much room in the diagram, and so it has to be cut down to show what is meant.

In our next issue we will explain further the difference between radio frequency and audio frequency waves, and how the detector changes the carrier wave from radio frequency to audio frequency.

EARN $100.00 IN GOLD

One hundred dollars in gold is the prize offered to the first amateur who succeeds in picking up the Donald B. McMillan station, WNP, on the schooner Bowdoin, now frozen in within 11 degrees of the North Pole. This offer is made by U. J. Herrmann, managing director of the Radio Manufacturers' Show Association, which will conduct radio shows in New York and Chicago this autumn.

To the next amateur who reports a confirmed reception of the McMillan expedition's transmission, E. F. McDonald, Jr., President of the Zenith Radio Corporation, will award a Zenith receiving set—an exact duplicate of the one in use on the Bowdoin.

The offers of Mr. Herrmann and Mr. McDonald are made to stimulate watchfulness on the part of amateurs capable of receiving the code message of WNP. Nothing has been heard from the McMillan party for several weeks, and while this causes no great uneasiness, due to the fact that Captain McMillan is now experiencing almost continuous daylight, the donors of the two prizes hope that some freak of reception may bring word from the ice-bound schooner.

The Bowdoin is equipped with a standard Zenith receiving and transmitting set. The latter, of course, is for code work only, and has a power rating of but 100 watts, due to the desire of the explorer to conserve space. It has been heard regularly, however, in various parts of the world, until recently.

With the lengthening of the daylight period, however, reception of the station has grown steadily less dependable. At present, according to reports furnished to Station WGN by Lieutenant Kent of the U. S. hydrographic office, the sun sets at 11:58 and rises at 12:02 at Refuge Harbor, where the Bowdoin has been laid up for the winter and where it is now frozen in with miles of ice in every direction bearing down upon it.

Amateurs who pick up the messages sent from WNP are requested at once to telegraph Mr. U. J. Herrmann, National Radio Manufacturers' Show Association, 127 N. Dearborn St., Chicago, or Mr. E. F. McDonald, Zenith Radio Corporation, 332 S. Michigan Ave., Chicago.

To the sender of the first telegram containing a message from the McMillan party which it is possible to confirm, will be awarded the $100.00 in gold.

Some Sending Station Stories

New Programs and Ideas from the Big Broadcasters.--Books Boomed by Radio

MANY people have a desire to read but when confronted by a million volumes in the public library, it is rather difficult to know which ones to pick out.

Among the most popular of the series of class-room lectures which Station WJZ has been broadcasting directly from New York University for the past two months is the Tuesday afternoon lecture by Prof. Howard R. Driggs on the subject of "Right Habits of Read ing." Reading has never been consid ered a habit by the majority of people. and is thought by many to be an accomplishment. But in the habits of selection lies the danger which a vast number of readers have succumbed to. and Prof. Driggs has opened the eyes of several hundreds of listeners during the nine weeks he has been a broadcast star.

The fact that casual reading may be worse than useless is known to every serious minded person, for psychologists are agreed that few of the lines which are read do not leave some impression upon the subconscious mind.

Among the popular features broadcast by WGY, the Schenectady radio station, is a weekly talk on books offered by the librarian and assistant librarian of the General Electric Company. Every Thursday evening a book, always of the non-fiction type, is reviewed. The book may be on the subject of travel, home building, philosophy or some other subject. Letters come in from all parts of the country, generally from isolated radio listeners who are veritably hungry for books. One such letter was received from a twenty-one-year-old farmer living near Tenstrike, Minnesota, who said he was just "hungry for such books and for such friends to tell me about them." He explains that he likes to read but for the past six years has lived in a country that is little more than a wilderness where he and his father and brother have been busy clearing the timber. With all of his daylight working he is trying to get a little knowledge and finds the radio addresses stimulating and educational.

FREE TICKETS ACROSS THE CONTINENT

This is the season of the year when people should be seen with bundles of literature pertaining to hotels, resorts, trains and boats, but instead the printed matter deals with all of the latest hookups, antenna and other data about radio. Radio printed matter is now to the fore and nearly every publication of any sort devotes some space to this modern educator, entertainer and plaything for all ages of mankind.

Instead of spending hundreds of dollars in travel tickets and hotel accommodations, money will be invested in the newer form of vacationing—radio-receiveritis. For a few dollars, a radio set may be purchased and installed in the home and then by simply turning the dial, cities throughout the world may be aerially visited and the interesting places there mentally pictured by the radio studio directors. For example, the Crosley Radio Corporation in Cincinnati, operating Broadcasting Station WLW, is preparing a series of descriptive talks which will embody the interesting historical and artistic advantages of the Queen City. In order to visit that city by radio, the traveler-at-home simply tunes his receiver to 309 metres and when the radio station is on the air at the particular time of the travel talk, he will learn of the beautiful things to be found there. Suppose the other broadcasting stations throughout the world would take a similar interest in this movement of vacation-at-home, it will make it most enjoyable for those who desire to have something more substantial for the money invested than a mere vacation away from the home or office. The time is not far off when many broadcasting stations will have programs in harmony instead of the individual ones that are on the air at the present time and then this method of vacationing will be even greater than now.

LEARNING HOW TO THINK

Anyone reading many radio journals is getting to understand pretty well how a radio works, especially if the journal he reads happens to be RADIO PROGRESS. But most people are not nearly so familiar with their own minds. They do not know how their brains work when they think, or perhaps we should say when they think they think. The new lectures on applied psychology which are being given in many cities throughout the United States are proving very popular.

In line with this general demand a series of ten talks on Elementary Psychology are being given by Dr. Gardner Murphy for the Home Study Department of Columbia University from Station WEAF on Wednesday evenings. These talks constitute an introduction to scientific experimental psychology as it is taught in universities, but are greatly simplified and abbreviated. The aim will be to induce the beginner to the main problems and methods of modern psychology, with selection of typical methods and results. Those taking the course will be asked to do some reading each week between talks, the references being taken largely from R. S. Woodworth's "Psychology: A Study of Mental Life." A syllabus of the course can be obtained from the Home Study Department of Columbia University for two dollars.

The general and widespread interest which the public is taking in psychology is evidenced by the large number of persons who are taking courses in practical psychology with a view to increasing their efficiency in meeting the problems of business and daily life.

Echo is Important in Broadcasting

Music Without Any Echo Sounds Dull and Flat

MOST people do not realize what an important part an echo is in rendering good music. Every one has heard an orchestra play inside a hall. Perhaps it has been a symphony orchestra rendering grand opera, or may be it was a jazz band playing in a dance pavilion. In either case, the music was surrounded by walls and ceilings. We are so accustomed to these conditions that we prefer them, and when the same orchestra plays entirely out of doors, as it may on rare intervals, we immediately notice there is something lacking. This something is the echo, or reverberation, as it is technically called.

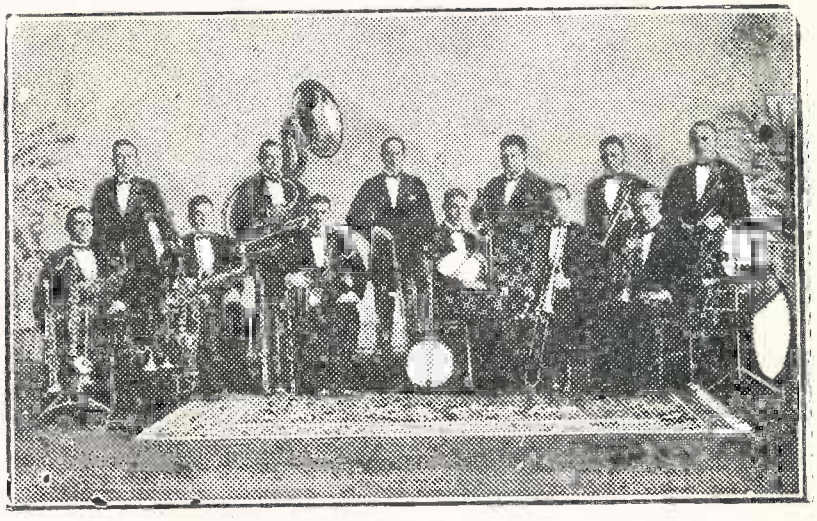
It was not realized until radio swept the field how important reverberation is in giving a natural tone to music. The same thing applies to speech. If you go into a large church, you will often see a wooden canopy supported a few feet above the head of the preacher. It is important to get this space about right. If it is too low, the echo occurs so soon after a word is spoken that it blends with it, and the effect is lost, giving the impression that it is an out-of-door speech we are hearing. On the other hand, if the canopy is too high, the reverberation comes so much later than the word that the ear can detect it as a separate sound, and it becomes what is known in common speech as an echo. Strictly speaking, reverberation means an echo which is so closely spaced that the human ear cannot consciously separate it, while an echo is timed far enough apart so it can be separated.

Reverberation is Important

A large amount of experimental work has been done recently by big broadcasting stations to find out just how much echo effect is desirable. The first broadcasting was done in ordinary rooms, with bare walls, and the echo was so bad that it was hard to understand the words. The next step was to drape the rooms entirely with thick, heavy fabrics. This completely killed the echo, but had the disadvantage that reverberation was entirely lost, and so music did not sound natural, but more like an out-of-door performance. Still later, it was discovered that by draping most of the walls and leaving a small part unmuffled, it was possible to reproduce broadcast music and make it more natural, that is, just the way it would sound to us if we were at the theatre.

The last step in this development has only recently been obtained. It consists in doing away with all draping and fabric hangings and constructing the walls of a suitable material which will absorb most of the echo but yet return just enough to cause reverberation. Probably the best example of such a modern broadcasting station is that of WBZ, at Hotel Kimball, in Springfield. The photograph shows how an orchestra is grouped in this studio. It will be noticed there is a complete absence of drapery hangings on the walls. In fact, the new studio room is absolutely devoid of drapes or other wall decorations. The last word in perfect acoustical effects was arranged for without the use of drapes or curtains. By closing the door of the reception room, and drawing the window shutters into a closed position tight against the window frames, one can at once appreciate how sound-proof WBZ's new studio really is.

The studio room itself is 20 x 30 feet in size and about 8 feet high. Between the ceiling of the studio and the bottom of the floor above is a space of about two feet, wherein all steam and water pipes are located. All of these pipes have been covered so that any noise in the pipes will be absorbed. Every precaution has been taken, so that they will not act as reflecting surfaces.



Studio Where Reverberation Starts

Three of the walls are made up of twenty inches of brick, two of the walls being on the outside of the building, while the third is in the partition between the addition and the older hotel structure. The fourth wall is built of gypsum block, which also possesses material to absorb sound. However, to be assured that no noise will enter through this wall, a layer of lith or sound-deadening material has been applied to this wall. The same material has been placed on the ceiling, so that it will be impossible for noise to come through from the floor above.

Continued on Page 10

Can the Lawyers Help Radio?

Experience in Great Britain with Laws on Regenerative Radios

By M. C. BATSEL, Radio Engineer, Westinghouse Co.

THERE has been considerable written recently in regard to interference caused by receiving outfits. As a result of this discussion the radio public may be confused in regard to the real situation, its causes and possible means of improving conditions.

We are sure that legislation making it illegal to operate a receiver that can radiate, if it is improperly operated will not prevent the use of such receivers. The following facts have led us to this conclusion.

1. There are many more receivers in use in the United States that were constructed by the users or someone in the users' locality, than there are of those manufactured by recognized manufacturers. The apparatus is frequently changed and experimented with so that there can be no check upon its ability to interfere with other receivers in the vicinity where it is located.

2. The cheapest and most efficient receiver that can be made is of the regenerative type so that the person of limited means desiring to listen to the broadcast entertainment can obtain more for his expenditure of money if he choses a regenerative set. This is true whether he constructs his own outfit or buys a manufactured set. The maintenance cost of the regenerative receiver is small. The receiver when properly operated will not interfere with other receivers nearby.

3. Simple inexpensive regenerative receivers will operate efficiently on small or indoor aerials.

4. In England the manufacturers of receivers for listening to the broadcast programs were required to obtain approval of the Bristish post office authorities on all types of apparatus before it was offered for sale. One requirement was that the apparatus should not be capable of producing interference with other receivers. Notwithstanding these regulations, the interference from receiving apparatus has not been eliminated, and according to the *Wireless World*, a radio magazine devoted to the interest of radio development in Great Britain, the British post office no longer requires that the apparatus be incapable of radiating. This magazine points out that it is very difficult to construct efficient inexpensive receivers that are not capable of radiating if they are improperly operated and voices the opinion that the way out of the troubles in Great Britain is through education of users of receiving apparatus rather than by limiting the enjoyment of the broadcast programs to those people who can afford to purchase expensive apparatus and pay large maintenance costs.

5. It is not difficult for the user of a regenerative receiver to know that his receiver may be interfering with reception by other people. When the regenerative amplification is increased to more than the useful amount the operator hears a squeal in his own receiver and should immediately reduce the regeneration or amplification until the squeal stops.

If every operator of a regenerative receiver who desires to enjoy the broadcast transmission realizes that every time he permits his receiver to squeal that his neighbors who may be listening to the same station must endure listening to the same squeal, we are sure that there will be little trouble from careless handling of regenerative receivers.

Should the education of users of regenerative receivers fail to produce results then it will be necessary for manufacturers and dealers to discourage the manufacture and sale of all apparatus capable of producing interference and to discourage the use of such receivers, thereby denying the public the privilege of obtaining the cheapest and most simple efficient apparatus now known for receiving. It would be practically impossible to enforce a law prohibiting the use of radiating receivers because of the home made apparatus and the experimenters. It is possible for those who care to pay for them, to obtain efficient receivers that are not capable of causing interference. These receivers may be operated without taking precautions of any kind and besides usually have other desirable features such as the ability to tune out local stations and listen to distant stations.

In closing, let me emphasize again that if every operator of a receiver that can be made to squeal when the tickler or regeneration is increased too much, will immediately reduce the regeneration until the squeal stops, that there will be no need to look upon the simple regenerative receiver with disfavor.

ECHO IS IMPORTANT

Continued from Page 9

The sound-absorbing material has been so installed as to serve as the interior of the room. It is laid in slabs of convenient size, and will present a block effect.

To obtain this room of perfect silence, devoid of echo, but with enough reverberation, a triple wall, ceiling, window-frame seat application of materials was necessary. Next to the wall proper a thick layer of flax sound-deadening material was laid.

The material used in the walls for killing sound, as well as in the window seats, the ceilings and the heavy window shutters, has been put to sound tests and has proven by repeated trial in other installations to be the finest sound-deadening combination to be had.

Every piece of wood used in the studio is birch, which has been specially dried, treated, rubbed and stained. The mahogany finish given to the wood makes a very striking contrast with the grayish tint on the side walls. Not a nail was driven in any of the wood. It was rather a long process of drilling in every instance that the wood had to be attached, and then wooden dowel pins were driven into the holes.

A Simplified Super Heterodyne

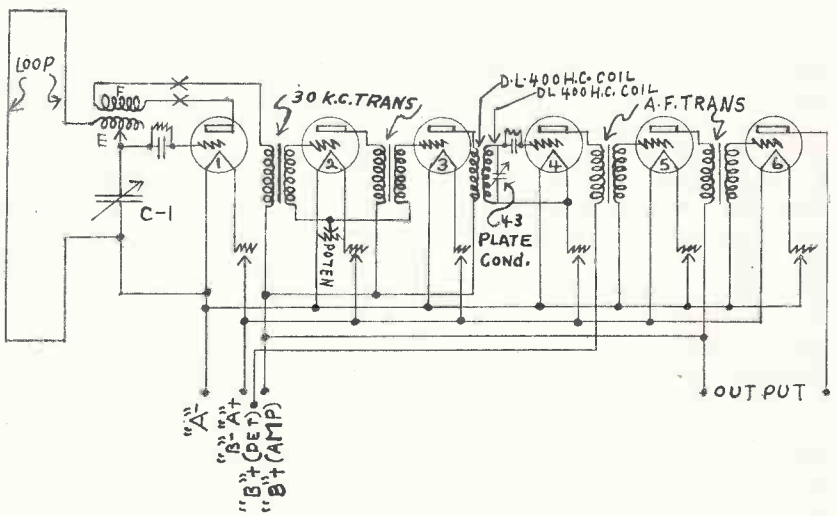
Here is a Simplification of This Very Popular Set

By C. WHITE, Consulting Engineer

THE principle of the super-herterodyne is nearly as simple as that of the single circuit regenerative receiver. Many radio fans are inclined to believe it difficult because it employs a larger number of tubes. In idea, a super-heterodyne is a kind of radio that changes short waves (high frequency) into longer waves (lower frequency). These longer waves which are capable of more efficient radio-frequency amplification are then passed through a low frequency amplifier and finally detected and passed through the regular audio-frequency amplifier. So you see that a super-heterodyne is nothing more than a long wave radio-frequency receiver with a frequency changer placed before the long wave apparatus. Bearing these two facts in mind, it is easily possible to design both simple and elaborate receivers.

As to the radio-frequency apparatus, most heterodyne receivers are essentially the same, but, the frequency changer can vary quite a bit in design. In the standard type of super-heterodyne two vacuum tubes and a short wave tuner are used. The tuner consists of a loop and a tuning condenser. Either one or two tubes can be used for the frequency changer. If two tubes are used, one tube is called the oscillator and the other tube the first detector. The oscillator is made to oscillate at a frequency slightly higher (or lower) than the signal frequency. This produces a beat note of a frequency which is the difference between the signal frequency and the frequency of the local oscillator. Since the original signal frequency is modulated with voice waves, then the new "beat note" frequency will be proportionately modulated. The first detector solely acts to exclude the higher frequencies and pass the new lower frequencies. These lower frequency waves are then transferred on to a long wave radio frequency receiver.

In some simplified super-heterodynes the oscillator and first detector are combined into only one tube. In such cases the principle is really like the autodyne. That is, this one tube must oscillate at a frequency slightly different from that of the incoming signal and act as the first radio-frequency detector. The one sound objection to this simplification into one tube control for the frequency change is the fact that when the first tube is tuned to oscillate at a slightly different frequency, the incoming signal is at the same time detuned and so weakened. One of the best ways of overcoming this objection is to make use of what is known as the second harmonic.



The Use of Honeycomb Coils Should be Noted

A second harmonic is produced when the autodyne reception is used, therefore making it possible to tune closer to signal frequency than with the fundamental. Hence we can tune closer to the signal frequency and get the desired beat note frequency by using the second harmonic. At present there are several receivers on the market making use of this principle which saves in controls and tubes.

The construction of this super-heterodyne which works on the autodyne second harmonic principle is very easy. There are no special parts, outside the long wave radio-frequency transformers. The unit E-F is nothing more than the standard 180-degree coupler and the loop is an ordinary short wave loop. An eleven or thirteen plate variable condenser with some sort of vernier adjustment is used for the unit C-1. If the autodyne tube No. 1 fails to operate or oscillate just reverse the terminal connections to the rotor coil F at the points marked x x.

It is not necessary to bring the taps for switchpoints to the outside of the panel because it will be discovered that after a preliminary tryout the oscillator will be found to work best on one particular tap. This eliminates one variable control and so makes the condenser C-1 the main tuning condenser. As the final long wave tuner two honeycomb coils are used. One coil is a 100-turn coil and the other is a 350 or 400-turn coil shunted with a 43-plate variable condenser. These two honeycomb coils need not be mounted on a standard variable coupling mount, but can be tied together side by side so as to form a

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Will English Become Universal?

Indications Point to Its Spread All Over the Globe

In the olden days French was regarded as the Universal language. Polite international society was supposed to know French by heart, so that a citizen of Rome could talk fluently with an inhabitant of Warsaw. However, that day has passed. Attempts are being made now to introduce Esparanto as a universal language, and some success is being attained along these lines. Educated people abroad praticularly are well known to be better linguists than Americans, and the knowledge of Esparanto is increasing rapidly on the Continent.

Will English Drive it Out?

However, many people think that English is destined to supersede all languages. A big help in this direction is the fact that radio is being developed much faster in English speaking countries. For instance, the United States has a good many more broadcasting stations than all of the rest of the world put together, and this use of English in broadcasting is having a tremendous effect throughout Europe.

A recent attempt to popularize the idea of English as the universal language was conducted from station WJZ, New York.

On Saturday, May 3d, at 9:30 p. m., William Wade Hinshaw, noted operatic impresario and singer, lead the most gigantic "community sing" ever attempted. The hundreds of thousands of radio listeners who tuned in to WGY were urged to join him in the singing of "America," "The Star Spangled Banner," and "Swanee River" as his voice was broadcast from station WJZ of the Radio Corporation of America in New York.

They All Joined in "America"

Mr. Hinshaw, who is internationally known as a former Metropolitan Opera singer and a producer of operas, delivered a radio address from WJZ three weeks ago, and at the conclusion he requested his unseen audience to join with him in singing "America." The number of letters which he received after the broadcasting proved that hundreds upon hundreds of his listeners had joined him, and upon the success of that rather impromptu experiment was born his idea of national, and eventually international, community singing through the agency of radio.

In Mr. Hinshaw's own words, "My idea is that through the radio it would be easily possible to have not only the whole of the United States sing together at one and the same time, but also eventually to have the whole world sing together in some song and create such a hymn of joy and peace that it would produce a tremendous force for the good of the world. My idea the other night was to make the little experiment without saying anything publicly about it ahead of time in order to find out whether the people would join with me, and whether they would find that they could sing right along with me as they heard me through the radio. I have convinced myself that this is perfectly possible and that it is absolutely feasible.

What Will Rhythm Do?

"If you will stop to think of the tremendous power vibration and rhythm have, you will see the wonderful effect for peace and good-will among men that would be brought about through having all men sing the same song at the same time. I believe that if we were to make an effort to get the people of the country to sing together, eventually, with the future advances in broadcasting, we should have the whole world singing in English—and that would mean that English would become the common language of the world."

Mr. Hinshaw has led singing in various ways all his life; he has a tremendous voice which has carried along audiences of thousands in the past, and with radio carrying that voice into the homes throughout the Eastern part of the country at least, singing songs familiar to practically every one, the Radio Community Sing is, in the opinion of both Mr. Hinshaw and the officials of station WJZ, a practical idea.

Naturally, Mr. Hinshaw was not able at the time to judge of the response to his request to join him in the songs, but from the returns which came in by letter it seems reasonable to conclude that a large section of the radio audience, east of the Mississippi, were singing these national songs at the same time. It is quite likely that further community "sings" of the same nature will be announced from time to time from the powerful broadcasting stations.

SIMPLIFIED SUPER

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tight coupling. After all preliminary adjustments have been made there are only two main tuning controls: the condenser C-1 and the 43-plate long wave tuning condenser. The receiver can be logged for stations in the same manner as the neutrodyne. An efficient transformer for the short wave 30 K. C. transformer is the Acme 30 K. C. unit, built especially for this type of service. The grid leak condenser and the grid leak units should be of a size recommended for the style of tubes used.

Improved by "C" Battery

If high plate voltages, 90 or more, are used, then a "C" battery will be found useful in keeping down "B" battery consumption. As a general rule about 1.5 volts of "C" battery for every 45 volts of "B" battery will give the best results. A "C" battery also improves the general tone reproduction and clarifies the received signal to a marked extent, especially when the volume is large. The simplified super-heterodyne is an ideal receiver for portable and summer use. If UV-199 tubes be used this receiver is readily portable and possesses great sensitivity and selectivity.

Be Sure to Keep Your Crystal Healthy

A Dirty Crystal Means a Sick Set

MANY a crystal set is running down because the crystal gets sick. There are several ways in which this may happen. Probably the most common disease which a crystal suffers from is getting a thin layer of grease on the surface. Many a man picks up his crystal in his fingers, and after examining it puts it back again. This is all very well if pains are taken to touch it only on the side and not on top on its active surface. If you want to know why, press your finger against a carefully polished French mirror, and you will notice that you have left a faint fingermark on the glass. This comes from the slight deposit of the natural oil which is contained in a healthy skin.

Unfortunately, this oil is a pretty good insulator, especially for the very small voltages which are generated in a crystal set; so if you touch the crystal on top with your fingers, you have done the same thing as wrapping it in spaghetti, and small wonder that it does not work. This is not from the layer of ordinary dust which is apt to collect around the house. Such dust is not a good insulator and does not damage the crystal in any way, unless it gets unusually thick. The best way to pick up a crystal is with a pair of pliers or tweezers.

If you have been so careless that you have touched the crystal and injured it, probably the best thing to do is to throw it away and pay 25 cents for a new one; but if you happen to have an unusually good crystal which you want to restore to health, it can be done by washing the surface with clean ether or alcohol. This removes the surface dirt and allows the crystal to work as it did before.

Lightning Kills Crystal

Another disease that a crystal sometimes suffers from is caused by a stroke of lightning, not usually a direct stroke, but one somewhere in the neighborhood. A discharge of this kind causes a heavy, instantaneous current to run through the crystal, and this destroys the sensitive spot. It is not known just how this is accomplished, but the most likely explanation is that the heat caused by the discharge is confined to such a small area that the little patch is burned out; result—no music. The only cure for this condition is to shift the cat whisker to another sensitive spot. In case it is a fixed crystal you are using, there is nothing much that can be done unless you are able to take it apart and adjust to a new sensitive spot.

Crystal Like Eskimo

A crystal is like an Eskimo in that it does not mind the cold, but it cannot stand much heat. That is the reason why solder is not used for mounting crystals. When you look at the little pellet surrounding the crystal, you perhaps have thought that it was solder, but such is not the case. The trouble is, solder has such a high melting point that it will ruin any ordinary crystal by overheating it when it is poured around it. A special kind of alloy is used for this purpose. The metal used commercially is what is known as Wood's metal. If you want to mount your own crystal it is well to buy a few cents' worth of Wood's metal at a jewelry store, as it hardly pays to make it up yourself in such a small quantity. If you find it unobtainable, then a pretty good substitute may be made by melting a small quantity of half and half solder (half lead and half tin) and pouring into it enough mercury to keep it liquid as it cools. Since solders differ somewhat, it is necessary to experiment. When cold, of course, the mixture should be solid. Then reheat this just to the melting point and pour around the crystal, and you will obtain a good mount.

Picking Good Crystals

This brings up the question of how to select a good crystal. Unfortunately there is no test known which will separate good ones from bad, except that of trying them out in a set. When viewed under a microscope, the good and the bad look identically alike. The chemical laboratory reports that an analysis of the two is the same. They even come from the same location in the mine, as a nugget of galena, for instance, may on breaking up show one-third good and the rest worthless. It is the necessity of testing each piece separately which adds considerably to the cost of a crystal. Untested galena in the mass is worth only a little more than nothing an ounce. But when this is split up into small pieces and tested with music in a good crystal set it attains a value of from 10 cents to 50 cents a piece. It is our experience that the 50-cent pieces are not any better than those which sell for 25. This refers to the natural crystals only.

Artificial Crystals Superior

When we come into the artificial class of crystals, the prices usually run from $1.00 to $1.50 apiece. The advantage of the artificial ones are that they are absolutely uniform and are alive all over, so that it is not necessary to keep fishing in the dark with a cat whisker. It is this hunting for a sensitive spot which gets on the nerves of a good many would-be crystal users, and, in disgust, they turn to a much more expensive tube set. Such trouble would be avoided by using any of the standard fixed crystal detectors. Such detectors also bring in music somewhat clearer than many of the artificial crystals do.

Special Reflex Crystals

One of the popular circuits is the reflex, which makes use of the same vacuum tube for radio frequency amplification and then for audio frequency amplification. Usually a crystal is used for a detector in this hook-up. Since a 45-volt "B" battery is used to operate the tubes, it sometimes happens that this electrical pressure is applied to the crystal with fatal effect. The ordinary crystal will not stand such a high voltage, as it burns out immediately. This is another place where an artificial crystal has the advantage, as most of them are not injured by such treatment.

Counting the Miles by Radio

This is a New Method of Measuring Distance at Sea

A NEW method of determining distances at sea was described by George Lewis, assistant to Powel Crosley, Jr., in a talk before the Ohio Academy of Science at Columbus. Mr. Lewis was a Lieutenant in the United States Navy and holds the first license issued to radio operators. For several years he had charge of experimental work for the Navy.

Various stations are established along the seashore at strategic points. Oftentimes these stations are in the same location as lighthouses. Of course, dangerous shoals are marked, and also big harbors. The apparatus in the station consists of two parts. One is a radio mechanism which sends out a series of dots spaced exactly one second apart. It is the same kind of mechanism which is used every noon and evening at ten o'clock by the Arlington station. These time signals are relayed by many of the larger broadcasting stations all over the United States. The difference between the Arlington time signals and the radio beacon dots is that the former omits the twenty-ninth second and the fifty-fifth to fifty-ninth second inclusive of every minute, in order to show the beginning of each minute. But the latter sends out dots for a few seconds continuously and then waits a while and then repeats.

Submarine Bell is Rung

The other part of the beacon consists of an immense bell which is suspended deep in the ocean near the bottom. A heavy clapper, which is operated by electricity, sounds the seconds on this bell. We say "sounds" because sound waves are carried through water in the same way as they are through air, except that they travel faster than through the water. The greatest care is taken to make the stroke of the bell start at the same time that the radio dots begin, and they continue simultaneously until the pause.

Radio waves go so fast through the air that they will circle the globe seven times in one second. For distances of a few miles, or for that matter, a few hundred miles, the transmission may be considered as instantaneous. On the other hand, it takes two seconds for the sound waves to go a mile through the water.

The combination of the submarine and radio signals enables the ship officers to determine accurately the position of the vessel, for example, with regard to a lighthouse. A pair of earphones is used by the radio operator on the ship, one phone connected to the radio receiver and the other to the submarine signal receiving set, so that it is possible for the operator to listen for the signals sent from the lighthouse and thus determine the position.

Counting Up to 20

Suppose the ship were ten miles out at sea, away from the lighthouse. When the beacon starts sending its group of radio waves and bell tones, the ship's operator gets the first instantaneously and knows that the sound waves have started out from the shore toward his vessel. Since these sound waves are going at one-half a mile a second and they have ten miles to cover before reaching the ship, it will take twenty seconds before he hears the bell. In the meantime, the radio waves are clicking off the seconds, "1, 2, 3, 4," etc On the stroke of 20 the first bell note strikes the ear. All he has to do is to divide the number of dots he has heard (in this case twenty) by two, and it gives him the exact distance between his ship and the sending station.

You Can Do the Same with Thunder

The same idea can be used in calculating how far off a thunder storm is. In such a case the flash of lightning serves the same purpose as the radio signal; that is, it tells you when the start of the sound signal is made. But since the lightning does not count seconds, you will have to do that in your own mind. There is this difference to be observed, though. Sound travels through air at the rate of a mile in five seconds, whereas in water it goes twice and one-half as fast. So if you see a flash of lightning and ten seconds later you hear the roll of the thunder which it caused, you will immediately know that that stroke occurred two miles away.

How the Broadcaster Gets the Music

American Telephone & Telegraph Co. Must Use Special Circuits for Radio

WHEN President Coolidge spoke recently his speech was broadcast from several stations in the East which were connected by the land lines of the American Telephone & Telegraph Company. However, the Central and Western part of the United States were not able to hear unless they had long-distance receivers and got it from the Eastern stations. As a matter of fact, one big Chicago station tried to make arrangements to broadcast this event, but the American Telephone and Telegraph quoted them a price of $2500 for supplying the speech over their toll lines. Since the toll rate between New York and Chicago is $14.00 for ten minutes, it seemed like a rather large sum, and considerable discussion in the newspapers was provoked.

Not Like Toll Talking

In explaining the difference between an ordinary toll line conversation and broadcasting a program, Mr. Edgar H. Felix, of the A. T. & T. Company, pointed out that completing a long-distance telephone call is a relatively simple task. Sitting at a desk in New York, one may call the operator at the local exchange by lifting the receiver from the hook, asking for "Long Distance," and having name and location of the desired party recorded. In a few minutes your friend in Chicago is ready to talk to you.

So many people do this daily that calling Chicago from New York has become a simple routine task for the staff of the telephone organization. Standard equipment and circuits are used as well as regular operators working on their usual tours of duty.

During the last year, long-distance telephone circuits have occasionally been used in connection with radio broadcasting. In these cases, the telephone lines have been arranged in a most unusual way, differing radically from ordinary long-distance telephone communication. The number of different oscillation speeds or frequencies, which must be transmitted in radio is very much greater than the number used in ordinary conversation, and furthermore, all these different speeds of vibration must appear at the other end with the same relative strength. That is, they must not suffer distortion on the way, or else the program will not be acceptable to the broadcast listeners. Special precautions to avoid line noises must be taken, too.

100 to 5000 Impulses

Reproduced sounds have two qualities: First, they must be understood, and second, they must have the same kind of tone as the original, to be natural. In commercial telephone service, the first is of prime importance. In broadcasting, however, naturalness must also be considered, for without it, there is little or no entertainment value to radio programs. We seek not only to communicate words so that they are intelligible to the listener, but to convey faithfully every intonation of voice and instrumental quality. This requires transmitting a much larger number of frequencies than is needed for intelligible speech.

Adapting a telephone line to a wide range of frequencies may be a meaningless phrase. Let us see just what is meant. Sound is caused by air waves which make the diaphragm of the ear vibrate. These vibrations in turn cause the auditory nerves to register an impression upon the brain. In speaking, the vibrations to which the ear-drum responds lie between the extreme range of 100 and about 5,000 impulses a second.

It has been found that a system which transmits frequencies between 500 and 2000 reproduces speech sounds which are easily understood, although lacking somewhat in naturalness.

Eight Channels Per Line

On an ordinary toll line speech is easily received at the other end if frequencies up to about 2,000 cycles a second are transmitted accurately. Because of this fact, we are able to use one single telephone line for as many as eight different channels of communication all going at once. When the operator connects you with Chicago, there is placed at your disposal a channel of communication, and not as is generally supposed, a simple pair of wires. There may be several different telegraph messages and two or three telephone conversations going on over the same wire which do not in anyway interfere with your own conversation.

When a line is used in connection with radio broadcasting, however, the very wide range of frequencies used makes it necessary to alter the circuits so that a "clean pair" of wires is available. All services ordinarily carried over the wire must be re-routed over other circuits. Furthermore, the accuracy with which this wide range of frequencies must be transmitted makes it necessary to employ special balancing equipment which overcomes the distorting effect of certain electrical qualities inherent in all wire conductors. To install and adjust the balancing equipment, the services of highly trained engineers are required. Numerous tests and measurements to determine the carrying qualities of the wire line over the entire range of frequencies are made. Based on these measurements inductances, capacities and other apparatus are installed so that finally good transmission is secured for all frequencies. Because of possible emergencies two pairs of wires are always prepared.

Naturalness the Aim

In listening to the music of a symphony orchestra, if it is desired to receive the music so that it will sound perfectly natural, a much wider range of frequency is needed.

When a musician strikes the "C" one octave above the middle "C" on the piano, the ear drum vibrates 517 times per second. When a flute player sounds a tone of the same pitch, the ear drum again vibrates at the same speed of 517 oscillations per second. The difference

which the hearer notices between the music of the piano and flute lies in the harmonics or over-tones. The basic tone is called the fundamental.

The second harmonic is always just twice as fast, or in this case, 1,034 vibrations per second. There is also energy distributed on the third, fourth, fifth and higher harmonics.

Harmonics Cause Timbre

The distinguishing character or timbre of each instrument is determined by the relative value of its harmonics. For instance, one instrument may radiate 50% of energy on the fundamental 12% on the second harmonic, 18% on the third, 10% on the fourth, 3% on the fifth, and the balance on still higher harmonics; another instrument may radiate 45% on the fundamental, 30% on the second harmonic, 12% on the third, etc.

The peculiar tone of a brass horn is caused by the fact that the seventh and ninth harmonic are very prominent.

Relatively small energy is present in any one harmonic, but to secure accurate reproduction, the sending transmitter not only must broadcast the fundamental tone which gives the pitch, but also give accurate reproduction of the harmonics. Otherwise, the flute, violin and piano lose much of their naturalness, so that it is difficult for the listener to distinguish between them.

For this reason very important preparations must be made before a line is ready for radio broadcasting.

Clean Pair for Radio

The rerouting of circuits, to make a "clean pair" of conductors available for broadcasting, is never undertaken unless it can be done without affecting regular commercial requirements of the telephone service. The extensive preliminary tests required for broadcasting must take place at such times when regular commercial communication is the least. This is usually in the early morning hours. The summoning of highly skilled engineers for this work tends to disrupt the schedule of other work to which they regularly devote themselves. They must be sent to distant points, involving considerable overtime and travelling expense.

Another fact of vital importance in preparing telephone lines for use in connection with radio broadcasting is that the output of the lines at the broadcasting end is amplified millions of times before it is finally radiated into the ether by the radio station. As a result, even the slightest disturbances reaching the circuit become extremely serious and are transmitted to the radio audience, unless special precautions are taken to avoid them. Interference occasioned by leakage on nearby high power lines and numerous other forms of induction must be corrected before the line can be successfully used.

Repeaters must be installed at various points along the line which increase the volume, wherever the music gets so faint owing to the distance it has travelled that it becomes difficult to hear. These repeaters are very similar to the amplifiers in an ordinary radio set and work the same way.

Must Not be Too Loud

If the input of the lines is too large, it affects neighboring circuits so that radio programs are heard on wires used for commercial telephony; if it is too small, so much amplification has to be used at the receiving end, that inductive interference for neighboring telephone and power circuits is broadcast. Consequently a balance between these two extremes must be maintained, determined upon in each individual case after careful preliminary tests under actual broadcasting conditions.

The actual work necessary to prepare long distance telephone lines for use in connection with radio broadcasting is indicated by the broadcast of a meeting of the National Electric Light Association. Several months ago microphones were installed in Carnegie Hall, New York, to pick up speeches by Julius Barnes, President of the United States Chamber of Commerce and vocal selections by Anna Case, Metropolitan Opera soprano. This program was broadcast through WEAF, New York; WGY, Schenectady; KDKA, Pittsburgh; and KYW. Chicago. A roll call was taken by means of the telegraph system which always connects all stations and repeater points involved in the simultaneous broadcasting, and the names of no less than 65 engineers were called off which represented the personnel especially detailed to the task of wire telephony and broadcasting. Many of these engineers were sent long distances to their various stations. They had to be on duty not only on the occasion of the program, but several days and nights ahead for preliminary tests. Naturally such preparations cause the expense of disorganization of schedules and the calling of substitutes.

Special Wires for Microphone

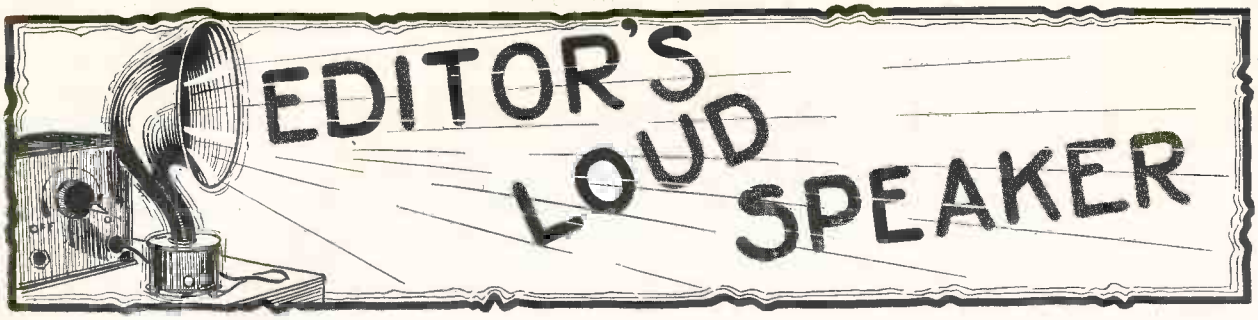
At the point where the program is being picked up, microphones are installed, special wires are run from the microphones to an amplifying equipment, operated by an amplifier expert whose task is to see that the telephone lines are furnished with the program at the proper loudness. Two complete sets of wire lines are always prepared so that should one through some emergency become noisy, the other circuit may be resorted to without interruption. Telegraph operators are stationed at each broadcasting station as well as amplifier and repeater points, so that any difficulty detected by the engineers may be at once corrected.

There is a vast difference in the handling of a commercial call and the preparation of long distance lines in connection with radio broadcasting. A wider appreciation of these problems and of the size of the task involved would make clear why more broadcasting with the aid of telephone lines is not undertaken.

HELLO GIRLS DISLIKE RADIO

Some radio directors complain because their audience is rather cold in responding to the efforts of the musicians. Applause, postal cards, and letters are perhaps slow in arriving and the number is small, but the night telephone operators of the towns where big broadcasting stations are located, hold the opposite opinion. When any particularly popular piece goes out on the air, many enthusiastic fans feel the immediate urge of applause, and as the result the telephones become choked with congratulations and applause.

As an illustration, the record of the Cincinnati telephone exchange is of interest. During one evening, when station WLW was broadcasting, between the hours of eight and nine o'clock, 2490 people called West 7600, the WLW telephone number. Of this number, only 108 were able to get the station, and 2382 subscribers were told "The line is busy." We can imagine some of the things these 2382 people said about the Telephone Company.



STATIC IN THE SUMMER

THE new crop of radio listeners, which has come up since last fall, are perhaps asking what static is. Unfortunately, they will know only too soon, for with the coming of summer, some evenings will bring considerable disturbance from this source. It is often asked just what static is and what causes it. So far, it is impossible to tell exactly what causes it.

It is known that electrical disturbances occur in the air some five to twenty miles above the earth, and that these electrical storms are going on all the time. Ordinarily they are so weak that a good radio is not disturbed at all, but at times they increase to such an intensity that thunder storms occur and reception is made bad. In all probability the thunder storms do not cause the static, but both are caused by the same electrical disturbance. It is hard to say which is cause, and which effect, but present indications point that way.

Like Souring Milk

In the same way there used to be a question regarding souring milk among the dairy farmers. They thought that a bad thunder storm caused their milk to sour. This seemed a little bit unreasonable to the U. S. Department of Agriculture, so they sent some of their experts to look into the matter. Sure enough, after bad thunder storms it was often found that the milk had turned sour. But they did not let the matter rest there. They ran a series of experiments to determine just how to account for this condition. What they found was this: Thunder storms are more apt to occur after a spell of hot, muggy weather, and the same hot muggy weather makes a rapid growth of the germ or bacillus which causes milk to sour. So both thunder storms and souring came from the same cause, and the thunder did not make the milk sour any more than the sour milk made the thunder, although both so often happened together.

Getting Rid of Static

If static is caused by electrical disturbances away up in the air, it does not look as though we could ever diminish it at its source. The best we can do is to prevent its interfering with the broadcasting as much as possible. Probably the best way to accomplish this for many amateurs is to reduce the length of the aerial. Suppose you are going crabbing along the banks of a creek. If you take an ordinary net it is plenty big enough to scoop up any crab that you may see. You may also catch a little eel grass and a few stones. But suppose you insist upon taking a net twice as big? It would not catch the crab any quicker than before, but it will pick up a lot more refuse in the way of weeds and stones, and so it is a distinct disadvantage.

The same way with your aerial —if you find that a 75-foot length of wire will bring in the music and a little static, then a 150-foot length will also bring in music and a great deal of static.

To be sure, you may need the longer wire if you have a poor set, but with one of the modern receivers 75 feet is enough for good reception of everything except the most distant stations, and by using this length the amount of disturbance not only from static but from your regenerating neighbors will be considerably reduced.

Two years ago it was recommended to use 150 or 200 feet in the antenna, but that was before the days of good broadcasting and good radios. If you have such a long aerial at the present time it will be better to insert an insulator in the middle of it so as to cut the length down to something like 75 feet.

Another point in regard to static that is sometimes overlooked is this. Suppose that two nights last week you were disturbed by interference. Does this mean that you should give up radio for the summer? It is like going to the theatre. You see in the paper that a new show is coming to town for three days only. Do you say because it will not open until Thursday night that you refuse to see it at all? By no means. Even though you may prefer to hear it Monday night, since it can not be heard then, you naturally pick out one of the nights when you can go, and you enjoy it just as much. So, if on some one night you find that reception is poor on your radio, do not be discouraged; try it again the next day. There are very few weeks during the summer when conditions are not favorable at least four or five nights out of the seven.

In a few weeks from now summer radio will be here. LET'S GO.

WHY THE RADIO SHOW?

This is the time of year when plants are beginning to push up through the soil and leaves are starting to come out through the trees. It also seems to be the time when the spirit of giving a radio show is in the air. For in-

stance, the Rhode Island Radio Show is now in progress at Providence, R. I., and active plans are being pushed through for the New England Show at Springfield, Mass. In fact, the fever is sweeping all over the country.

There are two big advantages in giving these shows. By this we mean advantages to the broadcast listeners, as of course the big advantage to the exhibitors is that they sell their products. These advantages are, first, the fan is kept informed as to the advances which are being made in the art, and second, he is taught that the old idea that the radio set is to be put away in moth balls with the winter overcoats during the summer time, is all wrong.

When it comes to the technical advances which have been made in sets during the past year, it is perhaps difficult for the show visitor to obesrve all the fine points, since most of the improvement in the art has been not so much revolutionary changes and hook-ups as refinement in design. This means that the various parts are better proportioned than before and that they work together more smoothly than they used to. The biggest single change noticed is the tendency to get away from squealing radios which disturb all other listeners within several blocks of the re-radiating set.

Like Your Automobile

The position of radio at the national shows to-day is somewhat similar to that of the automobile. We realize that an automobile is a pretty well developed proposition. While each year's model is a slight improvement of that of the year before, still a good 1924 car does not run very much better than a 1923 automobile did a year ago. The general improvement is more toward cutting down unnecessary parts and reducing the weight of parts that are heavier than necessary, so that the machine will be equally strong throughout. And the broadcast listener will find that the same is evident at the show. The number of adjustments necessary to operate a set is being continually reduced. As an illustration, take the rheostat controlling the tubes. A while ago a six-tube set consisting of three radio amplifiers, a detector and two audio amplifiers would have had six rheostats, one for each tube. Later, one rheostat was used to control all three radio amplifiers. The next step made the one rheostat handle all the five amplifiers, radio and audio frequency. This meant that two dials would control all six filaments. Carrying the idea still further, at the present time there are several manufacturers who use only one control for all filaments, both detector and amplifiers, and we know of two different radio sets which have dispensed with the rheostat altogether.

Long or Short Aerial?

Another improvement which is often seen is some kind of an adjustment for aerial length, which is made once and for all *inside* the cabinet. This adjustment takes care of different lengths of aerial and ground leads. It stands to reason that the same set cannot work equally well on a 25 and then on a 150-foot aerial without some sort of an adjustment. But once it has been adjusted for the particular antenna which you have at your own home, then there is no advantage in shifting it further. To have a control handle mounted on the panel is to tempt the user to change the adjustment, which is already right. So it looks like a move in the right direction to take it off the panel and hide it away somewhere inside, where it will not be monkeyed with.

What the shows are doing now is to bring out the fact that there are a great many *good* radios on the market, as well as several poor ones. The best sets are already able to get messages from such a great distance that the local conditions at the far away end put the limit on the loudness of the reception. As an illustration, suppose a listener in New York attempts to get Oakland, California. If his set is powerful enough, as it well may be, so that it picks up the waves in the ether caused by a disturbance at Oakland, it is quite evident that it will also pick up similar disturbances, which may start anywhere in the space between the two cities. If a tremendous thunderstorm is going on along the Missippi Valley, of course, the set will pick it up as static and interfere with the music from the coast. By making the radio more sensitive still, nothing will be gained. By doing this, of course, the music may be made to come in twice as loud, but by the same token, the static from the thunderstorm will also be twice as loud, and so reception will be no better. This limit to distance is called, "the static level." More will be explained about it in a later issue of RADIO PROGRESS.

As to the second advantage of the radio shows, there is no doubt about it that broadcast listening will be much more popular this summer than it ever has before. The programs will be better, the broadcasting stations are better, and the radios which may be obtained now are very much better than a year ago. While further advances in the art will of course be made, still a person who hesitates to buy a set now because he fears that other improvements will be made, is taking a near-sighted view. You can get lots of pleasure out of the sets now being built, and to postpone buying or building a radio until another year, will be just as foolish as putting off the purchase of an automobile because you thought the 1925 model would be improved over the present machine.

One thing more. When you go to the radio show don't remark casually to the man demonstrating a set that "Radio is still in its infancy." It has been computed by the Bureau of Standards that this remark has already been uttered (up to the time of going to press) 3,456,789 times.

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

SOMETHING NEW IN RADIO

In these days about everything imaginable is being broadcast by means of radio and something different on the program is always welcome. If we knew about what to expect from broadcasting stations each night it would soon become uninteresting and monotonous. Variety is what we are looking for more than anything else and that is what the stations are going to give us as they are interested in keeping the program entertaining for their unseen audience.

The first wedding over radio will be broadcast from WEAF on or about June 4. Wendell Hall, the Red Headed Music Maker, has won the heart of Miss Marion M. Martin, "The Little Girl in Chicago." According to a report from Atlanta, Wendell Hall and Miss Martin of the Chicago Tribune staff will be married in the presence of WEAF's microphone in the early part of June.

The Red Headed Music Maker has not only endeared himself to Miss Martin's heart but to hundreds of thousands of radio listeners all over the United States, having appeared in tour at more than thirty-five important broadcasting stations. The genuine feeling expressed in his rendition of love songs is accounted for because each of them was dedicated to the only girl in Chicago.

Having heard his wooing, Wendell Hall's millions of radio friends should have the opportunity to hear its culmination and so the famous Everready Entertainer's wedding ceremony will be heard through WEAF and possibly a number of other stations, through the courtesy of the National Carbon Company.

MESSAGE RECEIVED IN THE FROZEN NORTH

An unusual happening occurred last winter as J. S. C. Watt, a trapper and trader for the Hudson Bay Company, left civilization for the vast wilderness of the North. He started early in the fall in a party which included his wife. Since the party expected to be gone some length of time, they carried with them eight radio receiving sets as an experiment to see if they could keep in touch with the outside world.

Mrs. Watt became suddenly ill just before they left the outside world, and was taken to a hospital to undergo an operation. Mr. Watt, however, continued with his party not knowing whether his wife would survive or not.

The operation proved successful and Mrs. Watt recuperated very well but was unable to inform her husband as to how she was getting along.

At the request of the Hudson Bay Company, the Canadian Westinghouse Company requested Frank E. Mullens, radio editor of the National Stockman and Farmer, to broadcast this information during the regular market reports given through Station KDKA. Mr. Mullens broadcast this information Jan. 17 relative to Mrs. Watt's condition. Many of the radio fans may remember this message.

However, it was only a short while ago notice came through telling that Mr. Watt had received the message o. k.

Thus radio has again proved its usefulness in making things easier and better in the world. In sending information to the trackless waste, radio telephony has no equal.

AMERICAN PEN WOMEN

The League of American Pen Women has officially chosen WGN, the Chicago Tribune-Zenith broadcasting station, located at the Edgewater Beach Hotel, Chicago. for weekly programs of their own talent, under the direction of the Illinois chapter of which Mrs. Martha P. Ridge, of Evanston, is President. Mrs. Ridge has appointed Mrs. Vera Brady Shipman, a writer of national prominence on radio and other subjects, as chairman, and she will have charge of the program, which will be given each Tuesday evening, starting May 13.

The League of American Pen Women is a national organization of women writers and composers, with chapters in almost every State in the Union. Its National President, Mrs. Louis Geldert of Washington, has appointed State presidents, who in turn have been developing radio affiliations whenever possible. In New York city and Washington, radio broadcasting is being done regularly, and in Kansas City and several other cities radio chairmen are appointed, but as yet the work has not been constantly regular. Chicago is the first in the West to arrange for a weekly program of the members' work.

Each program which will be given on Tuesday evenings between 8 o'clock and 8:15 will consist of cuttings from the writings of Illinois literary members, short stories, poetry and reviews of longer books, and musical numbers, composed by Illinois members. Visiting league members will from time to time address the radio listeners, and the contact with members over the State and in adjoining ones will be highly beneficial for furthering creative work.

RADIO IN THE SUNDAY SCHOOL

Church services have long been broadcast by many of the large stations. For instance, on Easter when heavy rain in some parts of the country prevented the women from displaying their new millinery, they were able to hear the complete services at home over the radio. If the sending stations had only been able to broadcast their hats, it would have been perfect.

As an extension of the church services the General Electric Company has recently started putting on the air a series of talks as an aid to teachers and Sunday school children, for studying International Sunday School lessons.

Every Friday evening at 7 o'clock, eastern standard time, a fifteen minute discussion of the International Sunday School lessons for the following Sunday is read by the Rev. Leon B. Randall of Schenectady.

Creating Atmosphere in the Air

You Cannot Depend On the Footlights in Radio Drama

A BROADCASTING station has several handicaps in sending out a radio drama compared with the ordinary theatre. First and foremost probably is the absence of pretty girls. What does a man usually tell his friend when he wants him to see a certain show? Here's the way it usually runs. "Bill, you certainly must go and see that new show in town, The Chicken's Chirp. It's got them all beat a mile. Totty Twinkle Toes is the prettiest girl, and she certainly can dance, and as for the chorus, they are just dreams." There it is. Not a word about the brightness of the lines or the depth of understanding of human nature displayed in the plot. And of course in this respect, the broadcasting station hasn't a chance.

A second way that the radio drama is behind the theatre is in the absence of lighting effects. You all know how the lights are turned low with the red predominating as the villian stealthily stalks into the room—and as for the love scenes—would the hero ever think of proposing except out in the moonlight when all the blues and yellows were turned on dimly? Here again the broadcasting station is entirely out of it.

Sound Properties

But when we get to *sound* properties of the radio drama, the radio director has everything at his finger tips. He can turn on and off thunder and lightning, winds and weather, by the simple operation of throwing a switch to connect one or another microphone into the sending apparatus. As an illustration you will remember in the "Fortune Hunter," broadcast from WGY Schenectady, one of the scenes takes place in a pouring rain storm. The noise of the rain was caused by the simple expedient of rolling dry peas through a paper tube. The effect was so realistic, that it was stated on good authority that many radio listeners had considerable trouble with static, until they discovered that the storm was not real.

Another clever simulation was produced in "The Storm." Here the climax of the play is the forest fire. At a theatre it would have been difficult to reproduce the effect, but not so at a broadcasting station. An ordinary plumber's gasoline blow torch was used, and after this had been lighted up, by turning the valve on and off, a perfect reproduction was made of the roaring flames sweeping nearer and then farther away. The crackling of the underbrush was caused by stiff foolscap paper brought up near the microphone and then rumpled. Every now and then a limb, burned off from the trunk, would crash to the ground. This breaking of the limbs was imitated by snapping matches close up to the sending apparatus.

Thunder Not Good Enough

The story is told that one day a rehearsal was being held for a play, in which a violent thunder storm was to be in progress. At the proper cue a loud crash of thunder was heard, but it was not good enough. "Hold up," said the director, "that doesn't sound good enough. You must make it more realistic than that." "Beg your pardon," said the stage hand who was supposed to operate the thunder machine, "but unfortunately that was a real clap of thunder outside." So you see the broadcasting station must be able to improve on nature.

Portable Door Quite Useful

You have probably heard of the chap accustomed to coming home rather late, who said he was going to invent a portable keyhole, that could be inserted anywhere in his front door. But it is a portable door that is used quite often at WGY, and it is only by the closing of the door, in interior scenes, that the entrance or the exit of a character may be conveyed to the radio listener. The door is one of the peculiar conventions of the radio drama. Whereas in the home a softly closing door is considered desirable it is quite important in the radio drama that the sound of the door and clicking of the lock be loud enough to actuate the microphone. The WGY door is made of thin oak, and has a peculiar resonant quality, and is easily recognized as a door by its sound.

Another much used property is the bellboard. This consists of five bells arranged side by side and a buzzer. They are connected up to dry cells and a switch so that any one or more may be operated by the director at the proper time. The bells include a telephone, front door bell, fire bell, burglar alarm and clock chime; an alarm clock and cuckoo are further additions sometimes used.

Creating the Atmosphere

It is by creating an atmosphere by such properties that the radio drama differs from an ordinary play. On the other side of the fence, about equally spaced, is the movie, which appeals to the eye alone and has no sound to depend on. A special technique has been developed in written scenarios which have attracted the public. In the same way it has become apparent that the art of writing a radio drama is different from either of the other two. A playwright must develop his plot in such a way that the broadcast listener can follow the action and tell distinctively who is talking without being able to see a thing.

First Prize Radio Competition

General Electric Company has taken the lead in developing the radio drama by its recently conducted radio drama competition. They recently announced that the prize has been awarded. Miss Miller's play was selected from nearly three hundred manuscripts as the best original drama submitted and she will receive a cash prize of $500.

Miss Miller is a native of New York. She was graduated from Barnard College and later received her masters degree in comparative literature from Columbia University. For eighteen months, during the war, she served with the United States Naval Reserve on foreign language censorship. Some of her experiences in this work furnished

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Talking With Eleven Mouths

How President Coolidge Talked to Entire Nation

WE sometimes hear of people seeing double (although not so often these days), but it is rather unusul to talk double. However, President Coolidge did better than this recently when he spoke at the Waldorf Astoria. Eleven broadcasting stations, all going at once, spread his speech out into the ether. Radio listeners throughout the Eastern part of the United States who had the opportunity to hear the address of the President in April through the numerous broadcasting stations connected by wire telephone lines may be interested to know that this occasion established a world's record in the number of broadcasting stations which handled the same program simultaneously through the aid of telephone lines.

Eleven stations, including WEAF, New York; WCAP, Washington; WJAR, Providence; WFI, Philadelphia; WNAC, Boston; WCAE, Pittsburgh; WMAQ, Chicago; WWJ, Detroit; KSD, St. Louis; WDAF, Kansas City; WBAP, Dallas, formed the links of the great broadcasting chain which made the remarks of the President audible to a huge audience which probably numbered far into the millions. A total of 6,793 miles of telephone lines were used, all of which were carefully balanced and equalized so that true naturalness of speech would be successfully transmitted to the huge radio audience. In all, 42 repeaters and special amplifiers were in operation at 21 repeater points scattered from Massachusetts to Virginia and from Texas to Missouri. It required 55 engineeers, who were detailed to the work of handling these repeaters and amplifiers during actual operation.

The control input microphone was installed on the speaker's table at the Waldorf-Astoria, New York, the output of which was amplified through a speech input equipment located nearby. At the hotel a special telephone circuit carried the amplified output to the Walker Street building of the Telephone Company, where all the long-distance lines terminate. At this point also a line conducted the amplified speech current to Station WEAF at 463 West Street, making the President's speech available to listeners in the Metropolitan area. A line from WEAF furnished Station WCAP, the Chesapeake and Potomac Telephone Company, with the speech, and another reached to Philadelphia, where WFI, Strawbridge & Clothier, broadcast through their station. Repeaters at Princeton and Philadelphia maintained the correct volume of input for the purpose. Reaching from New York also was the regular line to Chicago with its repeater stations at Harrisburg, Brushton (near Pittsburgh), Beaver Dam, Ohio, and Morrell Park (near Chicago). At Brushton a special line furnished Station WCAE, Kaufman & Baer, Pittsburgh, and a branch reaching north from Beaver Dam supplied Station WWJ, the Detroit News, Detroit. Another long line from Chicago to Kansas City, via Burlington, gave the presidential program to Station WDAF, the Kansas City Star. Continuing southward through Newton, Wichita, Oklahoma City, Dallas and Fort Worth, the radio audience in the South Central part of the United States heard the program through Station WBAP, which was operated jointly for the occasion by the Fort Worth Star-Telegram and the Dallas News.

WJAR, the Outlet Company, in Providence, was furnished through WEAF in the usual way, while WNAC, the Shepard Stores, Boston, secured the program through direct wires from New York, with its special repeater at Boston.

On both the transcontinental demonstration and the broadcasting of the President's speech alternative circuits were provided so should any emergency arise the speech could be routed through another set of lines without interruption of the broadcasting.

It is interesting to note that because electric currents travel 186,000 miles per second, the remarks of the President were available to the radio audience in Texas sooner than to the listeners in the back hall of the ball room at which the President spoke in New York. Sound waves travel at approximately 1,140 feet, or one-fifth of a mile per second. While the sound wave which President Coolidge set up traveled 200 feet to the back of the hotel a radio wave travels with sufficient speed to cover a distance of 31,000 miles.

CREATING ATMOSPHERE

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the ground work for her successful radio play. Miss Miller is a writer of juvenile fiction, and has published three books in a series known as "The Linger-Nots." The books are "Golden Quest," "Valley Feud," and "Mystery House." She has also contributed many stories to Young People's Magazine.

The successful play will be presented by the WGY Players at a date to be announced later. WGY was the first station to introduce the drama to the air, and the players have offered one production weekly since October, 1922. The radio drama has proven one of the most successful and popular features offered by the Schenectady station. The Radio Drama Competition was inaugurated for the purpose of stimulating interest among writers in what is destined to become a new branch of dramatic art. Writers were advised to bear in mind that the radio audience gets a play exactly as a blind man would receive it in a theatre, and they were urged to take full advantage of "Noise Effects" as a means of creating atmosphere.

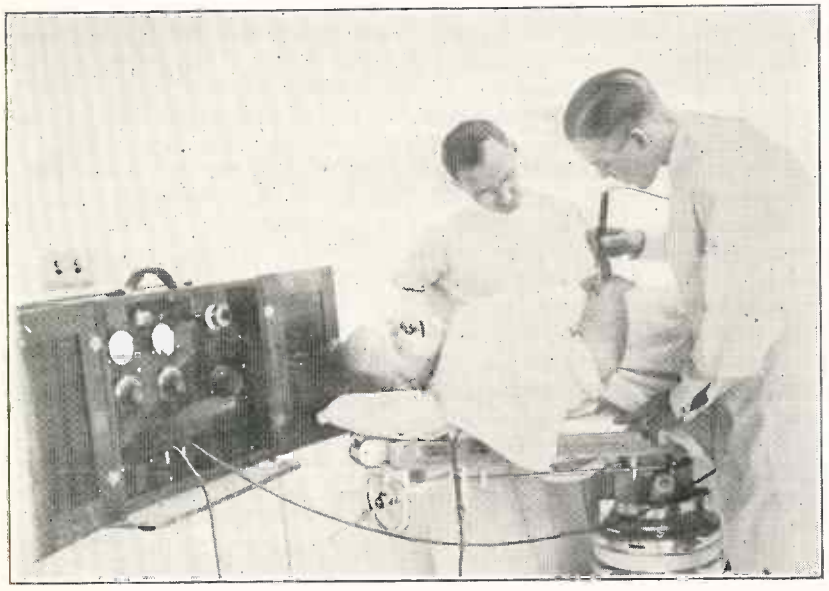
Additional prizes will be given for several other manuscripts which the judges have deemed worthy of production on the air. Announcement of these prizes will be made later.

The Killing of a Cancer by Radio

New Knife Cuts Into Flesh Without Shedding Much Blood

By OLIVER D. ARNOLD

A NEW type knife has recently been invented by Dr. Louis D. Schmidt. The principle it works on is this. Ordinary electricity, either direct or alternating current, at the speed of oscillation or frequency of 60 cycles a second is quite dangerous to the human body if the voltage is very high. One hundred and ten volts is usually quite safe,



The Bloodless Knife at Work

unless a person gets a shock when the resistance of his body and particularly his skin, is exceptionally low. For instance, if a person stuck his finger into an electric light socket while sitting in a bath tub there is a chance that a 110 volts might knock him out. Even 220 or 250 volts is not ordinarily dangerous, except in circumstances as just described.

When we get a pressure of 500 volts or more the conditions are different. Such potentials are often times fatal. It depends a great deal on the person. Occasions have been known when a man got a shock at 500 volts, and even though good contact was formed with each hand, still the victim was not rendered unconscious. But the feeling is one that you would not care to repeat.

High Frequency Not Felt

It is different, however, when alternating currents of high frequency are used. If the electricity reverves its direction as often as one hundred thousand times per second, that is, if we have a frequency of one hundred thousand cycles, then very large voltages can be applied to the body without feeling any sensation or pain. Currents up to one-half an ampere can be passed through the body with no sensation other than that of heat, while a few thousandths of an ampere is sufficient to electrocute a person on a direct or ordinary alternating current. As an illustration of this the writer has taken a frequency of one hundred thousandth cycles in the following manner: An ordinary 50-watt electric light was held in the right hand by the screw thread on the base. The centre contact was put up against one side of the transformer. The circuit was completed by touching the left hand to the other transformer terminal, then the voltage on the transformer was slowly raised until the electric light glowed at full brilliancy. This meant that one-half an ampere was flowing through his body without causing any pain. Next the left hand was slowly moved away from the transformer and an arc several inches long was drawn from his hand to the transformer. In such an experiment it is better to hold a small piece of metal in the hand for the end of the arc to strike as it is apt to cause a small amount of burning if the flame itself touches the flesh.

In performing this test if the frequency or oscillation had suddenly dropped from one hundred thousandth down to a low value, the experiment would have come to a very sudden close, as this is a higher voltage and current than is used at Sing Sing to electrocute criminals.

It is not understood just why such high frequencies are harmless to the body whereas low speeds of oscillation are so dangerous, but it has been recognized as a fact for a good many years.

Radio Knife Has No Edge

The new radio knife takes advantage of this phenomenon. It has no sharp edge like an ordinary surgeon's implement. It is simply a small diameter rod which may be straight or curved into any desired shape. In operation the patient is laid on the operating table with some sort of metallic pad underneath him, or perhaps strapped to him. This forms one terminal for the electricity. The knife itself is the other terminal. From these two contacts the electricity vibrates back and forth at a very high frequency—so high that it can not be felt at all. Power is supplied to the

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American Radio Relay League

Relaying 6,000 Miles in an Hour
Talking to and from New Zealand

A REMARKABLE demonstration of the possibilities of short wave amateur radio communication was given recently when a message was transmitted by private amateur radio stations from Bristol, England, to Vancouver, British Columbia, a distance of more than 6,000 miles, in a little more than an hour.

The test was conceived, it is believed, by S. G. Vigars, owner of station 3WS at Port Arthur, Ontario. He called the amateur operators, E. Maynard of Morse, Sask., and H. Linke, of Kitchener, and asked them to make arrangements with Western and Eastern amateurs to be "on the air" the night of the test. He also sent a message to J. J. Fassett, owner of station 1AR at Dartmouth, N. S., asking him to request an English station to give him a message for Vancouver.

Mr. Fassett, whose powerful station has been able to make contact with European amateurs almost every night, got in touch with the operator of British 5KO at Bristol. The latter eagerly agreed to send a message, and when the time came for the relay, a complete string of amateurs was waiting to pass the message across Canada.

The message was received from England by 1AR at about 2:10 a. m., Atlantic time, and immediately relayed to 3BQ, Kitchener, reaching this point about 1:15 a. m., Eastern time. In less than five minutes the message was received by 3WS at Port Arthur. The latter, however, was not able to get it off as easily as the preceding stations and was heard calling 9BX of Morse, Sask., for nearly half an hour before he could connect with that station.

Meanwhile, the operator of station 3BQ, seeing that there was trouble in getting the message west of Port Arthur, tried to connect with 6ARB in California in a desperate attempt to get the message through the South if it could not be done in Canada. But 6ARB was evidently busy with another station closer to him and was "dead" to the Canadian station's repeated calls.

The operator at Morse finally answered his call and relayed the transcontinental message to 4DQ of Vulcan, Alta. The latter, after much "CQ-ing," was able to raise E. Chang, station 5GO, at Vancouver, and thus the message reached the Western coast by an all-Canadian route. Mr. Chang immediately started another message in reply to the one from England, which was handled through the same Canadian stations, and reached Kitchener about 3:30 a. m., Eastern time.

This, however, was 4:30 a. m., Atlantic time, and 1AR, next operator to the East in the relay, was "off the air," so the answer waited in Kitchener until 7:00 p. m., when it was sent to 1AR, and, as far as could be determined, went to England that night.

All of this work was done on the 125 to 150-meter wave lengths, which were authorized for amateur use by the Canadian government a short time ago. This band has proven to be highly satisfactory as very little interference is experienced.

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500 American Amateurs Break Across the Pacific to New Zealand

The belief that amateur radio in the United States is about to swing wide the doors of other nations, opening the way to private communication between individuals in widely distributed sections of the globe, is given still greater credence by the report that F. D. Bell, prominent New Zealand radio experimenter, has heard 500 American amateur stations.

The reception of signals from amateurs in this country is becoming altogether "too easy," says Mr. Bell in a letter to the American Radio Relay League. "It has come to this that anyone with a single tube and a two-coil circuit can hear a dozen on any single night, and the receiver that won't bring them in is a 'dud.' I'm referring, of course, to the louder stations. For the very faint ones I am still a believer in two or even three stages of radio frequency.

"During the last twelve months more than 500 Yanks have been logged at this station. The other day I went through my entire record and marked down the number of different nights (if any) on which each station had been heard. If a station was heard more than once in a single night, I still counted it as one only.

"The operators at 6AHD (which is listed in the call book under the name of E. T. Plumer, Santa Monica, Cal.) share a five-watt tube between them and both pushed their calls across the Pacific in quick succession. The writer has listened once or twice in the region of 100 meters and heard a few Yanks on detector only. This short wave work is certainly wonderful."

As soon as the New Zealand amateurs are able to increase their range, two-way communication probably will be common.

KILLING A CANCER

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knife by a radio transmitting set, which is adjusted to give oscillations of about a 3000-metre wave which corresponds to a frequency of 100,000 oscillations per second. Of course, other wave lengths in that neighborhood may be used, as there is no tuning effect to be noticed. The current passing through the knife into the body heats the metal to such a high temperature that it burns its way through the flesh, just as a warm knife will pass through soft butter.

No Blood is Spilled

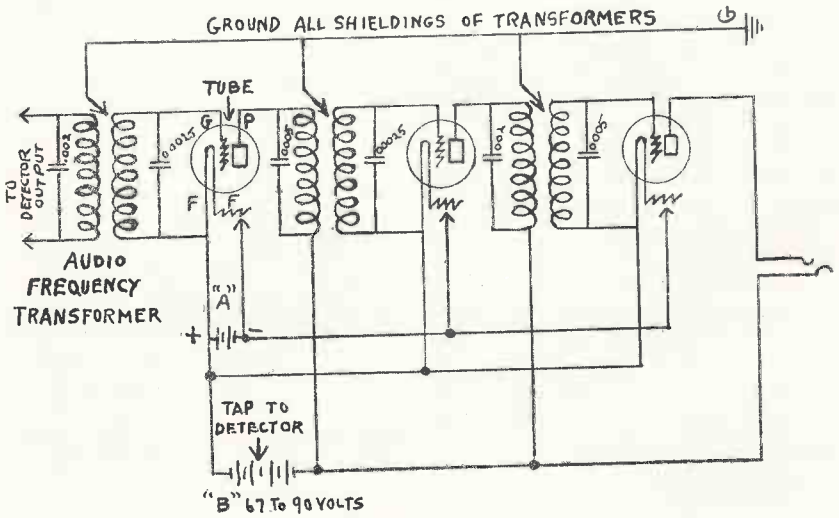
This high temperature makes the rod sear the flesh to such an extent that very little blood flows. In other words it cauterises its own wound. In a recent operation two men were cured of cancer of the bladder and only three or four tablespoons full of blood were shed. For such operations this is a marked advance, as it is not only easier on the patient but also allows the surgeon to work without being hindered by a copious flow of blood.

That Third Step Amplifier

By CLARENCE H. WEST

MOST every radio fan is the owner of a radio set with two stages of audio frequency amplifications, and, in fact, there are quite a few that have increased amplification by the "push-pull" method.

There is another class of radio fan that wants broadcast reception loud enough to be heard for blocks, not so much for the enjoyment of it, but just to let his neighbors know that he has the loudest radio receiver in the neighborhood.



Non-Howling Third Step

For those who want broadcast reception extremely loud and without distortion the following method has been found very satisfactory by the writer in bringing in DX stations loudly and locals to the point of terrific strength.

In constructing the amplifier use audio frequency transformers of one make and of the same ratio. A ratio of 3:1 or 4:1 works equally well. These transformers should be of a type that are shielded entirely, and the success of the amplifier depends on a good selection.

The fixed condensers used should be of the mica type and their construction such that there is no possibility of the change in capacity due to atmosphere and various other causes. Micadon condensers are satisfactory.

Now the second stage audio frequency amplifier is subject to more noises than a detector and one stage. Here is the point to doctor first of all.

The average layman who has experimented with the 3rd stage and given it up on account of being a "howling" proposition had best remember that these enlarged noises were in many cases an amplification of the mutterings and sputterings of the second stage.

Likewise a feed-back was being produced in the fields of the transformers. In numerous cases he has sought to improve matters by biasing the grids with a negative potential by using a "C" battery, and sometimes it worked fairly well, and more often it did not.

The first procedure is to adjust the second stage to the point of giving mellow tones without the frying or "popping" that is common. Of course the signal strength will be cut down somewhat; but the third stage, if properly constructed, will pick up this difference and amplify to a point of extreme loudness.

The diagram is self explanatory. At points where fixed condensers are shown, one should not solder the condenser to its connector until the circuit has been tested for the best reception.

The .002 m. f. condenser across the primary of the first transformer can be fastened permanently.

Across the primary terminals of the second and third transformers, the condensers shown are correct for the particular make of transformer used by the writer; but owing to the difference in the number of turns on both the secondary and primary of the transformers used it might be of advantage to try out condensers of different capacities. This can be judged best on test.

If after completing the amplifier the third stage lets forth a sound resembling a ringing of a bell or prolonged high pitch whistle, this denotes that the fixed condenser across the primary should be .002 m. f. or else the secondary condenser a .0005 or .001 m. f.

The above data is for the third stage transformer only. A combination of different value condensers across the terminals will terminate in a point reached where there is immense volume and no distortion.

The values as shown by the writer were found correct for this instrument; however, on account of difference in the number of turns on various makes of audio frequency transformers these condensers are subject to change; that is the reason that the writer advises that they be placed temporarily in the circuit until the right combination is found. It can be safely stated that any good make of transformer will suffice when the terminals are shunted by the proper value of fixed mica condenser.

In trying out this hook-up it is probably better to use 201A tubes rather than dry cell tubes. That is because, with only two steps of amplifier the volume on most stations is as great as the vacuum tube will stand, and so, by adding another amplifier, no louder results are obtained. The 201A will give a greater output than any of the other amplifiers, and so it is recommended for this use.

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 power rheostat and how is it used?

Answer. A power rheostat differs from an ordinary rheostat in two things. In the first place, it has a low resistance, usually about two ohms, and in the second place it will carry several amperes of current without overheating owing to the large size of wire with which it is wound. It is used in the same way as an ordinary rheostat, that is to control the voltage and brightness of the filament of the vacuum tubes. The reason why it is designed with such a small resistance is that power tubes use a good deal more current than those used for receiving purposes and this requires a smaller number of ohms to control. That is also the reason why large wire is used, as the ordinary size wire would be overheated badly, and perhaps burn up the rheostat.

Power rheostats are also used in some multi-tube sets for controlling the amplifiers. If as many as four or more 201A, WD-11 or WD-12 tubes are used in a set then the total current will be at least one ampere. One ampere flowing through two ohms will substract two volts from the battery potential and since this is more than is ever required, it is often times desirable to use the power rheostat in such a place. It works much like a vernier and unusually fine control may be obtained.

Question. Is it desirable to disconnect the "B" batteries when turning off a set?

Answer. It is not necessary to disconnect the "B" batteries, as no "B" battery current can flow through tubes that are extinguished. The only advantage in disconnecting these batteries is that at times the set may be interfered with by inexperienced persons and there is some danger that the tubes may be burned out. Of course, if the "B" batteries are disconnected this peril is avoided.

Question. Why is a dry cell sometimes used with a crystal set and how is it connected?

Answer. A dry cell is not needed in a crystal set, but often times it will increase the loudness of the reception. The theory is as follows: A crystal is used as a valve to let electricity run through in one direction and not in the other, but unfortunately no crystal has yet been discovered which acts perfectly. The trouble is it cuts down to some extent the current running in the desired direction, while it allows a little current to go backward in the reversed direction. This means that it is not one hundred per cent. efficient. The particular voltage at which crystals work is very different for different kinds of crystal and also for different specimens of the same kind.

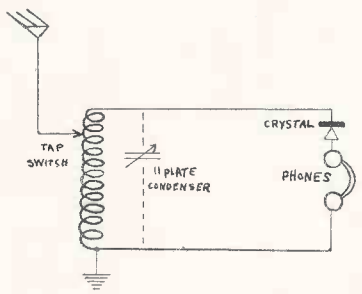


Fig. 1. Original Crystal Set

The idea of using a dry cell is to adjust the voltage on the crystal to such a value that it will be most efficient. This point can be found only by trial. In hooking up the battery there are several points to be noticed. Figure 1 shows a diagram of the ordinary crystal set before the battery is installed. Only one tuning coil is shown. If two are used it makes no difference in the operation. An eleven plate variable condenser appears dotted. This may or may not be used. In connecting up the dry cell, break the lead running from the phones to the ground, and insert a potentiometer as shown in Figure 2.

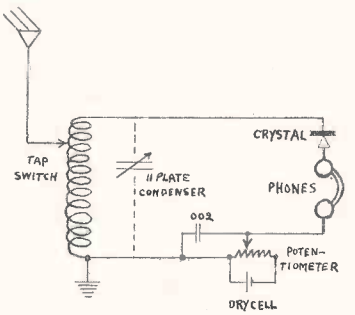


Fig. 2. After Adding Cell

This potentiometer may have a resistance of either 200 or 400 ohms. The arrow head represents the moveable arm of the potentiometer. It is to be connected to the phones and also to a fixed condenser marked .002. While this condenser may be omitted, it means that the radio frequency current has to run through the resistance of the potentiometer. Such a by-pass condenser allows the high frequency to jump the potentiometer, whereas the direct current from the dry cell will not go through the condenser.

The method of adjustment is as follows: First, vary the tap switch until the reception is loudest, with the potentiometer set in the middle of the scale. Then turn its handle back and forth slowly to see if a louder signal can be brought in. When the loudest position has been reached, try reversing the terminals of the dry cell and start over again. It will be found that one polarity of the dry cell gives better reception than the other. When this is found it should be left unchanged. Each

new crystal which you may use requires a diffeernt setting of the potentiometer and some crystals will be found which work best without it.

Question. What is meant by the term "toy transformer?"

Answer. This refers to a small instrument, usually called a bell ringing transformer. It consists of two windings, one the primary, designed for the city voltage, usually 110 volts, although in some cities it is 220 or 250 volts, and the other, or secondary, designed for a low voltage. This will usually be either eight or twelve volts, although some bell ringers have binding posts for 8, 16, and 24 volts. The lower voltage is used to ring a single bell over a short length of wire. If two or more bells are to be operated, the 16-volt tap is used. Occasionally, where the house is a large one and long wires are necessary, the 24-volt tap would be connected. Such an instrument is not ordinarily used in a radio set, as the current given out is always alternating. In fact, there is no such thing as a direct current transformer. If the alternating current is used to light the tube filaments, a buzzing noise corresponding to the speed with which the current changes is heard in the receiver. This speed or current change is usually 60 cycles per second and it gives a continuous low-pitched hum. A bell-ringing transformer, however, is sometimes used for a choke coil, and it is quite satisfactory for such service.

Question. Is it at all dangerous to install an outside aerial?

Answer. No, an aerial is more of a protection against lightning than otherwise. It is no more dangerous to have an aerial enter the house than it is to have telephone and electric light wires. Of course, an improved lightning arrester must be used. Be sure that it has a real ground.

Question. What is meant by dielectric constant?

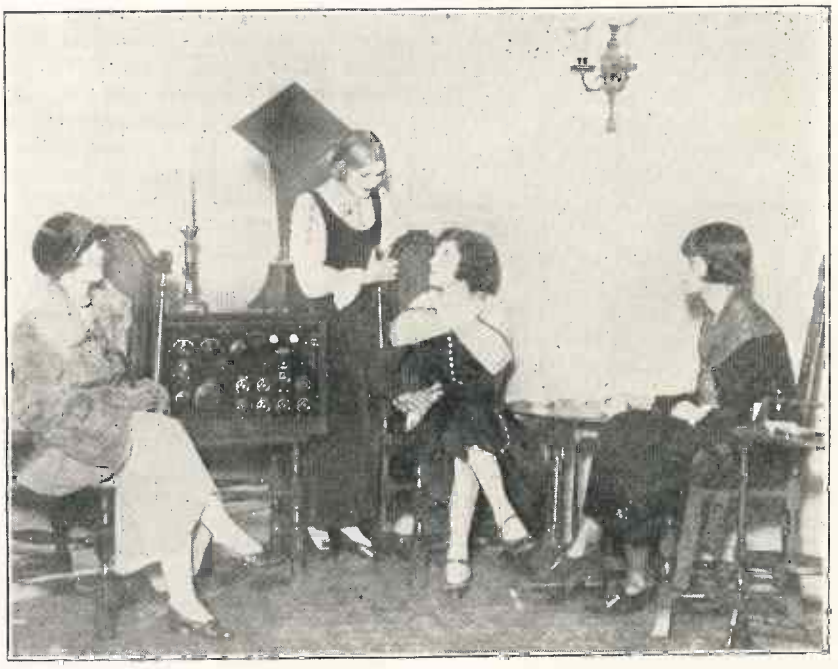
Answer. The dielectric constant is the same thing as the specific inductive capacity. It is a measure of how good a material is for making a condenser. If you take an ordinary 23-plate air condenser and measure the capacity of it, you will find that it has .0005 Microfarads (mfd.). Suppose you dip this whole condenser in oil. If it is a good grade of oil you will now find that the capacity has increased up to .0020 mfd. That is, it is now four times as big as it was. Since the only change is substituting oil for air, there must be something in the oil itself which makes the capacity four times as big. We do not know just what causes this increase any more than we know what causes the color of oil, but the quality itself is known as the dielectric constant, and since the capacity is increased to four times what it was before, the dielectric capacity of oil is four. To be exact, the capacity should have been measured first in a vacuum instead of in air, because everything is supposed to be referred to a vacuum for comparing its capacity. But it happens that air and a vacuum have almost identically the same capacity, and so the comparison to air is practically correct. Other material besides oil also increase the capacity if used between the plates and the condenser; thus paraffin gives about three times the air value, that is, its specific inductive capacity (s. i. c.) is three.

Continued on Page 32

HEAR YOURSELF AS OTHERS SEE YOU

It is not often that an actress has a chance to go to see a show. This is especially true of the play in which she may appear. But occasionally if there is a second company on the road there is a chance for a star to hear the musical comedy in which she plays a leading role. But, of course, the trouble is that the two companies are both playing the same comedy when on the road, so they naturally are not in the same town together.

Here is where radio steps in to their relief. When one company is resting or on rehearsal, it is possible for the company actually playing to broadcast the show and then Company No. 2, in a distant city, can pick up the play and hear how it sounds to the audience. Our picture shows an illustration of this. Four popular actresses from the Little Jesse James Company are listening to their duplicate in Company No. 2 as they are playing this comedy in Chicago. The broadcasting was done from the Sherman Hotel.



Improving Their Technique by Radio —Foto Topics.

You will notice the pleased expression on the faces of all these girls. That is undoubtedly because they realize that their understudies are not doing it nearly as well as they would handle it themselves. It is fortunate for the peace of mind for both companies that they are separated by several hundred miles and that the radio will not carry back talk.

THE PHONE SNUBBER

A rather novel appliance has recently been shown us by the O-D Research Laboratories of South Attleboro, Mass. Although it is very simple in idea and in construction, it works surprisingly well on the half dozen or so of different makes of phones or loud speakers on which it was tried. This phone snubber consists of a thin disk of rubber composition supported by two rings around the edge. It fits inside a telephone or loud speaker cap, just outside the diaphragm. By locating it in that position the air gap between the magnets of the phone and the diaphragm is not increased.

Works Like Tire

The phone snubber acts on the principle of the pneumatic tire. We are all familiar with the sharp grating rattle of the iron rim, as it rolls along over the gravelly road. The enclosed air chamber held within walls of elastic and resilient rubber eliminates these unpleasant vibrations, or changes them into smooth undulating wave motions. So it is with the bare iron diaphragm of the telephone receiver. With no check on its vibrations, it rattles and squeaks with utter abandon when loaded up to or beyond its normal capacity of sound volume.

Kills the Squeaks

Insert a phone snubber, and an elastic load is immediately imposed on the diaphragm which throws back the short wave vibrations, but allows the long harmonious wave impulses to pass easily through. However it has been found by months of patient research that the proper thickness, grade, and tension of the snubber diaphragm is very important, in fact, more essential than the proper inflation of the pneumatic tire, in order to obtain satisfactory results. The thickness and kind of material in the diaphragm frame is also very carefully tested. It has been found by experiments that a different snubber, or rather a different tension, thickness, and diameter is required to obtain the best results with different types and makes of phones. Therefore, it is very important that when supplying a set of snubbers that the make of phone is specified.

As a demonstration we can take a Baldwin type E phone and allow the volume of a three tube set reproducing broadcasting from a nearby station to come through. A medley of rattles, squeaks, and distorted music, probably issues forth. We insert a phone snubber within the cap, and immediately we have a miniature loud speaker, filling the room with sweet full toned reception, and the little Baldwin, getting down to its task with something to work on, performs in a way that will surprise the listener. Other makes of phones are benefited in the same way, and just as in an automobile, it is the *big* bumps which are the most affected by the shock absorber, so it is the loud and discordant notes in the telephones which are smoothed out by the phone snubber.

Making a Loud Speaker

By introducing a phone snubber of special design within a cheap loud speaker, it may be made to rival some of most expensive talkers on the market. An improvement in reception is found in any receiver that is properly fitted with a phone snubber. It will make a poor receiver good, and it will make a good receiver super-excellent.

LETTERS FROM OUR READERS

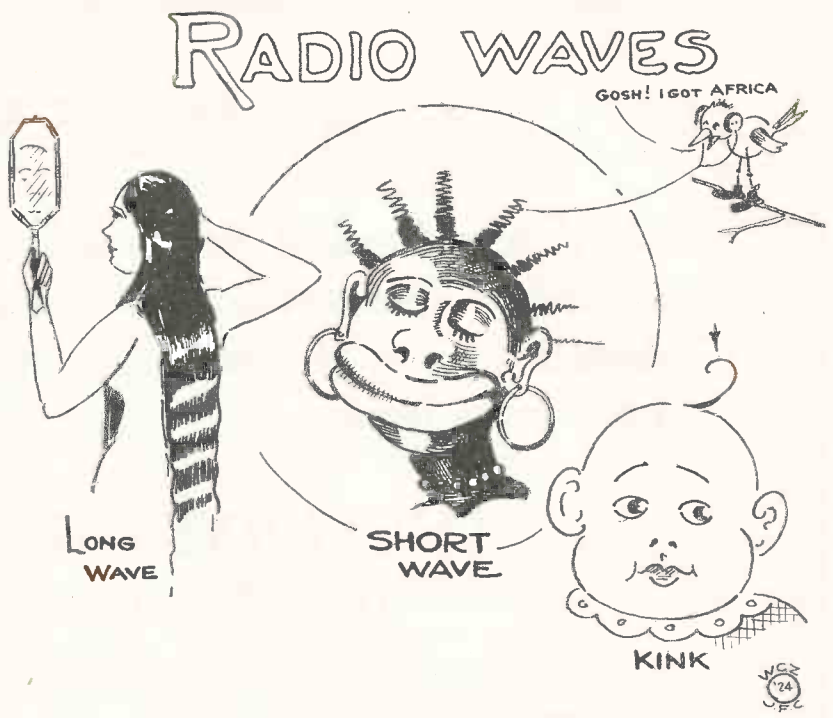
April 30, 1924.
35 Potter Ave.,
Prov., R. I.

Mr. Horace V. S. Taylor,
Editor, RADIO PROGRESS,
Providence, R. I.

Dear Sir:

I finished my Teledyne set last night and I wish to say it is all around one of the finest sets I ever used. The volume is very heavy, with no distortion, and the selectivity is amazing. I might add that I used the very best parts obtainable, also I use six-volt tubes. If anyone of your readers have any difficulty with the circuit you may refer them to me and I will gladly show how I made up my set. I would also like to take the opportunity here to compliment you on RADIO PROGRESS as a whole. It is a very interesting and instructive magazine throughout. Hoping everyone else has the success with the Teledyne I have, I am

Very truly yours,
LEWIS W. LONGLEY.



Graphic Explanation of Radio Waves

MAKING THE DEAF HEAR

A recent experiment at a deaf and dumb asylum consisted in an endeavor to make a person who was born deaf hear music through the radio. Of course, this has been tried many times before, but the present experiment differs from the previous ones in one respect. Amplifiers were used to obtain a loud note through the ear phones, and the subject on whom the experiment was tried, was tested over a period of several hours. During the first hour or so he heard nothing, but the phones were still kept on his ears. In half an hour more he began to notice a form of vibration, without recognizing it as music. After two and a half hours he expressed the greatest surprise that something was happening that he had never known of before—he was beginning to hear. By the time four hours had elapsed, he had actually heard the tune. The physicians in charge thought it best to discontinue at this point, as they feared overtaxing the auditory nerves of the subject. However, the experiment is being continued.

The ear specialists think that the reason for this unusual occurence is that through disuse the auditory apparatus of the subject had got out of order, just as machinery will when it is clogged with rust, and the prolonged shaking up by the powerful radio waves was similar to loosening the rust by forcibly operating a machine.

HELPING YOU GET RICH

Commencing on May 1 Station WJZ of the Radio Corporation of America, started broadcasting a daily feature of particular appeal to business men throughout the country, for through the co-operation of Dow, Jones & Company, publishers of the Wall Street Journal, a radio summary of the day's events in Wall Street was inaugurated on that date. The summary, which will bear the title of "The Day's Financial Developments," is compiled by the financial specialists of the Dow, Jones Company, and gives the radio listeners the closing stock market, exchanges, money and cotton quotations, the standardized Dow, Jones Averages, and a brief digest of the important occurrences on "the Street." In cases where exceptional incidents in a particular branch of the financial world occur, the leading specialist in that department personally delivers the review, giving the most authoritative discussion obtainable.

The service, which has a great value throughout the year, is particularly suited to summertime radio, for it will enable the men to whom the happenings of the financial world are of first importance to keep in close contact with the movements of the market even though they be far removed from the city. The service will be broadcast from 7:20 to 7:30 every night except Saturday and Sunday.

BALLOON AERIAL

There's nothing like a good high aerial. Just the thing for peak reception. Outfits guaranteed satisfactory as per instructions. All you need is a tank of hydrogen for inflating balloon. The cost of maintainance is less than radio batteries, tubes, etc., and one has a remarkable receptive advantage. Price all complete $5.00 C. O. D., and includes three 30-inch pure gum balloon bladders; large, rapid winding hand reel; special, light, alloy wire for antenna; pipes and fixtures for making your own hydrogen in a jug and complete instructions.

EVERETT SCANLON, Radio Specialties, Lakewood, Rhode Island.

Panel Material is Important

Many Sets Could be Improved by Substituting a Modern Panel

IN wiring up an "A" battery it is not very important what sort of insulation you use, provided it does not allow a short circuit between the various wires. The reason is that the battery is of such large capacity that leakage of a few thousandths or even a few hundredths of an ampere is completly lost in the shuffle. But when we take the case of the aerial and grid circuits of a radio set, conditions are very different.

Here we have a current of such small size that only the most refined laboratory instruments ever have a chance of measuring it. It may be of the proportions of a few 1/1,000,000ths of an ampere. So if a few millionths of an ampere are lost, that means all there is. That is why the kind of insulation which is quite satisfactory on the back of your set where the battery leads come in will not do at all on the panel where the high frequency, small volume radio waves are controlled.

There are several different kinds of panels on the market, which are good. In this class are the new hard rubber panels. Notice that it is the new hard rubber which is referred to as a similar material has been used in the past with only moderate success. The trouble used to be first that the sheets would soften or change color when exposed to strong sunlight, and second, that the insulation resistance would fall off over a long period of time to a point where it was not much better than for lower grade materials.

The new products, however, have completely overcome these troubles. By using different ingredients in the mixture, and especially by new methods of handling the manufacture itself, a product has been developed which is as stable under sunlight conditions as the cabinet itself. And furthermore, no danger is experienced of the high initial quality deteriorating through use.

A Word of Caution

At this point let us sound a note of warning, however. If you contemplate using a rubber panel by all means get one which is manufactured especially for radio use, as such sheets will not change with time. If ordinary cheap hard rubber is used, there is very great danger of the former action taking place. Hard rubber contains among other things a certain proportion of sulphur which unites chemically with the rubber to give it its good qualities. In the cheap grades of ordinary hard rubber this sulphur is not always entirely combined chemically, and the result is that the little particles of sulphur which have not combined with the rubber will slowly oxidize in the air and in time form a very thin layer of sulphuric acid on the surface. Now sulphuric acid happens to be a very good conductor and even in the minute quantities in which it would be so formed it causes a marked reduction in the insulating qualities of the rubber. By sticking to the panel material, as made by the reputable radio manufactuers, no such danger exists.

As an illustration of what may be done with modern hard rubber, the Celesto Panels manufactured by the Triangle Rubber and Supply Company of South street, Boston, may be mentioned. The softening point of the material, out of which these sheets are constructed, is so high that there is no chance of warping of the panel, nor of change in color. The dielectric constant, which is the measure of the condenser action, is quite low, being 3.2. The advantage of such a low dielectric constant or specific inductive capacity, as it is sometimes called, is this: When you bring your hand up to the front of the panel if it is not completely shielded (and most sets are not), then the bigger the capacity effect of the panel, the more you will be troubled by squealing and mis-tuning the set owing to body capacity. With a low dielectric constant this capacity effect is reduced to its lowest terms.

The phase angle difference of Celesto is also very low, as it measures only 0.4 degrees. This quantity is a measure of the losses which occur in insulation. Of course, the bigger the losses, the less energy is left to work the telephone or loud speaker, and by reducing the losses to this negligible residue the manufacturers have succeeded in delivering practically all the energy to the apparatus instead of wasting it in the panel. Still another good quality is shown by the fact that this material will not absorb enough water to be indicated at all by the ordinary test. That is one reason why such a panel retains permanently its good initial qualities.

Hard Rubber Easy to Work

The physical properties which have just been mentioned are all of a rather technical nature, and it requires a testing laboratory to measure them exactly. Of course, the excellence of a set, using such parts as described here does not require a laboratory to show its high class, but the excellent easy working qualities of this material are evident as soon as the radio amateur starts drilling or cutting the panels. When drilling holes to mount the various parts it will be found that the drill penetrates very easily and leaves a smooth, clean round hole. Another point is that the drill does not have much tendency to run off the side and so cause the hole to be wrongly located. This will be particularly appreciated when it comes to laying out ten or a dozen holes to take various switch points which will be connected to the taps of a variocoupler. At such a place the slight shifting of one hole is very evident, and ruins the appearance of an otherwise good looking set.

These panels are supplied in a large variety of sizes and in two colors, mahogany and black. They are both equally good from the electrical point of view and the choice depends entirely on the color which the user prefers.

A Noiseless and Unseen Crowd

Radio Has Developed a New Type of Invisible Audience

By C. M. RIPLEY, General Electric Co.

When you think of a large audience you naturally have in mind a jolly crowd where you hear considerable whispering, talking and shuffling of feet. At this time of the year considerable coughing is often in evidence too, but the tremendous crowd that listen to radio broadcasting are very different in this respect. Not a sound comes from the entire gathering, and, of course, one listener cannot see another.

No Snobbishness Here

Another pecularity of the radio audience is the fact that it is so very democratic. The machinist, the electrical worker, the elevator boy, the janitor, and the watchman are all listening on the wireless telephone together with the banker, the engineer, the merchant, the executive and the student. If there ever was a cosmopolitan audience in the history of the world, the invisible audience of radio is the last word.

All other congregations in the past have been members of a local community. The individuals had more or less similar tastes and experiences in life. They lived in the same climate, ate the same things: they were subject to much the same mental, physical and moral influences, and seeking entertainment from the same kind of amusements.

But the radio audience is different. That is why it is a new factor.

There are workers in mills, mines and factories; in offices, upon the farms and in camps, in the outskirts of civilization. There are those who tend the lights, in lighthouses and lightships. There are the bed-ridden at home and in hospitals, listening day and night and getting relief from their physical suffering. There are men and women who have traveled around the world—others who have never seen the ocean, or the Great Lakes or the Gulf or a large river. Other millions have never visited a metropolis or crossed over a great bridge. Thousands have never been inside of a large manufacturing plant or large church or theatre or inspected an electric power station and some have never seen an electric street car.

To millions the Woolworth building is only a picture; thousands have never seen a battleship or an Atlantic liner—much less set foot upon one or explored the marvels below deck.

Other thousands who are "listening in" have never been in the country, and and would not know a bullfrog's evening serenade from the lowing of cattle. Thousands have never seen snow or frost or natural ice, or a mountain; and thousands living on the pariries have never seen a hill.

To some the song of the nightingale is well known, to others that of the whip-poor-will. Some have hunted the deer, but have never seen a coyote, and others have fished for cod and hunted whale in northern waters, but know nothing of the crocodile or alligator. Thousands among the vast radio audience have tramped the forest, and can tell the spruce, fir and balsam from the hemlock pine and cedar, while others live mid the royal palms and the cactus plants.

Lumber Jacks Use Phone Jacks

At night, surrounded by snow, men in lumber camps are listening to radio, and construction workers who by day were broiling in the hot sun on railroad tracks across the plains, or new road construction in the mountains, find evening recreation through radio. Men who are pouring concrete into huge dams to harness the mountain cataracts; those who live in fishing villages along the water's edge; sealers, mountaineers and trappers. Wireless operators on ships who keep their constant vigil through the long watches of the night, and other lonely men in watchtowers looking out for the forest fires, all are members of the radio fraternity.

The farmer boy, unlike Lincoln, does not have to go ten miles to borrow a book in order to feed his mind to-day.

To the lonely man the radio program brings joy, companionship and new lines of thought to feed the mind. To the person who is surfeited with the noise and crowds of a great metropolis, radio brings a feeling of secluded and intimate association with the speaker or singer, the artist or actor, and the clergyman—undisturbed by an inconsiderate audience or the ill-timed applause of the over-enthusiastic. The music lover can hear music at its best—uninterrupted by the noises of an audience and auditorium.

Back to the White Lights

Yet the person on the outposts of civilization feels brought in touch again with the wide, wide world. By radio he takes part in the bustle and busy activities of the cities he longs to see—that he has been separated from for perhaps months or years. The sound of such activities comes to him across vast expanses of desert, forest or sea. Now he gets news and new ideas; hears strange voices and feels the pulse of metropolitan life.

In addition to solitary listeners, there are strange groups of listeners in our invisible audience. There are intimate friends, sweethearts and complete family circles. There are indoor and outdoor listeners, merrymakers and students, and audiences in hamlets with a population of only a few hundred, gathered to hear speakers from centers of learning and culture.

Steamship passengers who visit the radio room above deck or who hear the concert and speeches multiplied in the saloon by a loud speaker; passengers on railway express trains, etc., all these are included in the vast invisible audience of radio.

Biggest Congregation Known

And every Sunday morning a different clergyman of Schenectady has his entire service broadcast to the largest congregation ever known in the history of the world.

You all breathe the same air; you all listen to the same programs that come through this same air. What will this new brotherhood do in years to come to advance the progress of the human race? No one can say.

A. G. Davis, vice-president of the General Electric Company, said recently:

"Radio is a sociological fact destined to be of tremendous consequence. We have not yet begun even to estimate its significance."

No doubt, broadcasting will have its economic, political as well as educational and entertainment phases; but the social side—who can prophesy what the social effects of the radio will be?

Radio Dramas Popular

The radio dramas broadcast by WGY are one of the earliest manifestations of the social phase of radio, for real dramatic productions—such as "The Wolf," "The Man from Home," "Garden of Allah," "Paid in Full," "Get Rich Quick Wallingford," and other plays are broadcast. These feed the mind of the invisible audience and touch the heart. The clergymen and church program stimulate the soul and inspire the moral fabric of men and women and boys and girls—helping them to lead better and fuller lives. Thus there is now being ushered in a new and wonderful work for the marvelous and versatile electrical industry.

RADIO AND THE JAIL

It is said that radio keeps many a man at home at night, who otherwise would go out to the club. It is also helping to keep some criminals in jail, although not in quite the same way. Several cities have equipped their police stations with radio sets in order that the police reports which are broadcast may be picked up by all the stations at once.

Philadelphia has gone even farther than this. It is equipping all the police automobiles with portable sets so that all the patrol wagons will be in touch with the Central Station even while running around town. As soon as any crime is committed all information which is known is immediately broadcast all over the city with the result that it is much more difficult for the criminal to escape.

THE RADIO PIANO

One of the recent developments in musical instruments is a combined radio and piano. A player piano has a space in the upper part reserved for installing the radio set, and the dials and controls are covered by a panel in the front of the piano. The loud speaker is self-contained and a fine grill over the opening of the horn takes away the awkward appearance. It is quite possible with this new instrument to have a singer performing over the radio while one plays a piano accompaniment. To do this, however, it is necessary to keep the piano strictly in tune, as there is no way of changing a fraction of a tone up or down to harmonize the notes of the piano with those of the radio.

DR. RADIO PRESCRIBES

Continued from Page 26

Question. A wiring diagram shows No. 23 wire. Is it possible to use any other size?

Answer. The various sizes of wire differ so slightly that a change of one or two numbers is usually unimportant. In nearly every case where any size is specified it is just as satisfactory to use the next one larger or smaller. The exception to this rule is found where a spool of a certain length is required to be wound full. Then, of course, if smaller wire is used, more turns would be added than were expected, whereas larger wire will prevent the full number of turns being applied. Except for the question of length of windings and number of turns, the exact size of the wire is rather unimportant.

Question. Is a lightning arrester needed for an indoor aerial?

Answer. The Underwriters do not require a lightning arrester unless you have an outside aerial. Lightning is no more likely to strike an inside antenna than it is to strike your water pipes.

Bryant RADIO Tubes

have been on the market for 3 years. Their success is attributed to the fact that thousands of satisfied customers have ordered repeatedly. We are now in a position to offer all popular types of tubes at a price within the reach of everyone.

Our A tubes are tested to work on Radio Frequency.

Use Type 12 tubes for our Portable Set.

Order C. O. D. or from your dealer.

Repaired Tubes 200-201A—Type 12.

One Price, $2.50

TYPE 201A 5V.—¼ amp. super amplifier tube.

TYPE 199 3V.—.06 amp. Dry cell amplifier.

TYPE 12 1½V.—.25 amp. tungsten fil. Dry cell tube.

TYPE 12 1.1V.—.25 amp. Plat. fil. Dry cell tube.

TYPE 200 5V.—1 amp.

$3

ONE TUBE PORTABLE SET

(De Forrest Ultra Audion Circuit)

Very selective on all broadcasting wave lengths. Range 1500 miles in favorable location. Will operate loud speaker on near stations. Just the thing for your camp this summer. Price, set complete (without tube, **$6.50**).

Detector Guarantee

All tubes are rigidly tested before leaving factory; any found defective or unsatisfactory will be replaced, providing the filament has not been burned out.

Dealers and Jobbers Write for Discount

Bryant Radio Tube Exchange

(9th Floor)

453 Washington St. Boston, Mass.